THE USE OF RADIOCARBON AND BAYESIAN MODELLING TO (RE)WRITE LATER IRON AGE SETTLEMENT HISTORIES IN EAST-CENTRAL BRITAIN

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for
Sampson and Ophelia

Together we passed many milestones, and shared so much in the journey.
You were very sorely missed on this leg of the road trip through life.

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Abstract

This thesis focuses on the use of radiocarbon dating and Bayesian modelling to develop more precise settlement chronologies for later prehistoric settlements over an area extending from the Tees valley in the south to the Firth of Forth in Scotland and bounded by the Pennines to the west. The project has produced a corpus of 168 new radiocarbon dates from nine sites and used these, together with dates that were already available for another 10 sites to develop new chronological models for 18 settlements representative of different parts of the study area.

The results of the modelling underline the dynamic character of later prehistoric social organization and processes of change in east-central Britain over a period of several centuries. A widespread shift from nucleated settlements to dispersed farmsteads apparently occurred over a period of no more than a generation on either side of 200 cal BC, with a subsequent move back to open sites in the period following Caesar's invasions in 55/54 BC. It is not yet clear why the settlement pattern became more focused on enclosed settlements around 200 cal BC, but whatever the cause, this seems to form a single archaeological horizon all the way from the Forth to the Tees. The shift to open settlement around 50 cal BC seems, however, to be tied to new economic forces developing in the region as southern England becomes more focused on economic and diplomatic relations with Rome in the century leading up to the Roman occupation of northern England shortly after AD 70.

Questions of duration are also explored, related more specifically to the lifespan of settlements and even of individual structures or enclosure ditches. These questions lead to ones of tempo, whereby the cycle of rebuilding a roundhouse or redigging a ditch is examined.

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The task of submitting radiocarbon samples is not an easy one, especially when there are different bodies funding different dates, and all have different forms and procedures for the submissions. At English Heritage, I must thank Dr. John Meadows, Dr. Isabelle Parsons, and Kate Cullen for facilitating many of the submissions. Furthermore, Dana Challinor provided nearly all of the identifications on charcoal funded through English Heritage.

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CHAPTER 1: INTRODUCTION

Chronological understanding is at the heart of archaeological interpretation, yet for the Iron Age in Britain that understanding is still relatively poor. This can be attributed to the fact that many Iron Age archaeologists have not fully realized the potential of using radiocarbon dating as the foundation of a chronological framework. The primary reason for this lies in the existence of the 'Iron Age plateau' – a flattening of the calibration curve, which makes chronological separation of individual dates extremely difficult in the period *c.* 800–400 cal BC (Cunliffe 2005; Haselgrove et al. 2001). Compound this with a general belief that pottery typologies provide a more reliable framework than radiocarbon dating, and what we are left with is radiocarbon being employed in those cases where it is unclear from artefactual evidence from when a site or feature might date, and for which answers as vague as 'earlier' or 'later' Iron Age will suffice.

In the pursuit of understanding how British Iron Age societies functioned and developed, various typologies have been formulated using the available archaeological evidence. Attention was soon drawn to the changing nature of long-lived settlements, on the basis of which a series of 'settlement sequences' was proposed. Arguably, the most famous of these in northern Britain was the 'Hownam model', developed by Mrs Piggott (1950) as a result of her work at the site of Hownam Rings, Roxburghshire. The sequence is one of increasing complexity: unenclosed » palisaded » univallate » multivallate fort, with settlements becoming unenclosed again, perhaps after some period of abandonment, thanks to the *Pax Romana*. The goal of the 'Hownam model' was to use settlement typologies and sequences to tie an Iron Age in the North that was materially impoverished to the materially richer sequences of the South, which, in turn, had been linked to the Continent through Hawkes' ABC model (Armit 1999), which saw successive waves of contact, or colonization, with the Continent in the innovation and change in native artefact types such as ceramics and metalwork (Harding 2009, 3). At first, the model appeared fairly robust in the Lothians and even into the Borders – although it was at times extended by eager archaeologists into Northumberland so covering the entire Tyne-Forth region (MacKie 1969, 20–2).

This search for developmental, and chronologically meaningful, sequences of settlements has been important in the advancement of archaeological knowledge regarding the later Iron Age and early Roman period, by encouraging the development of a corpus of data on a regional scale. The untiring fieldwork of Jobey both south and north of the Scottish border (1960; 1962b; 1964; 1965; 1966a) as well as of workers like Coggins and Fairless in Upper Teesdale (Coggins 1985; 1986), coupled with the aerial survey and analysis of Gates (1983; 2004), was instrumental in allowing a fuller appreciation of the variety and distribution of settlement types across east-central Britain, providing a basis upon which early settlement pattern analyses could take place.

With the advent of radiocarbon dating, British prehistory was lengthened considerably (Renfrew 1973). This was not accepted easily as recalled by the words of Stuart Piggott upon receiving his radiocarbon measurement from the Henge at Durrington Walls, when he said "This date is archaeologically inacceptable" (Piggott 1959, 289). After giving clear taphonomic reasons for why the material was acceptable and should date the deposit, he goes on to conclude that it was "roughly a millennium too high!" (Piggott 1959, 290). These statements were being made of course in light of the then current knowledge and understanding of chronology that was based on a diffusionist model of cultural change moving from the Continent and up through Britain from the south. The initial impact this stretching of the prehistoric timescale had on the 'Hownam model' was to take a sequence of settlement changes thought to occur over a couple of centuries across a region and spread them over nearly a millennium. The implication for Hownam Rings was either that the pattern of settlement was intermittent or the sequence of development was considerably more complex than Mrs. Piggott had noted (Hill 1982b, 6).

The evidence accumulated through increased survey and excavation, however, showed that for every 'rule' there are exceptions. By the 1980s the evidence had been gathered to make a case against a 'Hownam model'. Broxmouth hillfort (Hill 1982a) and Dryburn Bridge (Triscott 1982) were among the strongest arguments against such regular sequential development, as they exhibit apparent reversals of the expected sequence (for an updated interpretation of Dryburn Bridge, see Dunwell 2007). As a result a general consensus has developed that this model is inappropriate (Armit 1999; Cunliffe 1983; Harding 2004; Welfare 2002).

Abandonment of the 'Hownam model', however, did not necessarily deter a continued search for general trends in settlement development, be they simply from open to enclosed (Alexander and Watkins 1998; MacInnes 1982), or based on house typologies (Hill 1982a) across the region. I would argue that the reduction of the archaeological settlement data to an order, sequence, or trend across a region, while an interesting analytical exercise, does little to further our understanding of the way people and communities organized, operated, and negotiated their lives physically, socially, or symbolically. Although the identification of a trend toward enclosure is of some importance (Knight 2007), the identified trend needs to be disentangled and understood by investigating the timing, tempo, and ultimately the social processes that underlie and underpin it.

While the ‘Hownam model’ was a useful model in its time, current research either purposely or inadvertently makes strides to replace the sequence. Any such attempt to replace the sequence will always be lacking, because it almost certainly denies fully understanding settlement transformation at the basic level: the site. Only through developing the chronological data relating to site transformation will it be possible to move forward and begin to understand the underlying processes of settlement development and also of social change.

1.1 Toward developing a settlement chronology for east-central Britain

The aim of this project is to develop a chronological foundation that is independent of typological analyses for understanding changes in settlement during the later pre-Roman and Roman Iron Age. The project targets not only published sites, but also developer-funded sites that have been recently excavated. It does not rely solely upon published and unpublished scientific dates, but also features a targeted programme of additional radiocarbon dating and Bayesian modelling of settlements across the region that are thought to date to this period. By specifically targeting multi-phase sites, it is possible to estimate the dates when individual sites were transformed (e.g. changed from open to enclosed, etc.). Furthermore, the data that are compiled and created can be analysed quantitatively across the region, leading to new archaeological interpretations and understandings of the specific settlement types. The methodology evolved and tested by this project has significant implications for how Iron Age chronologies, and indeed all settlement chronologies, should be constructed in the future, by not only providing a spatial and temporal core from which settlement chronologies in Britain can be extended, but also standing as a model for similar projects in other time periods and regions.

Among the key questions currently facing researchers of the later first millennium BC, which can only be answered through a tighter absolute chronology are:

- How do the different and increasingly complex forms of enclosed settlement, which became a prominent feature of the record in lowland and upland regions alike after *c.* 400–300 cal BC, relate to one another chronologically and socially?

- When and why does the subsequent shift away from enclosure commence? To what extent was Roman presence a factor in certain areas?

- How long is an Iron Age settlement typically occupied? Are we dealing with long periods of stasis or even abandonment punctuated by occasional building and/or maintenance events, or continuous sequences of occupation over shorter periods?

The area chosen for study comprises north-east England from the Tees Valley extending northward, through Northumberland, and over the Cheviots into south-east Scotland as far as the Firth of Forth (Fig. 1.1). Radiocarbon dating has been more widely used in the latter region than in many other areas providing a large number of recently excavated Iron Age settlements of different types and with multiple phases, which have ^{14}C dates and can be used to address questions such as those outlined above.

The specific *aims* of this project are: 1) to construct a chronological framework for Iron Age settlement in the study area using radiocarbon dating and Bayesian statistical modelling, enabling individual settlement histories to be reconstructed and compared across the chosen region; 2) to use the results to generate enhanced understanding of settlement expansion and change in central Britain after *c.* 300 cal BC; and 3) to develop a methodology suitable for establishing improved prehistoric settlement chronologies elsewhere in Britain.

The *objectives* to achieve these aims are: 1) systematic collection and critical assessment of all available relevant radiocarbon dates; 2) careful selection and submission of new samples for dating from sites with suitable sequences; 3) Bayesian modelling of the dates to generate estimates of the date and duration of successive occupation phases at these sites; 4) comparison of dated sequences across the region; and 5) to propose archaeological interpretations of the data.

Figure 1.1: Map showing the general region under study shaded

1.2 Structure of the Thesis

Chapter 2, *Settlement, Society, Environment, and Time*, examines the significance of settlement and looks specifically at the different later Iron Age settlement types and their physical variation across the region. Also covered here is the timing of the Roman advance into and through the region. The physical environment and climate are discussed along with later prehistoric economies in east-central Britain. Finally, the chapter concludes with a brief consideration of later Iron Age social organization and practices of disposal both of artefacts and of the dead.

Chapter 3, *Chronology, Radiocarbon, and the Rev. Thomas Bayes*, not only assesses the state of Iron Age chronology in Britain, but explores both radiocarbon dating and the Bayesian approach while explicitly laying out the methods and processes followed for the PhD research project. This includes an explanation of the sites selected and the criteria employed, as well as an introduction to Bayesian chronological modelling for the uninitiated.

Chapters 4–7 contain the *Site Results*, which are presented site-by-site, within each of the four sub-regions defined within the project. These results are revisited in Chapter 8 where more general themes that transcend the sub-regions are discussed.

Finally, Chapter 9 provides concluding remarks on the output of the project and its intended impact on British Iron Age studies. It also offers suggestions for further improvements and how this project can be extended and built upon in any future work.

CHAPTER 2: SETTLEMENT, SOCIETY, ENVIRONMENT, AND TIME

2.1 The significance of settlements

Settlements, and their components, have been and continue to be the foci of many different avenues of archaeological research and discourse. Areas of investigation include: Iron Age cosmology and/or gender as reflected in the roundhouse and other settlement structures (Giles and Parker Pearson 1999; Harding 2009; Parker Pearson 1996; Pope 2007); enclosure as a (re)negotiation of the social order (Bowden and McOmish 1987; Frodsham et al. 2007; Oswald et al. 2006; 2008), as a functional response to damp soils (Hamilton 2007), or perhaps as indicative of pastoral activity (Harding 2006); increased settlement size marking the aggregation of a previous, more dispersed settlement pattern as part of an increasing social hierarchy (Cunliffe 2005); and hillforts as highly defensive and territorial marking settlements, providing a mechanism to ensure cultural cohesion across a region, or perhaps as ceremonial centres (Frodsham et al. 2007; Payne et al. 2006).

For these avenues of research, the particular focus has been on the physical, the social, or the symbolic function of the settlement. The emphasis, nevertheless, is generally only on one of these aspects and very rarely on two or all three of them. An analysis or interpretation of settlement based on one such attribute is incomplete and lacks the subtlety of the historical circumstances within which peoples in the past lived, interacted, and constructed meaningful relationships within their community and with the wider world (cf. Taylor 2001). While these compartmentalized studies are necessary to further scientific thought and enquiry, more holistic approaches are possible by taking advantage of information that has been made available by the fragmentary analysis of settlements and bringing these different lines together. This, however, requires us to pause and ask the simplest question:

What is a settlement?

Despite the academic interest in later prehistoric settlement, it is often assumed that the definition of a settlement is known or understood. A settlement, according to Hingley (1989, 75), can be defined “either as a single isolated compound or as a distinct cluster of a number of compounds.” He further points out that in the case of clustering compounds, these must be close enough for a single settlement to be demarcated, using Hallam’s interval of 150m between components as the cut-off point

(Hallam 1970, 31). This, however, is not much more than a definition to determine the 'limits' of a settlement.

The definition could be expanded to encompass the notion of a settlement as a location of permanence, or semi-permanence, in the landscape where the population – be they individual persons, families, or communities – practice much of their daily life. Physically, settlements can be defined foremost in that they contain the locus of habitation, a house or some similar structure that protects from the elements (even a rock shelter or cave). Beyond the place of habitation, there might be ancillary structures for work and/or storage, and they will most likely contain some other well-defined loci (e.g. animal pens, paved yards, paths, pits and so on). Settlements are not monuments[1], but they may well be *monumental*. For later prehistoric Britain hillfort 'defense' banks and ditches embodied not only an enormous input of human resources in their construction but would have also had an equally enormous visual impact when viewed from the surrounding landscape (Bowden and McOmish 1987; Oswald et al. 2008). Equally, an enclosed homestead and roundhouse, if constructed solely by a family unit, would involve an enormous investment of labor; and even a lone roundhouse might have been quite imposing at as much as 7.7m (25.5ft) in height (Harding 2009, 209). Furthermore, the performance of constructing the banks and ditches would have likely played an important role in the (re)negotiation of social ties between groups across the landscape (Bowden and McOmish 1987).

Settlements are not passive backdrops against which life played out. The very construction of the settlement is a conscious and active effort that organizes the "power relationships and the practice of social interaction" (Parkington and Mills 1991, 365). The settlement, and its individual constituent parts, exists not only in the realm of the material, but also in the social and the ideological. The settlement is structured, in the most literal sense, yet is structuring in that it defines many of the places and spaces within which a prehistory was embodied, experienced, and ultimately played out daily (de Certeau 1984). As such the settlement should be an especially important locus for post-structuralist analyses that focus on the recursive relationship between social structure and practice (cf. Bourdieu 1977; Giddens 1984; Sahlins 1985).

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[1] I do not use the term 'monument' here in the same sense as the Royal Commission on Ancient and Historic Monuments, English Heritage, etc. looking back from the present as a place of public interest for its (pre)historic significance. Instead I am interested in separating settlements as lived everyday places from monuments, or places of public interest that are places of performance, ritual, etc.

As the location where everyday life is practiced, prehistoric settlements should be subject to orthodoxy (Bourdieu 1977), that is displaying cultural inertia (cf. Hawkes 2001), and are therefore resistant to change. If settlements are “not merely reflections of, but material manifestations of, the social formation” (Parkington and Mills 1991, 355), then it follows that major transformations in the settlement form, as seen in archaeological contexts, should either be preceded or followed closely by transformations in the social form. Developing a more complete understanding of *how* and *why* physical and social transformations took place at each settlement is primary to (re)writing the settlement history for a region. The utility of that understanding and the comparability of the sites within the region can only fully be realised with the development of robust site-by-site chronologies.

Settlement types

In the effort to advance our understanding of settlements and the prehistoric societies that inhabited them, various methods have been developed to classify them. Unfortunately, many of these classification systems derive from long-term local or regional usage, and are in many cases limited by geographical extent or by being

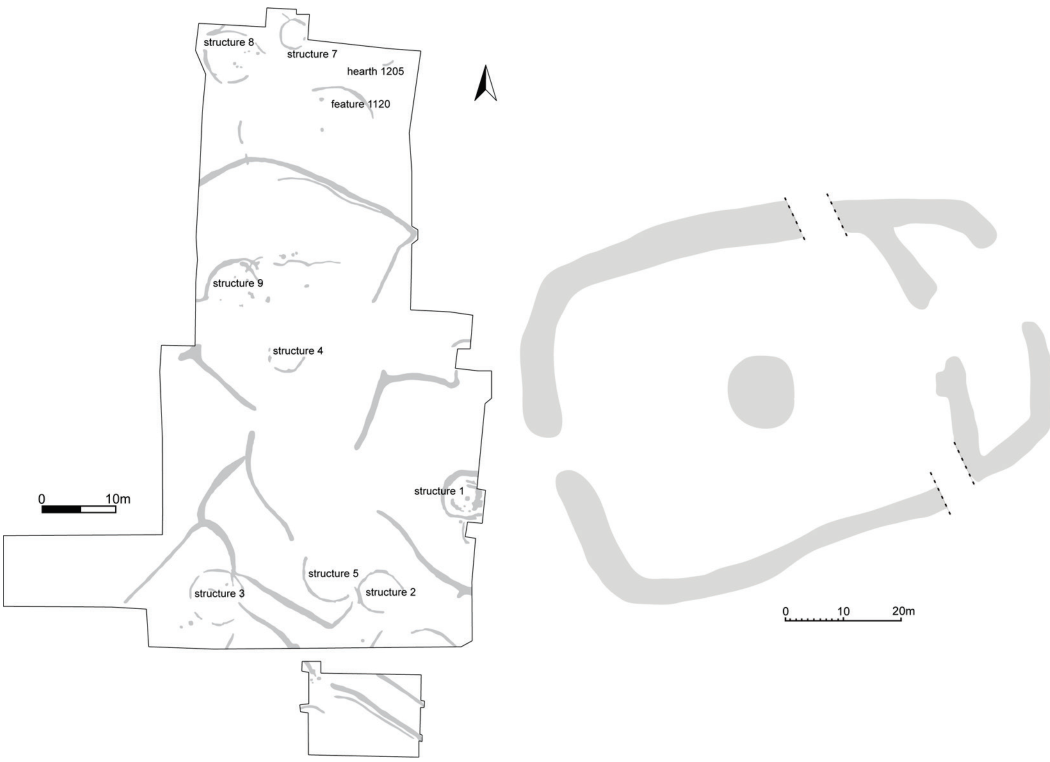

Figure 2.1: ‘Open’ (left) and enclosed (right) later Iron Age settlements. Kilton Thorpe Lane is on the left and a simplified plan of the later Iron Age farmstead of Fishers Road West is on the right

overly descriptive (Taylor 2007, 5–6). In the area of interest here, this is further exacerbated by differences in terminology that sometimes occur when dealing with material on both sides of the Anglo-Scottish border. The following section, however, is an attempt to distil the current terminology down to its basic constituent parts, and to review the two most common ways that settlements are classified.

The first approach to classification is perhaps the most common and is based on analysis of the morphological characteristics of the settlement, categorizing settlements as Open or Enclosed (Fig. 2.1). Enclosed settlements can be further divided morphologically into palisades, ditch and bank enclosures, and various forms of hillforts. However, even an 'open' settlement can, and usually does, have some ditches associated with it, so that the distinction between open and enclosed can be inexact (Harding 2009, 247).

This classification system of open or enclosed settlements and their constituent subforms was a very practical, and rapid, form of analysis as much of the survey work in central Britain took place over vast swaths of land. Later prehistoric settlement in the region is perhaps best characterized by enclosures, traces of some of which have been encountered in the uplands enabling their morphological classification. In the lowlands, enclosures have been argued as rarer, though they remain the dominant form, usually only identified through the use of aerial survey (Gates 2004). Aerial survey has the advantage of making enclosures easy to identify, and so effectively skews the picture away from the other settlement type, the open or unenclosed settlement. New data on open settlements was brought to light with more recent work in Northumberland and East Lothian in advance of road schemes and other development (Lelong and MacGregor 2008; Proctor 2009).

A second way to categorize a site is based on size. There are two ways in which size can be judged, and both can be used in conjunction with each other. Firstly, there is the overall size, or spatial extent, of the settlement. Assuming that the limits of a settlement can be determined this is fairly easy to calculate. Secondly, the settlement can be categorized by calculating the size of the population based upon the number of probable habitation structures that were being used at any one time. This second classification often results in the use of terminology such as: *homestead*, *hamlet*, *village*, and *oppidum*. While the important distinction here is probably between dispersed and nucleated settlements, these terms are still useful in that they are familiar descriptors for most people, however ill-defined they may sometimes be in the literature.

The homestead, also referred to as a farmstead, is often seen as the typical Iron Age enclosed settlement in the north (Fig. 2.1). It includes a main building/house and one or more ancillary buildings. Unenclosed variations may exist in the form of 'hut circles' that have been identified through aerial photography. These, however, cannot be dated without excavating them, and therefore, they could easily be enclosed sites without visible enclosure or ploughed-out Bronze Age round barrows. The sites are likely to have been home to an extended family, a single household.

The hamlet is slightly larger than the homestead and can be either open or enclosed. It would consist of a few houses, occupied at the same time. The houses could be inhabited by different extended family units or a large extended family that has split into multiple households but still reside in the same locale (Hingley 1989). Really the hamlet is something between the homestead and the larger village. Kilton Thorpe Lane, which is part of the present research, if indeed a single phase of past activity, would be classified as a hamlet with its three roundhouses and a few ancillary buildings.

The third settlement type is the village, which contains multiple extended family units, and displays increasing intrasite complexity. Glastonbury Lake Village is perhaps the most well-known example in Britain and would have been occupied by perhaps 200 inhabitants when at its largest, with 10–20 persons occupying each of the 14 identified units (Coles and Coles 1986, 164–65; Coles and Minnitt 1995, 204). The inhabitants had access to varied plant and animal resources, and took part in wood, ceramic and metal crafts, along with basketry and the working of bone/antler.

The fourth settlement type is the *oppidum*. In the strictest definition the Latin word *oppidum* means 'town', but among contemporary archaeologists there is no universally agreed definition. Cunliffe (2005, 30) uses the term to refer to nucleated settlements with urban characteristics, while Collis (1984) includes a defensive element in his characterization. For both, these settlements appear to arise in the 2nd or 1st century BC and are large when compared to other settlements in their region, with Collis (1976, 10) indicating they are 30 ha or greater in area. This has led to large hillforts – defended settlements by name – to be classified debatably as *oppida*, when they may be no more than enclosed hilltop villages. Some sites in central Britain (e.g. Stanwick, Traprain Law, Eildon Hill North) have been called *oppida* regularly, in one or both senses of the word, especially since they are all thought to have been tribal centres, but it is beyond the scope of the current research to delve any deeper into the debate.

Settlement variation

To say later prehistoric native settlements are highly variable in physical form and social and economic significance is perhaps an understatement. North and west of the Tees » Bristol Channel » River Exe divide, the picture can best be described as "one of dispersed settlements distributed, fairly densely in some areas, across the landscape" (Hingley 1989, 140).

According to present knowledge, a typical later Iron Age settlement in central Britain is the ditched or walled enclosure that contains one or a few roundhouses (e.g. West Brandon, Thorpe Thewles phase 2, West Brunton). Although conjoined compounds do exist, single enclosure (homesteads) dominate (Hingley 1989, 76). Hingley (1989, 56–57) points out that Iron Age enclosures of banks and ditches were common in both upland and lowland Britain, but that when the underlying geology is near the surface stone-walled enclosures appear to be more favoured.

In central Britain a trend toward enclosure in the second half of the first millennium BC has been noted (Haselgrove 2002). In the past this was thought to be the result of increased warring between populations, or an increase in defence with the arrival of the Roman military (Knight 2007). What is becoming clearer in east-central Britain is that as the Iron Age is coming to a close, enclosure boundaries were no longer being maintained (Haselgrove forthcoming-a). Some settlements (e.g. Thorpe Thewles) are spilling over the former boundaries before settlement ceases. Further south in the East Anglian Fens, similar settlement evidence points to increased nucleation until the 3rd century AD, after which single farms appear to dominate again (Hingley 1989, 76).

2.2 Exploring early history in east-central Britain

The study period of this research spans the later Iron Age and early Roman periods (*c.* 400 cal BC–cal AD 200), with a particular focus on changes in settlement typology and the interaction between native Britons and both the environment and the newcomers to the island, and its repercussions. This transitional period began with the first Roman invasions of Britain that occurred in the late Republican period under the leadership of

Julius Caesar in 55 and 54 BC. The peoples of Britain that were encountered at this time by Caesar had, however, been in close contact with Romans on the Continent for up to 150 years (Cunliffe 2005, 237), or even longer, but with the intensity increasing through time (Jones and Mattingley 1990, 57). While much of the evidence is focused on southeastern Britain, Harding (2004, 25) notes that as many Gaulish coins have been found in northern Britain as have coins minted in southern England. This, he suggests, represents direct contact with the continent rather than some form of secondary redistribution. Much other artefactual evidence also suggests direct trade with peoples in/from Brittany, Normandy, and the Pas de Calais; goods came from as far afield as the Mediterranean through these same pathways, having travelled up the Rhône through to the Seine, Loire, or Rhine river valleys, or along Atlantic coastal routes (Jones and Mattingley 1990, 57). The recent discovery of the Stirling torcs attests to just how widespread the trade networks were. One torc was originally crafted in southwest France while a second, with its form normal for north and west Europe, displays a level of craftsmanship thought to originate from within the Greek or Roman world (National Museum of Scotland website http://www.nms.ac.uk/our_museums/national_museum/past_exhibitions/iron_age_gold.aspx - retrieved 27th June 2010).

While Caesar is often viewed as having been no more than partially successful in his campaigns, he may well have laid the groundwork for integrating the elite in the southern and eastern kingdoms into a Roman way-of-life through a process of fosterage, whereby the sons of the elite were raised/educated within the Roman Empire (Creighton 2000; 2006). This influence was likely not relegated to just the South and East, but perhaps extended North and further inland as evidenced by the discovery of over 200 Republican and early Imperial coins mixed with Iron Age coins in hoards at the site of Hallaton, Leicestershire that has been dated to a few generations either side of AD 43. The coins are indicative of contact between the later prehistoric peoples of the East Midlands and the Roman Empire (Score 2006; forthcoming).

This relationship between some of the British kingdoms and the Roman Empire over the nearly 100 intervening years facilitated the invasion of Claudius in AD 43 and physical expansion of the Empire into Britain. Claudius was not a man of military might, and probably invaded Britain in search of a military victory to solidify his position as emperor (Breeze 1982, 21). The first governor of Britain, Aulus Plautius, would establish the ‘Fosse frontier’ in AD 44–7 (Cunliffe 2005, 237), although this was probably not much more than a road linking forts/settlements from Exeter to Lincoln (Breeze 1982, 23).

In the early conquest period, during a flurry of expansionist activity, some indigenous groups (known to us by Roman ascribed 'tribal' names, such as the Dobunni, Trinovantes, Dumnonii, Durotriges, Corieltavi, and Catuvellauni) were reorganized through treaty into client kingdoms of Rome, and/or then into formal administrative areas, the *civitates* (Hanson 1987, 74)[2]. The Romans determined the territorial area and a territorial centre was established, usually thought to approximate to the indigenous tribal boundaries. As some of these 'client' rulers died, the treaties that they had originally made were either renegotiated or the kingdoms were absorbed into the province. The Atrebates were probably absorbed upon the death of their king Cogidubnus in much the same way as the Iceni were absorbed by Rome in AD 60 upon the death of their leader Prasutagus, who had no male heirs (Breeze 1982, 23).

After the Boudican revolt in AD 60–1, there was a period of quiet fort building (Jones and Mattingley 1990, 71). The 'Fosse frontier' demarcated the Roman and 'barbarian' divide up until AD 70, when, under the governorship of Petillius Cerialis, Queen Cartimandua of the Brigantes was expelled and her 'kingdom' was brought into Rome (Hanson 1987, 38–39). Significant is the date of AD 70 marking the point of the Roman military expanding as far north as North Yorkshire and the Tees valley. By AD 72/3 they had crossed the Stainmore Pass and moved up to present-day Carlisle, when the timbers for Carlisle Fort were felled (Groves 1990). Roman rule was extended further North to the southern Scottish Highlands under the rule of Vespasian and his two sons (AD 69–96) (Jones and Mattingley 1990). The further expansion was led by Agricola, who in AD 77 (or 78 depending on the account) returned to Britain as Governor. The life of Agricola was recorded by his son-in-law Tacitus, and it is from these accounts that much of the present information has derived.

Under Agricola's leadership, the Romans moved beyond the tribal area of the Brigantes in the Tees valley, northward through Votadini territory, as far north as the

[2] The ascription of tribal names and boundaries is almost certainly a construct of the Roman invasion that has been perpetuated through to modern times. It is not known whether any of the 'tribes' named by the Romans actually operated as such. In fact, the coin hoards at Hallaton suggest that there were multiple, independent groups within the East Midlands at the time of the invasion. What is not known is whether those groups came together to respond in a time of crisis, or if they adopted separate strategies (http://www.archaeology.co.uk/articles/the-hallaton-treasure-evidence-of-a-new-kind-of-shrine.htm - retrieved 19th July 2010)

Tay. The remainder of the first century AD would see Rome garrisoning central Britain while slowly moving back out of Scotland, first to the Forth-Clyde and then the Tyne-Solway line by about AD 103 (Breeze 2007, 36). Around the same time most of the forts along the Fosse way were also being abandoned, with the troops being redeployed into Wales or along the northern frontier demarcated by the Stanegate at the Tyne-Solway isthmus.

The Stanegate remained the most northerly line of Roman occupation until the reign of Hadrian (AD 117–138), who in AD 122 ordered a wall be built from sea to sea, across the Tyne-Solway isthmus to separate the Romans from the 'barbarians'. The wall was constructed just north of the existing forts of the Stanegate, so owing its position not only to the topography, but also to existing military installations (Breeze 2007, 37). The construction of Hadrian's Wall was the first occasion that Rome defined a frontier or boundary with a structure of such magnitude and permanence. For the next 16 years the wall served its purpose to maintain – in fact to control – the frontier zone.

When Antoninus Pius came into power in AD 138, things began to change. Initially, it was expected he would maintain the existing frontier, especially now that it had been consolidated by Hadrian, for he had no military experience. However, he pushed forward and "*conquered the Britons…and after driving back the barbarians, built another wall, of turf*" (Historia Augusta, Life of Antoninus Pius, 5; as quoted in Breeze 2007, 51). The Antonine Wall was constructed in *c.* AD 142 and stretched across most of the Forth-Clyde line. Occupation of the wall was short-lived and by AD 158 Hadrian's Wall was being repaired in anticipation of reoccupation (Breeze 2007, 63). In the end, despite forays into Scotland at the beginning of the 3rd century by Septimius Severus, Hadrian's Wall would remain the northern frontier in Britain until the 5th century when Roman troops began to withdraw from Britain.

From *c.* AD 80 until the end of Roman occupation in the 5th century, there was a continuous military presence in central Britain. Even when the military was holding a line at Hadrian's Wall there were at times forts/fortlets occupied north in the Tyne-Forth region. The troops were not necessarily static and in the 50 or so years between the construction and abandonment of Hadrian's Wall and the Antonine Wall, and the reoccupation of Hadrian's Wall, minor incursions and battles took place in the frontier. It even has been suggested that Severus had come to the island because the "situation on the northern frontier had deteriorated and the governor had written to state that either more troops or the presence of the emperor was required" (Breeze 2007, 67).

The Roman presence took different forms across central Britain and was not always one of domination and repression. In the Tyne-Forth region it would appear that the relations between the Romans and Votadini were good as the site of Traprain Law (long thought to represent a central social and political place of the Votadini) continued to prosper throughout the Roman occupation of Britain, perhaps as a client kingdom (Mattingley 2007, 424). More complicated is the case of the settlement on Eildon Hill North, which is thought to represent a centre for the 'hostile' Selgovae. The hillfort is within sight of the Roman garrison (fort and vicus) of Trimontium (Newstead) and had a Roman signal tower placed in its centre [3] (Rideout et al. 1992). While it is clear that Traprain Law was in use throughout the Roman period, what is less certain are the political dynamics and historical circumstances that led to the siting of a signal tower on Eildon Hill North. In the latter case, it is unclear whether the hillfort was still in use, actively inhabited, at the time the tower was constructed. The narratives of Roman and native interaction would be quite different depending on the chronology of these structures.

Recent work has questioned and/or downplayed the role of the Romans in changes identified in later prehistoric societies. Frodsham et al. (2007, 261) argue that in the Cheviots, the fortified settlements that have been shown to have been indefensible might have been part a "style war in which the aim was to out-do the neighbouring site/group by means of architectural expression and activity". Giles (2007, 248) concludes that the shift to enclosure in the later Iron Age of East Yorkshire "cannot be attributed to Romanisation, but must be understood as the long-term consequences of historical transformations originating in the Iron Age." Some of the trends that have been identified and explained in some cases as the result of native-Roman interaction may well be part of a longer temporal process of change.

Although recent work has challenged traditional views of the interaction between Romans and the various tribes, it is necessary to employ new methodological tools that would allow new insights into the history as we know it. A more precise and developed chronological understanding of the native settlements holds great potential to put

[3] The interpretation of the remains being of a Roman signal tower is the subject of current disagreement among some archaeologists working in the region (Haselgrove pers. comm.)

forward new interpretations and indeed unravel their social dynamics. This is because the settlement is the dominant element of Iron Age archaeology in central Britain, and the understanding of its historical transformations is key to such endeavours.

2.3 Climate in later prehistoric Britain

Although Haverfield (1924) initially saw in Britain a divide between the north and south, which essentially fell along the same line of the 'Fosse Frontier', Haselgrove (1999; forthcoming-a) has argued that in prehistoric times, in central Britain, the distinction between east and west centred on the Pennine ridge, was more significant. Roberts and Wrathmell (2002) have pointed out that this same division was significant in respect to medieval settlement and land use. It is this east-west division that appears to be integral in modelling past climate and understanding land-use patterns and economy.

In relative terms, the area to the west of the Pennines is cool and wet, while the east is warmer and drier. The immediate implications are for arable agriculture, with the east being more amenable to cereal agriculture, although at a higher risk of drought, and the west being less suited for good agricultural production. The effect the climatic difference would have had on temperate grasslands (pasture) is much less well understood than the effect on cereals, but current research suggests that grasslands are more affected by interannual variation than mean changes in temperature and precipitation (Zavaleta et al. 2003) suggesting that west of the Pennines would be more amenable to pasture land given the lower risk of variation within a given year. Nevertheless, climatic conditions were highly variable during the study period and are poorly understood with any chronological precision (Brown 2008).

The first millennium BC witnessed two climatic downturns that are part of an oscillating cycle (Brown 2008). Both of them began with two to three centuries of decreased temperatures and increased precipitation before moving into periods with warmer and drier conditions. Between 1000 and 500 cal BC, the mean summer temperature was as much as 3.7ºC lower than the modern day (Mörner 1980). This was similar in scale to the Little Ice Age in the medieval period between AD 1550 and 1850, a period when many upland farms were abandoned (Bell 1995, 146). Despite initial direct extrapolations for a similar pattern of wholesale settlement abandonment also at the end of Bronze Age, such models are now considered redundant. Enough evidence has accumulated to show that a human presence persisted in the upland environments, even if the scale was reduced (Bradley 2007; Haselgrove and Pope 2007).

Tipping and Tisdall (2005) interpret the palaeoenvironmental record as demonstrating an oscillating cycle of abandonment and reoccupation in both the uplands and coastal plains of central Britain throughout the first millennium BC. They argue that these are localized abandonment episodes, perhaps taking place as resources are either depleted through human use or adversely impacted through climatic change. There is pollen evidence in 8 out of 9 radiocarbon-dated cores reviewed by Turner (1979) suggesting that previously localized forest clearance gave way to widespread clearance by *c.* 100 cal BC–cal AD 200 (Bell 1996). Interestingly, this widespread clearance is witnessed in cores in different topographic settings. Questions still remain as to the rate at which widespread forest clearance occurred, to the timing of these more isolated events, and how this correlates to the local and regional archaeological settlement picture.

2.4 Later Iron Age economies

Agriculture

Research into the subsistence economies of Iron Age peoples has been amongst the most revealing of the past two decades. This research has seen the old notions of the footloose ‘Celtic cowboy’ in central Britain be replaced with images of relatively sedentary farmers practicing a mixed agricultural regime.

Throughout the Iron Age, at least across the Midlands and East Anglia, there is a general overall increase in the reliance on sheep, but with a shift at about the time of Roman conquest to increased numbers of cattle (Albarella 2007). The increasing use of sheep may be related directly to an increase in arable land and the folding of sheep in the fields, which would be useful for manuring and perhaps less destructive than cattle (Albarella 2007, 394–95). While there is certainly variation in the spatial patterning of the animal assemblages, Hambleton (1999) has shown (with the usual caveats for holes in the data be it at the regional level or even lack of published faunal data in specific site reports) that with the exception of banjo enclosures which have more sheep, there appears to be no correlation between settlement type, geological location, or altitude, and species frequency.

Albarella (1997; 2007) has noted that a high proportion of sheep were killed in the autumn, probably just before the coldest part of the year. He suggested that the animals were kept for multiple purposes (wool, milk, and meat) and that the slaughter was a direct result of the difficulty associated with maintaining the flock throughout the winter. In terms of cattle, Hambleton (1999) indicated that their occurrence is varied with some sites across Wessex, the Upper Thames valley, and East Anglia displaying a higher proportion of juveniles and others adults. Sheep seemed to be preferred, probably not only for use in manuring, but because they are able to tolerate a wider range of environments, rendering cattle more expensive to keep and therefore also possibly of higher status (Chadwick 1999, 159).

While it was once thought that widespread forest clearance was likely a reflection of an intensifying pastoral economy (Piggott 1958), more recent work has shown that the Iron Age people of central Britain were farmers as well (van der Veen 1992). Palynological data suggest that the later prehistoric period across central Britain is marked by increasing forest clearance and the expansion of agriculture, however this data is unable to differentiate between an increase in arable or pasture (Tipping 1997). East-central Britain, specifically in the later Iron Age, sees an intensification of agricultural activity, as surmised from evidence for land clearance and settlement moving into areas of damper and heavier soils (Haselgrove 1999, 271; Jones 1981). While the work of Topping (1989) showed that the cord rig fields of the uplands in Northumberland and southern Scotland date to at least the first millennium BC, Van der Veen (1992) has provided clear evidence of emmer and barley production throughout this period and identified what she sees as a shift to the use of spelt wheat in northeastern England in the later pre-Roman Iron Age. This shift to spelt wheat has been interpreted as being advantageous in the cultivation of the damper and heavier soils of the uplands.

Exploitation of marine resources is difficult fully to understand and appreciate for the later Iron Age, as direct evidence is extremely scarce. Stable isotope analyses have shown practically no exploitation of marine protein from the start of the Neolithic until the medieval period in Britain (Jay and Richards 2006; Jay 2007; Müldner and

Richards 2007)[4]. Similar conclusions were drawn on a large project on an island in the Baltic Sea (Öland, Sweden) that shows a shift to terrestrial resources at the start of the Neolithic and only the beginning of marine resource exploitation again in the Roman period (Eriksson et al. 2008). Dobney and Ervynck (2007) assert that the absence of this particular resource is, in fact, likely to be a real phenomenon and not the result of taphonomic processes. They posit that the behaviour towards fish may lie perhaps in the way Iron Age people ordered the natural world, or in some other ideological explanation. Whether or not this is true, there is a general acceptance that marine resources were not normally important (Champion and Collis 1996; Cunliffe 1995b; e.g. Green 1992). While this may hold true in general, there are settlements, such as North Road, Berwick-on-Tweed (PCA 2006), where marine resources were being utilised in significant quantities, which urges for new/additional interpretations.

Non-subsistence economies

Many industrial communities in the Iron Age can be considered as emerging in liminal environments (Haselgrove and Moore 2007, 5; Henderson 1991; Sharples 1990). Non-subsistence economies include ceramic and metal production, although in central Britain neither of these appears to have been prevalent. In fact, to date the earliest direct evidence for iron working in central Britain comes from the later Iron Age in East Yorkshire (Haselgrove forthcoming). What was prevalent in terms of non-subsistence strategies was the exploitation of the sea for salt production. An Iron Age network for salt has been identified through analysis of briquetage, centred on the Tees lowlands (Fitts et al. 1999; Willis 1999). This was reinforced and expanded by the discovery of a brine evaporation oven at Street House Farm on the North Yorkshire coast (Sherlock 2007), and briquetage recovered at North Road, Berwick-on-Tweed (PCA 2006).

The production of salt and the network of exchange that developed as a result were clearly in place prior to the Roman conquest, and probably stretched further back in time. This suggests a much more closely linked and broad-reaching community than previously thought, and also a higher level of social integration and organization among peoples in central Britain (Willis 1999).

[4] Richards et al. (2006) have shown that from the Iron Age through the late medieval period in Newark Bay, Orkney, U.K. there is evidence for as much as 50% of the protein to have been derived from marine resources, but to date this study would appear to be the exception to the rule.

2.5 Iron Age social organization

There are two important institutions of social organization that must be considered when looking at Iron Age society: the family and the community. The family in general can be related to those living together under the same roof or within the same compound (cf. household); the community can be as narrow ranging as the settlement or as wide as a region. The distinction between the two and how they are constructed is important as the way they are perceived impacts interpretations of how society within the settlements were constructed and/or transformed.

The way the family organizes itself is related to rules of kinship and can be broadly categorized as either *nuclear* or *extended*, with the nuclear family being the 'traditional' (but perhaps more aptly Western idealized) family unit consisting of the mother, father, and children and the extended including relations further afield such as aunts, uncles, and even distant cousins. It seems quite likely from the evidence gleaned from historic authors and the archaeology that native later prehistoric Britons were part of extended families (cf. Harding 2009, 283–84; Hingley 1989, 7).

Moving beyond, or extending out from, the immediate family there is the community. Communities consist of people, and groups of people, who share beliefs in common gods, and/or who share a common heritage, be that linguistically or ancestrally. Communities may also be groups of individuals who share access to resources held in common, or interact in common networks of exchange (Hingley 1989, 9). There are groups of native settlements in the Fens that represent communities that share access to resources, while other groups of settlements may be based upon divided inheritance of land (Hingley 1989, 76). There is, therefore, a multivocality associated with community, such that it exists on many different levels and at different scales.

When the family unit is an active subsystem of the community, it has enormous potentiality for mobilizing groups. This could be under the control of a chief at times of war or even without any specific leader for community projects. Where the settlement record is one of dispersed homesteads, the family can be expected to be the primary, or sole, organizer of the community (Orme 1981, 149–50). This is the prevalent settlement pattern of east-central Britain (Hingley 1989, 140).

To understand the community, the way that Iron Age society operated must also be considered. Debates on the degree of hierarchy and/or heterarchy that existed within

Iron Age society in Britain and Ireland, as well as on the Continent, have emerged during the past decade or so. The traditional model of later prehistoric society was one of increasing complexity and hierarchy (Cunliffe 2005). Cunliffe's model revolves around the Wessex hillforts and would have many, if not most, playing the role of perhaps elite residence that provides protection in times of conflict and/or fortified central place for storage and redistribution of foodstuffs. Haselgrove and Moore (2007, 11) have noted that, in fact, "the final centuries BC and the first century AD were characterised by the emergence of a new (or at least more visible) elite." The Cunliffe model has been challenged by more recent models that, while accepting that later Iron Age society in south-west England was more hierarchical, regards society outside of this area as more fluid and certainly more equal (Hill 2006). In this competing model, even hillforts could be constructed through communal cooperation and without the need for a powerful elite class. Cripps (2007) suggests that later prehistoric society in Devon and Cornwall might be seen as more or less horizontally stratified, rather than hierarchically constructed, with settlements being shaped as a result of inter/intra-societal dynamics. While an increase in hierarchy may be taking place in southern, or at least southeastern, Britain and on the Continent, the picture in central Britain is one where the rise of 'hillforts' can be seen not as marking a developing elite class, but rather as the "residences of extended family groups that co-operated effectively with one another" (Frodsham et al. 2007, 263).

The focus of the research that follows is on native settlements, where it has been traditionally thought that the inhabitants "for one reason or another, failed to become highly romanized" (Hingley 1989, 23). In central Britain, an analysis of the metalwork shows it expressing a "local identity which was adopted within a Romano-British frontier milieu and interpreted in different ways by people of different backgrounds" (Hunter 2007, 294). The later prehistoric peoples in this region can be seen as having developed an identity that is distinctive and different from the native populations to the north and the south. While North Britain continued in an 'Iron Age' lifestyle until Roman retreat and much of the South was firmly entrenched in the 'Roman villa' lifestyle, the centre was left to interact with the Roman military, which possibly aided in solidifying this identity (Haselgrove forthcoming-a).

2.6 Disposal of the dead and deposition of artefacts

The recovery of artefacts through archaeological investigation is most likely to occur in the places where people lived and died. In the periods preceding the Iron Age, the study of burials within monuments and/or cemeteries and any associated artefacts has been a critical part of the development of a chrono-typological framework. The Iron Age, however, sees a shift in burial practice from one with inhumations or urned and un-urned cremations within monuments or large cemeteries to one that is virtually archaeologically invisible. There are a few notable exceptions to this generalization in the Iron Age cemeteries of East Yorkshire and the inhumations of south-west England (Cunliffe 2005, 545–6). The general consensus is that the mortuary practice in the later Iron Age was dominated by excarnation with possible secondary burial rites taking place (Carr and Knüsel 1997; Carr 2007).

While there is a lack of burial evidence, and associated artefacts, across much of Britain in the later 1st millennium BC, this has not had an overly negative impact on studies. In fact, it has been quite possibly an aid as researchers have been forced to ask new questions about the contexts within which artefacts have been recovered. Some specific studies have focused on deposition of metalwork in 'watery' places (Bradley 1990; Hunter 1997) or in hoards of objects such as torcs, coins, and horse equipment (Hutcheson 2007; Score and Browning 2010). The objects in question are often fortuitously recovered through metal detecting and the implementation of the Portable Antiquities Scheme in England will likely have an even more positive effect on both the quantity and quality of data for these type of finds for years to come (Worrell 2007).

If we turn to where people lived, we find that later prehistoric settlements are, in general, 'clean' insofar as few, within the limits of their excavation, have areas of rubbish accumulation that has built up throughout the span of use. This has led to increased interest in artefact deposition within settlements in an attempt to glean new information about later prehistoric socio-cultural practices (Cunliffe 1995a; Hill 1995). It is here that we began to see the ritualization of practice in everyday life within Iron Age society.

2.7 Concluding remarks

> 'British prehistorians have devoted considerable efforts to defining different classes of monuments and to tracing their development over time and space.' (Bradley 1998, 149)

While the primary focus of Bradley's comment is Neolithic and Bronze Age monuments, this statement is easily extended to later prehistory. However, unlike the ubiquitous monuments of the earlier ages, the later prehistoric landscape is populated by settlements, and the British prehistorian has historically tackled the study of settlements in much the same way, through morphological classification, temporal sequencing, and spatial patterning. These same types of analyses have been used in the study of portable material culture as well, but settlements, as places where people lived their daily lives, are much more resistant to change. Many developments that are traced archaeologically can be considered quite dramatic (i.e. enclosing a house with a ditch or filling a ditch to open a settlement up), with the effort and cooperation required to undertake these tasks often being monumental. Attempts to deduce a pattern of increasing complexity in settlement form seem to have failed. It has been shown that even with the radiocarbon data that exists today in and around the Milfield basin, it is impossible to deduce any sort of chronologically developmental trend in settlement morphology (Passmore and Waddington forthcoming).

To understand transformations of individual Iron Age settlements there are multiple, though not exclusive, lines of evidence that include both historical and palaeoenvironmental sources. We know that during the later Iron Age and Roman period (*c.* 400 cal BC–cal AD 450) the climate generally was warming (Bell 1995, 147) and deforestation occurred across much of southern Scotland and northern England (Huntley 2007; Tipping 1994; 1997). This deforestation, however, was almost certainly the product of settlement expansion into sparsely populated areas in the later 1st millennium BC (Haselgrove 1982; 1999) and subsequent agricultural intensification (van der Veen 1992) rather than a direct result of climatic change, although the two could have worked together. At the same time ancient sources provide a fairly well-accepted timeline for the position and actions of the Roman military in their campaigns into central and northern Britain.

While settlements are easily the most common type of Iron Age site known in Britain, their importance for understanding Iron Age people goes beyond their simple ubiquity. With a shift from deposition and exchange of metalwork to domestic architecture as a primary medium of display moving into the Iron Age (Haselgrove and Pope 2007, 7), the settlement becomes that much more important as a locus for investigation and understanding. It has been suggested, for instance, that for much of the Iron Age, especially outside southern Britain, the settlement became the locus for ritual (Hill

1995), an idea which might explain a shift away from burial monuments to burial rites that are predominately unrecoverable archaeologically (Carr 2007). In order to better understand and interpret changes in Iron Age society as reflected in and/or triggered by transformations of the places in which people lived, a more precise chronological framework is needed, as this is the only way to fully appreciate the timing and tempo of change.

CHAPTER 3: CHRONOLOGY, RADIOCARBON, AND THE REV. THOMAS BAYES

3.1 Iron Age chronology: an assessment

The chronology of Iron Age Britain has, for nearly the last century, revolved around the development of chrono-typologies primarily through artefact seriation. Diagnostic pottery, metalwork, and coins have been used to order and analyse other associated archaeological data across much of Britain, tying the material culture of an 'undated' Iron Age Britain to the tree-ring dated chronologies of the Continent. While this work had a profound impact in southern Britain, it has done little to help in the materially impoverished North where the metalwork is scarce, the coins are nearly non-existent until the decades leading up to the Roman invasion, and the native pottery in general is only broadly datable to the first millennium BC.

Sadly, up to now, there have been few attempts at developing precise independent Iron Age chronologies in Britain. This is not to say that more precise chronologies have not been advocated by archaeologists researching the Iron Age (Cunliffe 2005; Haselgrove et al. 2001), but for various reasons, they have yet to take shape.

First and foremost among the reasons behind the current 'failure' of Iron Age chronology is the well-documented problem with calibrating radiocarbon dates in the Iron Age (Cunliffe 2005, 652–54; Haselgrove et al. 2001). This is a direct result of a major plateau in the calibration curve between approximately 800–400 BC (Fig. 3.1). When radiocarbon measurements are calibrated and fall within this plateau – a 'flat' region of the curve – the effect is to spread out the resultant calibrated probability. A second minor plateau exists at approximately 400–200 BC. In the early days of radiocarbon dating with 1-sigma errors of 70–100 years on the measurements, these two plateaus could actually have a combined effect on the calibration of some results, so that the result would be only a general date calibrated to 'the Iron Age', but even one or two decades ago, the best answer we would expect was that a site dated to the earlier or later Iron Age.

If many radiocarbon dates from Iron Age sites all calibrate to either approximately 800–400 cal BC or 400–200 cal BC the utility of radiocarbon quickly comes into question if the intent for chronology is to go beyond simply spot dating a site that contains no diagnostic material. This problem was partly solved with progress in measurement precision, so that nowadays the 1-sigma errors on individual Accelerator Mass

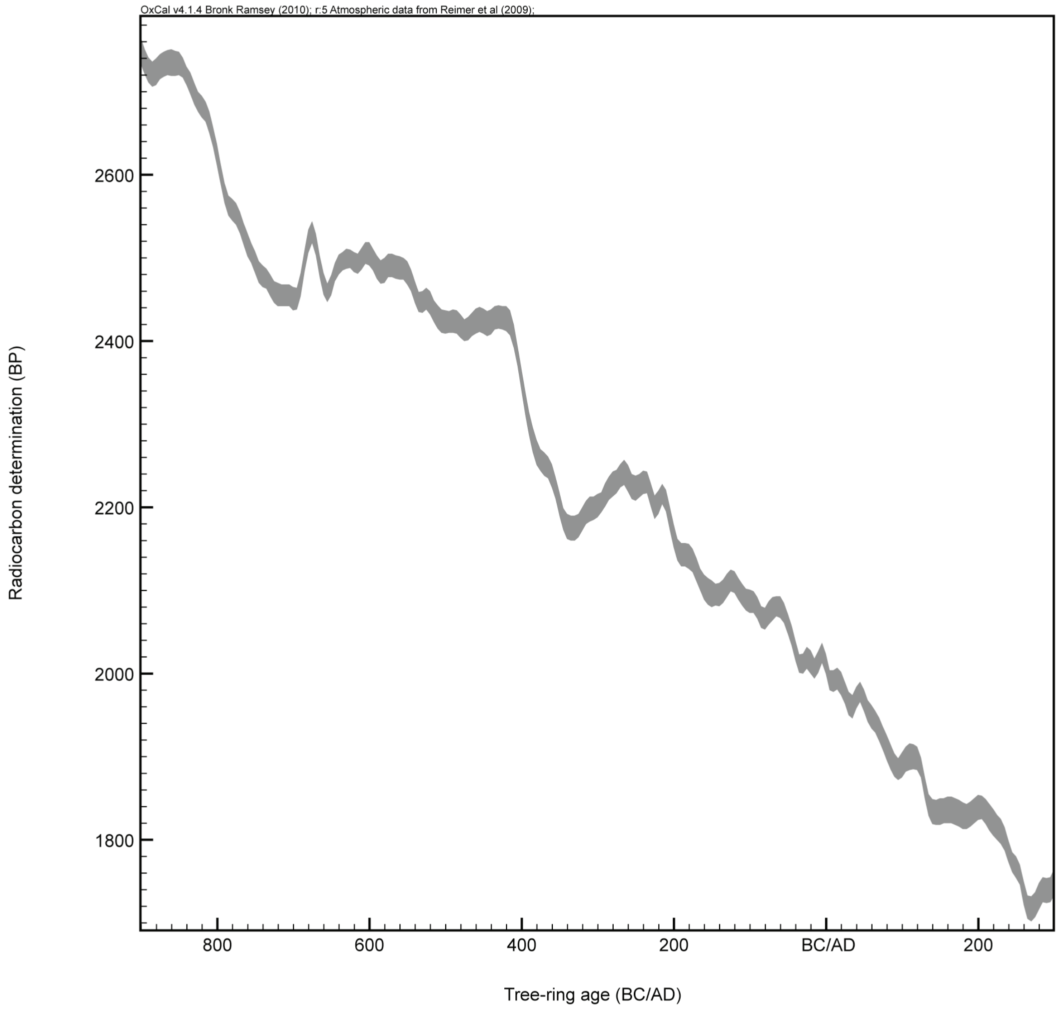

Figure 3.1: The IntCal08 (Reimer et al. 2009) radiocarbon calibration curve spanning *c.* 900 BC–AD 300. The variable thickness of the calibration curve is due to it being represented as a 95% probability band at any given point

Spectrometry (AMS) measurements from archaeological material of this date are routinely as low as 25–35 radiocarbon years. While many earlier Iron Age results will still calibrate to a roughly four century span from 800–400 cal BC, in the later Iron Age the increased precision means that fewer results will calibrate across the entirety of the second plateau (Fig. 3.2).

The imprecision of calibrated radiocarbon dates in the period has led to the second problem, probably best described as an unwarranted belief in the accuracy of dating through artefact typologies (Haselgrove forthcoming-a). The argument could be made that chrono-typological dating is more useful in later prehistoric southern Britain where more chronologically sensitive deposits are available than in the North. In this case the assumption is that the process of production, consumption, and deposition is fairly well

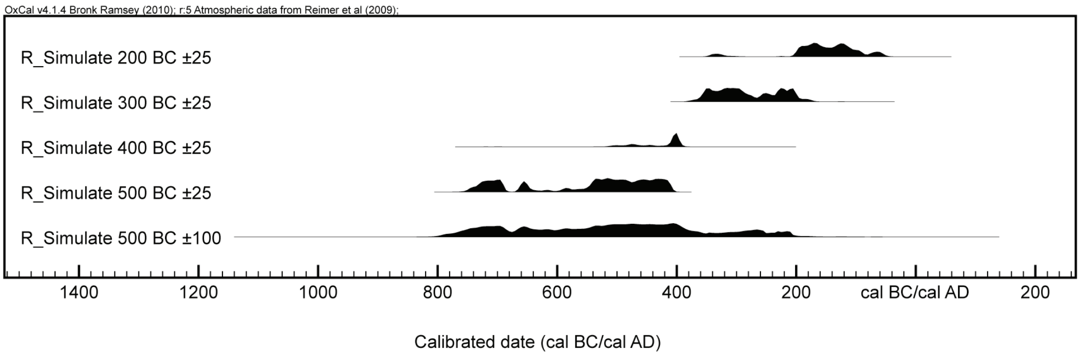

Figure 3.2: Probability calibrations of typical radiocarbon dates for the British Iron Age. The upper four dates have 1-sigma error of ±25 years while the bottom date has an error of ±100 years. The results are simulations of a possible result given the 'real' date in the label (i.e. 200 BC, 300 BC, etc.)

understood so that an accurate estimate can be made for the date of a context from which the material was recovered. It is difficult to say whether or not this is a valid assumption as there are very few instances where material typologies have been adequately independently dated at multiple sites with the intent to compare results across a region to examine the temporality of these processes.

A further complication is presented by the potential for residuality among diagnostic artefacts. Some artefacts may be residual in their context through natural or anthropogenic reworking of the deposits, so that an indirect date on the object by dating other material in the deposit can be misleading. Another layer of complication is added by the possibility of heirlooms, objects that could be considered especially rare or precious and that are passed down to later generations. This is probably most likely to affect the perceived date of these rarer diagnostic artefacts, such as brooches, increasing the time between their production and deposition. While the complication presented by residuality in reworked deposits can be addressed through a rigorous appraisal of the deposits, the issue of heirlooms is much more difficult to overcome. The dearth of diagnostic artefacts available to build robust reliable seriations is another reason why independently developed chronologies utilizing such techniques as ^{14}C dating are so important.

One of the earliest examples of the radiocarbon dating of pottery phases was by Naylor and Smith (1988), who attempted to integrate ^{14}C dates within a Bayesian framework to examine the pottery phasing at Danebury Hillfort. Although the methodology was flawed in its use of an outdated calibration curve, the use of 1983 as the date *before present* (BP) rather than the internationally-agreed 1950, and its lack of rigour in considering taphonomy and association between the dated samples and the pottery that was phased, this paper nonetheless paved the way for the future of Bayesian statistics in radiocarbon calibration and dating. More recent work investigating the timing and tempo of change in pottery styles utilizes direct radiocarbon dating of carbonized food residues on Neolithic Peterborough ware, and has showed much more fluidity and temporal overlap between different styles than previously thought (Marshall et al. 2009). Needham et al. (1997) similarly looked at Bronze Age metalwork and concluded that while temporal overlaps in the various assemblages existed they were not prolonged. Their statistical analyses, furthermore, had the effect of adjusting the chronology for the middle portion of their assemblages. Such targeted studies that provide independent dating for typological frameworks are very much necessary across all time periods, especially where pottery or metalwork typologies are routinely used as chronological markers.

3.1.1 Radiocarbon and Bayesian methods

Overall, there is not necessarily an issue with radiocarbon dating providing accurate and precise chronologies for the Iron Age (although the precision is still much diminished for the earlier Iron Age); the problem has been the failure to see beyond our once valid perceptions to the future of high precision AMS dating and statistical modelling. This work is having an enormous impact in other periods in prehistoric Britain, such as recent work on Neolithic Causewayed Enclosures (Whittle et al. forthcoming) and Long Barrows (Bayliss and Whittle 2007), where it is challenging our earlier perceptions of the longevity of ritual and the timing of the onset of the Neolithic in Britain. Recent research further afield is challenging our understanding of the long-accepted chronology of Dynastic Egypt (Bronk Ramsey et al. 2010), and creating some controversy in the process (http://www.almasryalyoum.com/en/news/egyptian-archeologists-comment-carbon-dating - retrieved 2 September 2010).

Since much of the present work relies on radiocarbon dates it is important to address briefly here not only how radiocarbon dating works, but more importantly what can be dated and the potential problems associated with the dating of specific materials. The ability to statistically model radiocarbon results along with other chronological information, both relative and absolute, drives the process of chronological framework development: from which questions can be asked; to the selection of samples; and finally to the production of the final results and their interpretation. As such it is also necessary to discuss in greater detail the process by which we move from the scientific date to the resulting model.

3.1.2 The development of the radiocarbon method

The ability to date material by measuring either the amount or decay of the radioactive carbon-14 (^{14}C) isotope in it has existed for well over half a century. Most archaeologists are familiar with the technique and it is beyond the scope of this thesis to delve too deeply into the technical aspects of radiocarbon dating – the physics and chemistry – beyond what is directly relevant to archaeologists with regard to sample selection and possible technical problems that may be encountered. Numerous detailed accounts of ^{14}C dating have been written by and/or for archaeologists (Aitken 1999; Bayliss et al. 2004; Bowman 1990).

For material to be suitable for radiocarbon dating it needs to be linked in some way to the global carbon cycle. Generally in archaeology the material forms part of the biosphere – plant and animal material – where the chain is connected through photosynthesis in plants absorbing carbon and animals eating the plants. Similarly, materials that interact with the atmosphere by taking up carbon in the process (i.e. setting mortar) can also be dated. While the large sample sizes required in the early years of radiocarbon dating limited what could be dated, the advent of Accelerator Mass Spectrometry (AMS) dating has created a veritable plethora of datable material because the size of the sample required is so small. We are now able to date individual grains of carbonized wheat, fragments of straw in adobe bricks, and even the scrapings of charred food remains from pots. These days nearly every site has more than enough material that is datable.

The application of radiocarbon to archaeology has had revolutionary effects on the discipline (Bayliss 2009; Renfrew 1973). The first was simply the ability to assign an independent age to organic material from archaeological sites, testing the deep-held diffusionist paradigms that viewed cultural change in Britain in successive waves of contact and colonization (Harding 2009, 3). However, with calibration the age became calendrical time so that radiocarbon chronologies could be compared directly to historical texts. These revolutions can be seen as paradigm changing, altering the way we do/make archaeology by providing a means to compare objectively the timing of events and processes of short and medium duration, and allowing us to appreciate, analyse, and interpret the nuanced dynamism of past societies.

3.1.3 The Bayesian method

If we can view radiocarbon dating as the first 'revolution' and calibration as the second, then the third 'revolution' is the application of the Bayesian approach to chronological modelling (Bayliss 2009)[5]. The Bayesian method is not exactly a new development in archaeology, or even British Iron Age archaeology. As mentioned earlier, Naylor and Smith (1988) published one of the earliest examples of integrating radiocarbon dating within a Bayesian framework to examine the pottery phasing at Danebury Hillfort. Despite the flaws in the analysis, which were subsequently highlighted and corrected (Buck et al. 1992; 1996), the Bayesian approach was taken up early in England, so that 66% of all radiocarbon dating funded by English Heritage between 1994 and 2000 had the samples selected using a Bayesian framework (Bayliss and Bronk Ramsey 2004, 26).

Bayesian statistics is a vibrant and active field, replete with devoted academic journals. The aim here is to present the method of using Bayesian statistics for chronological modelling at a level that is understandable to the uninitiated. More in-depth methodological information with examples and more specific equations is provided by Bayliss (2007; 2009), Bayliss et al. (2007), Buck et al. (1996), and Buck and Millard (2004). There are now many examples of the Bayesian method in practice covering nearly all periods in British prehistory, and some with particular focus on settlement dating include: Howick, Northumberland (Waddington 2007) for the Mesolithic; Parc Bryn Cegin Llandygai, North Wales (Kenney 2008) and Warren Field, Aberdeenshire (Murray et al. 2009) for the Neolithic; Cheviot Quarry, Northumberland (Johnson and Waddington 2008) for the Bronze Age; and Conderton Camp, Worcestershire (Thomas 2005) and Sutton Common, South Yorkshire (Van de Noort et al. 2007) for the Iron Age.

Bayesian statistics are named after the Reverend Thomas Bayes who was born in London at the beginning of the 18th century, and was both a Presbyterian minister and mathematician. It is in his *Essay Towards Solving a Problem in the Doctrine of Chance* (1763) that Bayes presents what has come to be known as Bayes' Theorem, and simply put states:

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[5] Although Taylor (1995) has suggested that AMS dating is the third 'revolution', the introduction of AMS was not so much 'paradigm changing' as it was a technological advancement allowing for a wider selection of material to be dated (Bayliss 2009, 126). However, if one wishes to view AMS as the third revolution I am happy with Bayesian chronologies as the fourth.

$$\frac{P(\text{data}|\text{parameters})}{P(\text{data})} \times P(\text{parameters}) = P(\text{parameters}|\text{data})$$

Standardized likelihoods	Prior beliefs	Posterior beliefs
"the dates"	"the stratigraphy/phasing"	"an answer"

(after Bayliss 2007 fig. 1)

The Bayesian method is a probabilistic approach that determines which parts of the dating probability (e.g. calibrated radiocarbon date, archaeomagnetic date, etc.) are most likely given the archaeological evidence, with the goal of producing a reduced date range for each sample, known as a *posterior density estimate.* This probability is shown in black in the model figures while the original calibrated date range is shown in outline. By convention, these probability distributions are presented in *italics* when expressed as date ranges in the text. Also, it should be noted, *posterior density estimates* are not absolute. They are *interpretive* estimates that can and will change as further information becomes available and as other researchers choose to model the existing data from different perspectives.

The method, however, actually goes beyond simply increasing the precision of the individual results. It is possible to query the chronological model with 'events' that exist archaeologically but for which there is no direct scientific date (e.g. beginning of a settlement, rebuilding of a house, digging of an enclosure ditch, etc.). It is these events that lie at the heart of what archaeology investigates, with the discarded charcoal, bone, or fired piece of pottery being the residues with which archaeologists are required to work. It is through developing these local and regional chronological frameworks based on events that we are able to construct temporally sensitive interpretations and/or narratives.

Finally, the process is iterative. In fact, the Bayesian method has been likened to a hermeneutic spiral whereby we formulate questions, model the data, examine the results and start over – repeating the process until we have a stable model that does not change appreciably with the addition of more information (Bayliss et al. 2007).

OxCal

All of the modelling in this thesis is undertaken using the radiocarbon calibration and Bayesian chronological modelling program developed by Prof. Christopher Bronk Ramsey of the Oxford Radiocarbon Accelerator Unit, University of Oxford, U.K. and called simply OxCal.

As Bronk Ramsey (1995, 425) has pointed out, the Bayesian approach in general and the OxCal program in particular are not only able to help the archaeologist or dating specialist to determine the optimum number and location of samples for dating, but also provide feedback on whether the calibration curve is likely to present problems for interpretation given the suspected age of the material. This section is meant to summarize how the OxCal program works, and more importantly to elucidate the underlying mathematical process involved in providing an answer. Except where noted, the information in this section is derived from Bronk Ramsey (1995; 1998; 2001; 2009a) and the online manuals for OxCal versions 3.10 and 4.1. In order to avoid confusion, terms presented in this thesis that are specific to the OxCal Chronological Query Language (CQL), some of which may have other meanings in the realm of archaeology, are presented in the `Courier` font.

Chronological models are composed of *events*, as the most basic building blocks. These are short by definition, or archaeologically instantaneous. A radiocarbon measurement is a number given to one type of event – the death of an organism – that is instantaneous. Similarly, the events that are identified archaeologically can themselves be seen as virtually instantaneous, such as the moment a pit was dug or a house was constructed. It is, of course, arguable at what point a house can be considered 'built', as the construction is a process that will span days or even weeks. However, dendrochronology is the only form of scientific dating used regularly in archaeology that has the ability to distinguish sub-annual dates for events, and even then only in unusually good cases of preservation. So, archaeologically, any process that lasts less than one year is instantaneous from the point-of-view of nearly all scientific dating methods, and can be considered an *event*.

Events can be grouped, and these groups can be ordered (`Sequences`) or unordered (`Phases`). It is here that the formation of a Harris Matrix (Harris 1979) is useful. This can be produced by the archaeologist from their understanding of the stratigraphy and phasing of the site, and then used to identify the model relationships and determine where the undated archaeological events that are of importance should exist within the framework.

When two or more radiocarbon measurements are combined, as is the case when multiple measurements are made on the same material, this occurs prior to calibration and follows the method described in Ward and Wilson (1978), yielding a more precise radiocarbon age for the sample. Calibration of all the radiocarbon measurements then takes place before modelling commences so that all models are run in the calendar timescale. OxCal, like most other calibration programs, accounts for the variability in the calibration curve errors in the normalization of the probability distributions, although this only has a significant effect where the calibration curve is highly variable with large errors (e.g. start of the Holocene) (Bronk Ramsey 2001, 355–56).

The chronological models run in OxCal v4 use a Markov chain and Monte Carlo (MCMC) sampling methods and by implementing the Metropolis-Hastings algorithm. Previous OxCal versions (3.2–3.10) utilized a mixture of the Metropolis-Hastings algorithm and the Gibbs sampler (Gelfand and Smith 1990) as this allowed for fairly smooth posterior distributions to be calculated with reasonable speed given the limitations of desktop computing power at the time. The Gibbs sampler has the drawback that it is difficult to implement in a broad range of models without writing special algorithms for each case. With the rapid development and seemingly exponential growth in desktop computing power, the Gibbs sampler is no longer necessary and so has been removed from the current version in favour of the completely general MCMC method that is applicable in all cases (Bronk Ramsey pers. comm.).

At the heart of OxCal, and of 'solving' Bayes' Theorem, is the Markov chain Monte Carlo analysis. The analysis method is used to "simulate complex, non-standard multivariate distributions" (Chib and Greenberg 1995, 327).

A Markov chain is characterized by a countable (and usually finite) number of processes, with each process being random and retaining *no memory* of where it has been so that no single process can influence where it will go. Because of these characteristics, the Markov chain can be used to model phenomena and "compute probabilities and expected values which quantify that behaviour" (Norris 1997, xiii).

The Monte Carlo sampling process allows the computer to 'sample' the prior probabilities given the constraints (e.g. stratigraphy and phasing) imposed with the goal of finding samples from the *priors* that are constituent, or in agreement, with the constraints. In short, the MCMC process builds up a representative sample of possible 'solutions'.

The implementation of the Metropolis-Hastings algorithm is especially useful in Bayesian applications as it forgoes the need to 'know' the normalization factor of Bayes' Theorem, so long as the samples are drawn from a probability distribution, $P(x)$, where a function proportional to the density can be calculated at x (Chib and Greenberg 1995).

In practice, the computer starts with a calibrated date somewhere in the model and determines what all the probabilities should be given the model constraints and given 'Scientific Date X' were to equal 'Year Y' – the initial drawn sample. As with all MCMC processes the program requires time to 'forget' the initial state, a process known as the *burn-in*, and so the initial 1% of passes, based on the total number of iterations, are discarded. In addition, the process should converge on an answer, and if the convergence value falls below 95% the program increases the number of MCMC passes. Because it is not always clear how many samples should be discarded as part of the *burn-in* process, OxCal runs the Markov chain from three different starting values and compares the variation between and within the sampled draws. The most basic site models will often complete more than 100,000 passes, and the more complex models will run well over a million with some models running into the tens of millions.

OxCal has implemented diagnostic checks to examine the agreement between the stratigraphic placement and archaeological phasing of the samples and the probability distributions of the date of those samples, which are reported by way of various *agreement indices*. Each individual date is given a value that corresponds to the agreement of that date with the model constraints, while the model has an overall index of agreement (A_{model}) relating to the agreement of all the samples with the model constraints. These values should be above the chosen threshold of 60, as this value is close to the 5% confidence level for a χ^2 test (Bronk Ramsey 1995, 428). When a sample has been excluded from the mathematical calculations of the model – recognizable by the '?' after the sample identifier in the model – the individual agreement index for that sample is the actual probability that the sample is in the correct position given the other dates and the model constraints.

3.1.4 Bayes and radiocarbon: in practice

Like all scientific endeavours, the Bayesian method begins by defining the research questions (Fig. 3.3). When looking at an individual settlement these usually include:

- When was the site first occupied? When was it abandoned? How long were people living there?
- When was Structure *X* constructed? When was it rebuilt/remodelled? How long was each period of use?
- When was feature *Y* constructed?

Moving beyond the individual site to the wider landscape the questions often become intraregional, such as:

- What is the probability that people were living at Site *A* while people inhabited Site *B*?
- What is the probability that Event *1* occurred before/after Event *2*?

The next step in the model-building process involves evaluating the pool of potential radiocarbon samples, and putting their contexts into a Harris Matrix (Harris 1979). From this, simulated chronological models can be produced. Simulations are highly informative in the sample selection process as they will help to identify not only the ideal number of dates needed to model the problem, but the ideal locations of the samples as well. At this stage it becomes possible to determine the sort of precision that can be expected given the samples, stratigraphy, and current technological precision of the dating method (Bayliss 2009).

After a first tranche of samples is submitted the process enters a loop, whereby the results are input into the model(s) and it is evaluated. Further simulations are performed and the second tranche of dates is submitted. While the first tranche almost always samples somewhat evenly through the matrix/model, the second and later tranches are used to further refine the date estimates and test any contexts where the original results are not what was expected. This loop usually occurs two or three times, but could continue for as long as the project timetable allows. At this time the results are fully analysed, reported, and interpreted and published as what Bayliss and Bronk

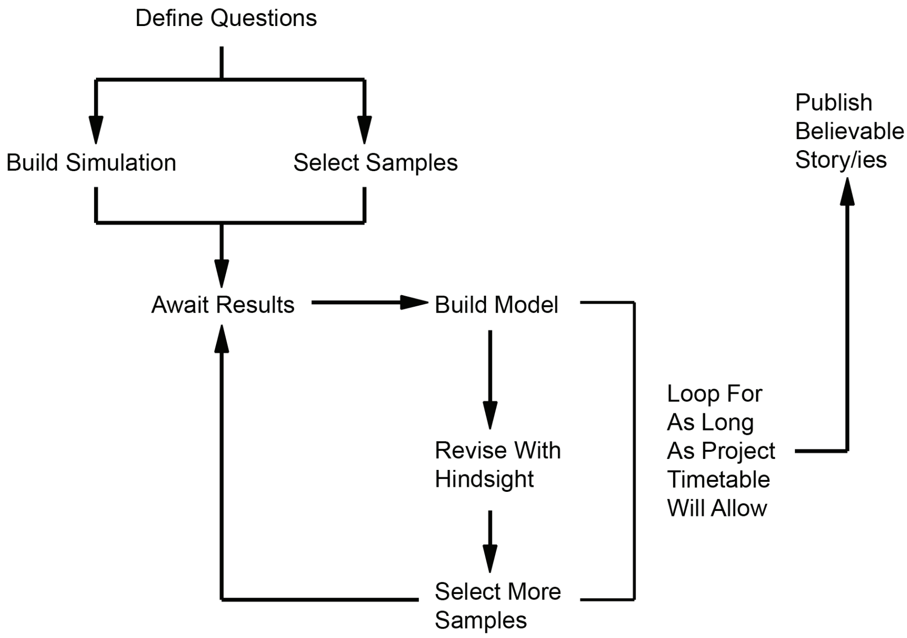

Figure 3.3: The Bayesian method in practice (after Bayliss and Bronk Ramsey 2004, 28: fig. 2.2; Bayliss 2009, 132: fig 9)

Ramsey (2004, 28: fig. 2.2) aptly refer to as ‘believable story/ies,’ further underlining the fact that the Bayesian results are interpretive estimates that can change as other researchers create more data, or model the existing data in different ways. It is the interpretative nature of the Bayesian modelling process that allows for, and in some cases requires, alternative models to be produced as a form of sensitivity analysis that uses the altered parameters derived from different prior assumptions or even different archaeological understanding (i.e. phasing) to examine how the model will react given the ^{14}C dates that are available.

The radiocarbon ‘date’

The radiocarbon laboratory provides a ‘date’ for the death of our sample. The ‘date’ is a combination of the laboratory measured radiocarbon age of the sample and the calibration of that age. It is up to the archaeologist to determine how the date of death concords with the date of the deposit from which it was recovered. The assumptions that underlie sample selection, or how a sample relates to its context, provide the most tenuous link in the model. Every sample must be thoroughly scrutinized and evaluated. Where possible, a functional relationship needs to be demonstrated between the sample and the context (e.g. charcoal in a hearth, bone in a burial, etc.). For less secure samples, or those where there is no clear functional relationship, it becomes increasingly necessary to understand the taphonomic processes that likely resulted in the sample being where it was found (Bayliss and Bronk Ramsey 2004).

With different problems and questions come different reasons for selecting samples. For instance, dating carbonized seeds from a ditch deposit may be a sound choice for understanding crop husbandry developments where the species are important, not the context. Seeds are, nevertheless, less desirable for dating than articulated bone, or any other material that can be assumed with a high degree of confidence to be in its primary depositional context, in that same fill deposit if the question was one relating to when the ditch was open. The seed is chosen because it is directly related to one set of questions specific to the material being investigated and dated, while the articulated bone would provide dating evidence more specific to the context as its articulation indicates deposition at that point when the ditch was open and an entirely different set of questions focused more on the development of the site. Because of the need to demonstrate connectivity between sample and context or sample and question, the single-entity approach to radiocarbon dating that is so widely advocated (Ashmore 1999) must not be used blindly. A radiocarbon date on bulked identified short-lived charcoal recovered from a hearth probably has more utility than a single piece of bone in an otherwise bone-free pit fill.

Laboratories that produce scientific dates (e.g. radiocarbon, luminescence, tree-rings, etc.) have stringent methods in place to provide quality assurance. Beyond their own internal measures, many radiocarbon laboratories have in the past and continue to participate in inter-laboratory quality assurance tests (Gulliksen and Scott 1995; Otlet et al. 1980; Rozanski et al. 1992; Scott et al. 1990; 1998; Scott 2003). Also, most laboratories do an adequate job of publishing the methods used to obtain a measurement either in peer-reviewed journals, on laboratory websites, or in the documentation accompanying a measurement certificate. Discussed below are some more specific considerations that should be kept in mind when evaluating the quality of the resulting date on various material types. However, because the laboratories quality assurance is fairly transparent we can generally accept that the inputs derived from the dating laboratories are correct, within statistical expectations.

What can be dated?

As stated earlier, anything that is linked to the global carbon cycle can be dated through measuring the amount or decay of ^{14}C, but here I will focus on what is typically dated in archaeological contexts: macrobotanical remains (charcoal, seeds, etc.); human and animal bone; cremated human bone; and carbonized residues on pottery. Each material type is not without its own possible technical complications as discussed below.

Macrobotanical remains

Perhaps the most ubiquitous sample type submitted for radiocarbon dating from archaeological contexts in settlements are macrobotanical remains. The samples include anything from the charcoal from hearths used as fuel for cooking and heating, the seeds and nut remains from the processing of food to eat, and even wood and plant remains from the structures that were inhabited.

In the early days of radiocarbon dating, through radiometric methods, the required sample size was rather large. Even today, 20g of charcoal is a conservative estimate required for a radiometric date (Beta Analytic, Inc; http://www.radiocarbon.com/sending.htm#q3; retrieved 25 April 2010). The large charcoal sample sizes that were necessary led to two potential problems. The first is simply the fact that the result could be biased through the admixture of different aged material, where material has had to be bulked up (Mook and Waterbolk 1985). Measures can be taken to overcome or account for this by ensuring that all of the bulked material comes from the same dense concentration of material (i.e. hearth, discrete rubbish dump).

The second problem, familiar to most archaeologists, is the ‘old wood’ effect. Basically, since a radiocarbon age is directly related to the death of the sample, if there is heartwood – inert or ‘dead’ wood in the centre of the tree – or charcoal from a 300 year old tree mixed into a sample then there will be an unintended and unknown offset to the result (Bowman 1990; Waterbolk 1971). In this case, even if all of the material were to come from a hearth, the result can be biased toward some pieces of charcoal in the sample that happen to come from the centre of a very old tree. In practice this is overcome by ensuring that all wood and charcoal samples are identified and known to be either of short-lived material or the outer rings (i.e. sapwood) of longer-lived material.

Although the modern accepted practice is to submit identified short-lived material (Ashmore 1999), when utilizing older published and unpublished dates, the problem of admixture can still exist. In this case, the quality of the context (i.e. density of the carbonized deposit, etc) can still be evaluated. The problem of 'old wood' is, unfortunately, much more difficult to evaluate after-the-fact since the original sample will have been destroyed in the dating process. If there is unsubmitted sample material remaining it is possible to return to that and check the type of material within, although there will always remain the possibility, however unlikely, that any 'old wood' was already removed. This was done by Rideout et al. (1992) with one result from Eildon Hill North that was earlier than expected. Sample GU-2194 contained oak, while the replicate sample GU-2373 had all oak removed. The latter sample *fits* within the stratigraphic framework of the settlement, while the former sample is much too early given all the other results (see Chapter 7.3).

Because of the problems associated with dating charcoal, particularly unidentified fragments, carbonized seeds are increasingly preferred as there is greater confidence that these single-entity samples are a direct result of human activity. When comparing AMS dates on carbonized seeds from the same deposits as bulk unidentified charcoal dates, van der Veen (1992) noticed that the charcoal was in some cases earlier, which may also explain the preference. However, for van der Veen's observation the issue is more one of a possible 'old wood' effect as she suggested that charcoal was more robust in the ground and so more easily redeposited and therefore residual without destruction than seed material (e.g. grains and chaff). While chaff probably would not survive being moved around too much in the sediment, carbonized seeds are more robust and can be intrusive in the contexts from which they are recovered, and so too young. Once again, a good understanding of the taphonomy of the sample and its context are crucial to determining where problems might exist.

Human and animal bone

Where conditions favour the preservation of collagen, bone becomes another useful potential radiocarbon sample. In the case of Iron Age settlements, the majority of preserved bone is likely to be from non-human animals; however, human burials can and do exist.

As van Klinken (1999) notes, three factors must be taken into consideration when determining the reliability of a radiocarbon measurement on bone: 1) to what extent the bone has been diagenetically degraded; 2) to what extent the sample has been contaminated by exogenous carbon; and 3) what method was applied for pretreatment and extraction of the collagen itself.

Over time, after an organism dies, fossil collagen degrades (Hare 1980; Tuross et al. 1980) so the burial conditions must favour collagen preservation. Even where bone survives the collagen may actually be too poorly preserved to allow for reliable dating (van Klinken 1999). Most labs quantify the collagen yield by weight of the whole bone and class a yield of >20% as ‘well preserved”’ and <5% ‘poorly preserved’ (Hedges and van Klinken 1992, 284). It is usually the bones in between these yields that are problematic, and research on carbon and nitrogen isotopes in fossil bone suggest that a C:N value of 2.9–3.6 can be indicative of good collagen preservation (DeNiro 1985, 808). While this is a good method to evaluate the reliability of a result, the nitrogen value needed to calculate the C:N value is usually only made on human bone for use in palaeodietary reconstruction (Hedges and Reynard 2007; Tuross et al. 1988) and so not always provided unless requested. A C:N ratio that falls outside of this range does not necessarily indicate that the collagen was poor, and the value should not be used to indiscriminately exclude results.

Although a sample may not be overly degraded and have an adequate yield of collagen, there remains the possibility that the sample has been contaminated through the introduction of exogenous carbon. The most common sources for this contamination include: 1) consolidants and preservatives; 2) products of microorganism activity; and 3) mobile humics in the soil (Hedges and van Klinken 1992). While the standard pretreatment methods (Longin 1971) should adequately remove any contaminants, there has been a continuing effort to improve the quality of the extracted collagen, and reduce the amount of possible contaminating exogenous carbon. The newest development of ultrafiltration (Brown et al. 1988) has been introduced into the process by some laboratories (Bronk Ramsey et al. 2000; Hüls et al. 2007). At the Oxford Radiocarbon Accelerator Unit, the incorporation of ultrafiltration into the bone pretreatment has been shown to be especially useful for older samples (Bronk Ramsey et al. 2004b). The importance of stringent quality control procedures has also been highlighted as there is the possibility of introducing carbonaceous material into the sample if the filters are not thoroughly cleaned (Brock et al. 2010; Bronk Ramsey et al. 2004b), and even so in some cases contaminants do remain (Hüls et al. 2007; 2009).

Other methods such as amino acid profiling and infrared spectral analysis can be used to analyse a bone sample prior to dating and determining the quality of the material (Hedges and van Klinken 1992). Except in cases where the burial environment is such that severe diagenesis is thought to have taken place even with bone that looks otherwise pristine, or where the bone physically appears degraded, these methods are all at an increased cost that many archaeological projects simply cannot absorb. The C:N range provided by DeNiro (1985) is perhaps most useful for evaluating a series of bone dates, although usually limited to human bones. Furthermore, while it may be tempting to favour bone dates that include the ultrafiltration method in the sample pretreatment, the possible introduction of exogenous carbon must always be kept in mind. To date, neither method can be seen as necessarily favourable with samples of only a few thousand radiocarbon years.

<u>Carbonized residues on pottery</u>

Pottery, in ceramic societies, is an artefact that is found regularly on settlement sites, albeit in varying quantities, and which holds the potential for providing dating evidence. Directly dating pottery is attractive as the pottery can be placed into a chrono-typological framework. Although thermoluminescence dating is a possibility, the errors associated with the measurements make it much less precise moving back in time (±5–10%) and thus much less viable. The 1-sigma error on a 2000 year old piece of pottery can be as much as ±200 years (Duller 2008, 21). Radiocarbon dating is more viable, and the increases in precision in AMS dating further expand its utility.

Ceramic sherds have been dated in the past by processing the entire sherd. The underlying assumptions were that the carbon in the sherd was a result of 1) organic temper added during the pot-making process, or 2) sooting and food burning during its use for cooking. Unfortunately, the first assumption does not stand up to scrutiny as the potter's clay is often contaminated, especially sedimentary clays and clays derived from shale deposits containing peats or even coal (De Atley 1980, 989). Furthermore, the post-depositional processes affecting the pot sherd are such that it possible for it to incorporate both younger and older carbon in the form of humic acids in the soil (Nakamura et al. 2001).

With the development of AMS dating, it is now possible to obtain a date on the residue adhering to the pot. A distinction must be made between soot and food residue. Bowman (1990, 15) warns of the potential danger when dating soot that the result might be too old if the fuel was old wood or peat. One way to get around the problem of dating soot versus food residue is only to date material from an internal surface or an upper external surface (i.e. rim or shoulder) that very probably represents 'boiling over'. Furthermore, the residue should have a visible three-dimensionality so that it can be scraped gently off the surface with a scalpel (Hall et al. 2010). The immersion of the entire sherd in an acid bath to remove the residue risks not only incorporating sooting but can also remove the mineral matrix and introduce exogenous carbon resulting in an anomalously old date.

Food residues are themselves not without issue as the material being dated is not often well characterized and so can present technical problems (Hedges et al. 1992; Nakamura et al. 2001). Certain foodstuffs, such as seafood, can produce dates that are too old because of a marine offset. The characterization of the individual food residues is still an active area of research (Copley et al. 2005; Evershed et al. 1997; Evershed et al. 2002; Mottram et al. 1999; Regert et al. 1998). George Kirke, at the University of Bristol, currently is undertaking a Ph.D. looking more specifically at the properties of the organic residues that have been shown through radiocarbon dating and Bayesian analysis to be accurate or inaccurate.

Cremated bone

A final material that can be radiocarbon dated is cremated bone. The ability routinely to date cremated bone has only been in existence for about a decade (Lanting et al. 2001), but has been shown to be reliable (De Mulder et al. 2007; Naysmith et al. 2007; Olsen et al. 2008) especially if the bone is fully calcined (heated to over 600° C). Van Strydonck et al. (2009) have shown that some cremated bone samples can suffer from contamination, but that the source of the contamination is not fully understood. Unlike normal bone, cremated bone can neither be used for palaeodietary studies, nor are isotope ratios any value in determining the possibility of contamination as the material being dated is not bone collagen but rather the structural bioapatite (Zazzo et al. 2009).

Taphonomy

Many of the issues raised above should not cause too much concern. Issues of contamination and best practice for sample preparation are usually best left to the laboratories, although it is important that the archaeologist provide feedback on results. If a result is of an unexpected age then the archaeologist and laboratory must work together to determine why that may be the case. Oftentimes the source of error in a result does not lie with the radiocarbon laboratory but rather with the archaeologist and a misunderstanding of the taphonomic processes that led to a sample's context of recovery. Furthermore, it must always be remembered that the production of a radiocarbon measurement is a statistical process and so the age has 95% probability of truly lying within the 2-sigma range, therefore 1 in 20 results should be expected to lie outside of the 95% probability range. Understanding taphonomy, while bearing in mind the possible sources of errors, is an important part of the radiocarbon dating process and the crucial link between the ^{14}C age and the Bayesian modelling parameters (Bayliss 2000; 2009).

Although Boaretto (2009) suggests that charcoal and bone come from less secure contexts than things such as *in situ* mortar/plaster and material in ceramic jars, only in the very rarest cases might the date of death of an artefact or ecofact actually be the archaeological event of importance. Therefore the need to understand how the material relates to its context and how that relates chronologically to the site as a whole is paramount. As such, it does not always follow that at any given archaeological site with abundant material that could be dated, there are abundant choices as to what should be dated.

Ashmore (1999) has illustrated the 'old wood' problem well. He suggested a way forward through the dating of identified short-lived single-entity samples. While the Ashmore method increasingly is becoming standard practice, this has had a mixed effect on the quality of the available radiocarbon dates as *what is being dated* is only part of the equation. Samples increasingly are submitted because they are short-lived despite coming from contexts where the taphonomic processes for that sample are poorly understood (Bayliss pers. comm.).

Bone is a good material for dating because for all intents and purposes it is durable. Also it often comes in large enough pieces that we generally can be sure it has not moved much from biological activity (Hedges and van Klinken 1992, 279). However, this also means that it is likely able to withstand being redeposited multiple times through human agency, so that there is a possibility that a random piece of bone in a deposit could be significantly older than the actual deposit. One way around this is to focus on dating pieces of bone that either were *articulated* in the ground, and so deposited with tendons and ligaments intact, or recorded after the excavation as *articulating*, and so probably disturbed to the point that they were not identified during excavation as articulated but which were deposited together intact.

Like bone, much pottery is fairly robust and can be redeposited. It is important to provide a grading to the overall condition of the pottery with residues when determining which ones to date. Worn and highly abraded pottery sherds are likely to have been reworked even if they have residues intact. On the other hand, it is assumed that pot sherds that appear to have somewhat 'fresh' breaks and robust residues were deposited and covered over rapidly as their surfaces would otherwise have been noticeably modified by freeze/thaw events after deposition (Swain 1988).

Figure 3.4: Shaded map of the approximate area from which sites were selected for radiocarbon dating and Bayesian modelling

3.2 The practice of this project

The basic practice of the project began with a survey of all scientific dates available from Iron Age, or putatively Iron Age, settlements in the study area (Fig. 3.4). It then progressed to examining the sites with dates and producing simulation models. Some sites were then selected based on selection criteria outlined below to have additional radiocarbon dating undertaken and final models produced for inclusion in the thesis, and the data analysed, reported, and interpreted.

In order to produce a dataset with the potential to provide a robust framework for developing later Iron Age settlement histories, it was necessary to select the sites included in the analysis with the utmost care. Not only did the sites physically need to conform to a carefully chosen set of criteria, but the quality of the excavated material needed to be such that it held the highest potential for radiocarbon dating and analysis within a Bayesian framework. This section details both the methods used for site selection and those employed for radiocarbon sample selection and Bayesian analysis.

Site selection

The project began by compiling a list of all available scientific dates from putatively Iron Age sites in the study area and identifying sites in the area known, or interpreted, archaeologically to have shifted from one settlement type to another (i.e. open > enclosed). This search was not limited to the published literature but included internet research, visits to county HERs in England, and contact with archaeological units working within the study area. The purpose for the search was to 1) evaluate the data forming the current chronological understanding for the region, and 2) identify sites that might be suitable for inclusion in the project for further radiocarbon dating and subsequent Bayesian modelling.

The first outcome of this extensive search has been the production of a dataset of Iron Age dates for the area. These have been combined with all new dates produced by the project (see Appendix 1) and will be deposited with the Archaeological Data Service (ADS) located at the University of York. This research produced a dataset containing 334 radiocarbon dates from the sites included in the thesis and a further 215 dates that calibrate to between 1000 cal BC and cal AD 350 from 53 further sites across the region. The project submitted samples that produced 168 radiocarbon dates in addition to the previously collected 334 from 9 of the 18 sites included in the project.

The second stage was to identify sites with a good potential for chronological modelling, and that would be an aid to the interpretations based on the general, site-specific research questions:

- When was the settlement first occupied? When was it abandoned? How long were people living there?

- When did the site transition to open/enclosed occur? What length of time was the open/enclosed phase of occupation?

- When were individual structures constructed? If any were rebuilt/ remodelled, when might that have taken place? How long was each use?

The primary considerations toward determining 'good potential' include:

- A 'relative abundance' of pre-existing dates: quite often sites will have one or two radiocarbon (or other scientifically-derived) dates that were used solely to verify its putative Iron Age date, or to determine if the site fitted into the earlier or later Iron Age period. The numbers of pre-existing dates at sites with radiocarbon dates range from five at Kilton Thorpe Lane, Cleveland to 59 at Phantassie Farm, East Lothian;

- Stratified deposits and sequences: since the project is essentially using the major shift in physical settlement typology as an indicator of possible changes in the socio-cultural realm, sites where there is stratified evidence for a physical change would often rank higher than those where there is no clearly defined stratigraphic relationship. All but two of the sites selected have identified sequences with at least one major shift in the settlement typology;

- Substantial material archive: it was anticipated that most sites, even those with over a dozen pre-existing dates (i.e. Thorpe Thewles, Cleveland), would need more dates once they had undergone initial modelling. If the material archive is small to non-existent, or cannot be located or accessed, then the potential to retrieve samples from the necessary contexts diminishes and the site decreases in overall potential.

As a result of the initial phase of data collection, approximately two dozen sites were originally identified as having good potential for chronological modelling, and so inclusion in this project. There were several factors that led to limiting the total number of sites.

Firstly, since the project was scheduled to run for a total of three years that placed a limit on the amount of new dating that could be undertaken. It was expected that the project would submit material for as many as 200 additional radiocarbon dates. For each site there should be a minimum of two tranches of submissions, which generally creates a lag of 6–10 months between the first submission and receiving the final results. As part of its contribution to the project, English Heritage agreed to fund up to 150 dates, but for sites which did not qualify for English Heritage dating, those that were either outside of England or currently part of an active program of developer-funded (PPG16) work, dates had to be sought through the NERC Radiocarbon Facility (NRCF) fund. This accepts applications only twice a year and upon submission of material has an expected turnaround for results of 8 months.

Secondly, there were issues with gaining access to archive material and paperwork. Much of the 'fieldwork' required liaison with HER and museum curators and gaining access to archive stores. Where possible meetings took place with the original excavator, especially when new material was being submitted for dating, but it was sometimes difficult to accommodate everyone involved and arranging meetings could postpone sample selection by a month or more at times. When it was clear that individuals were too busy, much of the work took place through e-mail and telephone exchanges and, while slowing down the process, this still enabled it to move forward.

Thirdly, since many of the sites were anticipated to receive newly acquired ^{14}C dates, the list had to be limited in order to ensure that the anticipated 200 new dates were not spread too thinly across the sites, as to do so would have had a negative effect on the overall precision of the estimates generated for any individual site. Early simulations and modelling of pre-existing dates suggested that most sites would need between 15 and 25 well-chosen, newly dated samples. This was used to limit the list of potential sites to receive new dates to 10, of which there was enough funding for eight of the sites to be dated thoroughly. The overall list was reduced to a total of 18 sites (Fig. 3.5) undergoing Bayesian modelling, and in the end, half of those sites received added radiocarbon dates as part of the process[6].

The sites were then divided into sub-regions, with the selection process guided by the desire to have a spatial spread of sites across the entire region but at the same time retaining relatively distinctive groupings that provide a level of proximity for

[6] None of the sites located within Scotland received additional radiocarbon dating. Most of these sites had a large number of pre-existing radiocarbon dates, although in the end not all those dates were from ideal or adequate samples as discussed in each site model. Nonetheless, the limits imposed on the project through the time and funding available meant that the Scottish sites were only included in the modeling and comparative analysis stages.

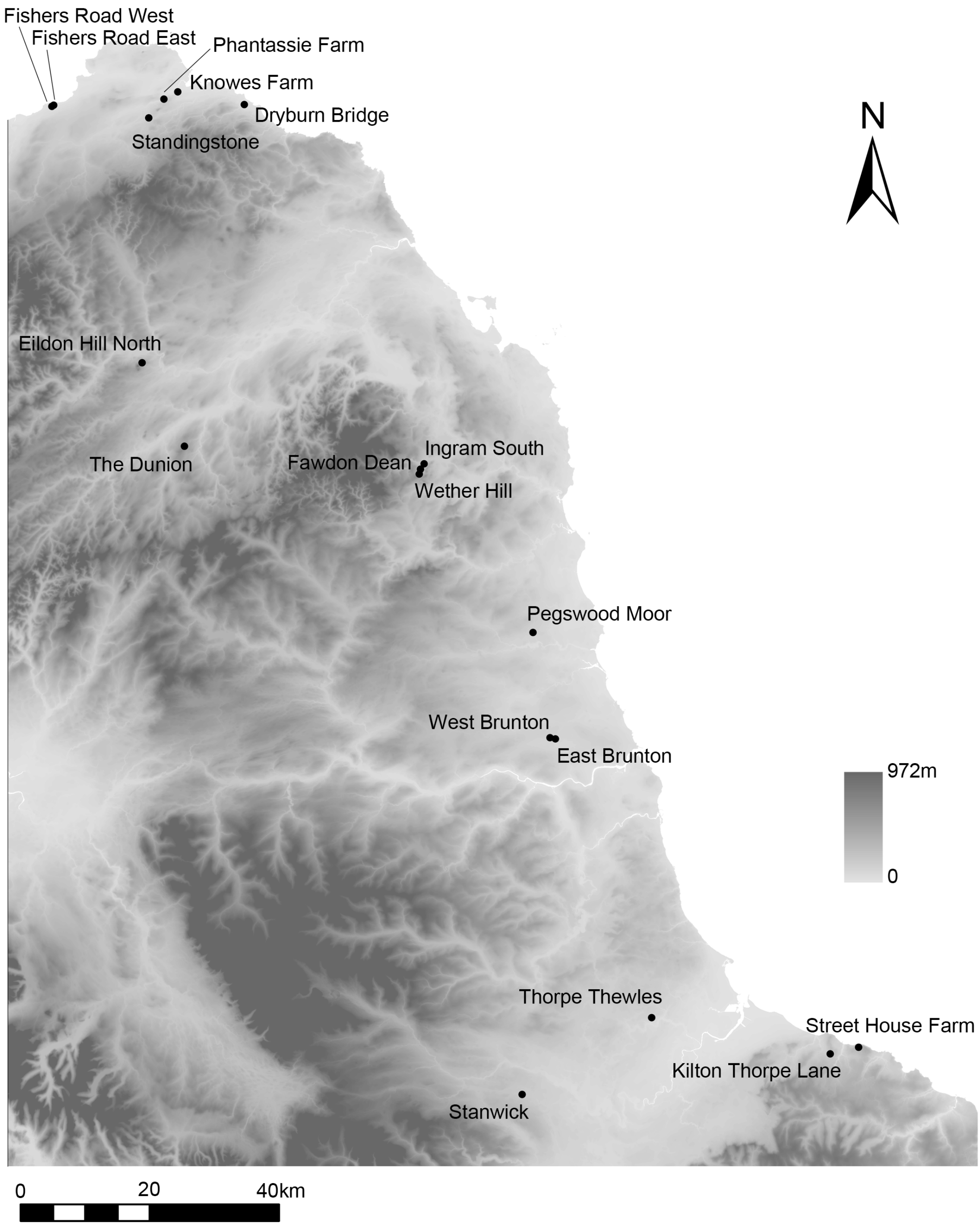

Figure 3.5: Shaded relief map showing the spatial distribution of the sites included in the Bayesian modelling portion of the project. In addition, Ingram South, Fawdon Dean, Pegswood Moor, East Brunton, West Brunton, Thorpe Thewles, Stanwick, Kilton Thorpe Lane, and Street House Farm received additional radiocarbon dating

comparability within a sub-region and fit into, or closely resembled, historically used geographical units of analysis. The initial divisions were made along the river courses of the Tees, Tyne, Tweed, and Forth. These divisions were further refined to provide an east-west element in the area between the Tyne and Tweed.

The sites are broadly distributed across four sub-regions. These include: **Tees valley** – Kilton Thorpe Lane, Stanwick[7], Street House Farm, and Thorpe Thewles; **Cheviot Hills** – Fawdon Dean, Ingram South, and Wether Hill[8]; **Northumberland coastal plain** – East Brunton, West Brunton, and Pegswood Moor; and **Tweed-Forth** – Dryburn Bridge, The Dunion, Eildon Hill North, Fishers Road East, Fishers Road West, Knowes Farm, Phantassie Farm, and Standingstone.

The sub-regions form a starting point for comparisons of the data. Although there are only a few well-dated and modelled sites in each of the sub-regions, these can be used not only to begin producing an historical narrative for each sub-region but also to pose and refine further questions relating to other important sites in these areas. Furthermore, the data allows for broader comparisons between the sub-regions. For instance, the close proximity of sites within the Cheviot Hills and Northumberland coastal plain sub-regions allows for a more detailed analysis of the temporality of settlement processes within those areas, while also allowing comparative views to be drawn between these two distinct geographical and topographical areas. Similar comparative analyses can be made between the Cheviot Hills or Northumberland coastal plain and Tees valley sub-regions (c.f. Ferrell 1997), where the geographical distinction is a north-south rather than east-west division, and the topographical distinction is different for both pairs.

Site type classification

Site phases were classified based on information provided by the principal archaeologist, or in the final published report/monograph. The primary distinctions

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[7] Stanwick was dated and modelled through additional funding from English Heritage as part of the production of a monograph on the site.

[8] Dates were made available from Wether Hill but due to constraints with time it was not possible to refine the modelling and provide further dating. It is included here as it lies on the hilltop overlooking the other two Cheviot sites and is used in the comparative analysis of the sub-region.

have been made between enclosed (e.g. ditched, palisaded, and ditch and bank) and open settlements and the types of timber and stone structures found at the site.

While the distinction between *open* and *enclosed* feeds directly into investigating the temporal nature of enclosure in later prehistory, further classification of types of enclosure (e.g. ditched, palisaded, etc.) should serve to allow a more detailed comparison, and thus more nuanced interpretation of the results. Similarly, by looking specifically at structure types, it may be possible to extend the current debate on their timing and temporality.

Much of the modelling undertaken within this thesis appreciates that archaeological phasing is necessary for ordering the data and presenting coherent interpretations. It also acknowledges that the tidiness of the phasing often leads to an oversimplification of the data. Most chronological models contained herein, when utilizing archaeological phasing, allow for the phases to overlap in time. In doing so, a feature or feature group that is constructed in one phase is given the opportunity to still be in use in another. This sometimes requires a re-thinking of the stratigraphy and features and makes it necessary to identify specific points within the stratigraphy that can be argued as signalling a change in the settlement. In most cases determining the locations of change in the stratigraphy is a simple matter – a ditch is dug or it is filled and paved over – but the problem is that there is almost never any date directly associated with these specific moments. However, by reconciling the information provided by direct stratigraphy and archaeological phasing in unique ways for each site it is almost always possible to estimate the date for the transformation in question. The quality of the results is often directly correlated to the quality of the samples selected and the confidence in the taphonomic association between the sample dated and context from which it was retrieved.

Assessment of existing dates and simulation

All of the sites included in the project had at least some pre-existing ^{14}C dates. These were used in conjunction with the site stratigraphy and phasing and list of contexts containing suitable material to produce simulation models. These models are highly informative in the sample selection process by not only helping to gauge the optimum number of samples to achieve the desired precision in the analysis, but to determine from where those samples should be taken. Furthermore, the simulations can, and often do, highlight when the plateaus in the calibration curve might present problems

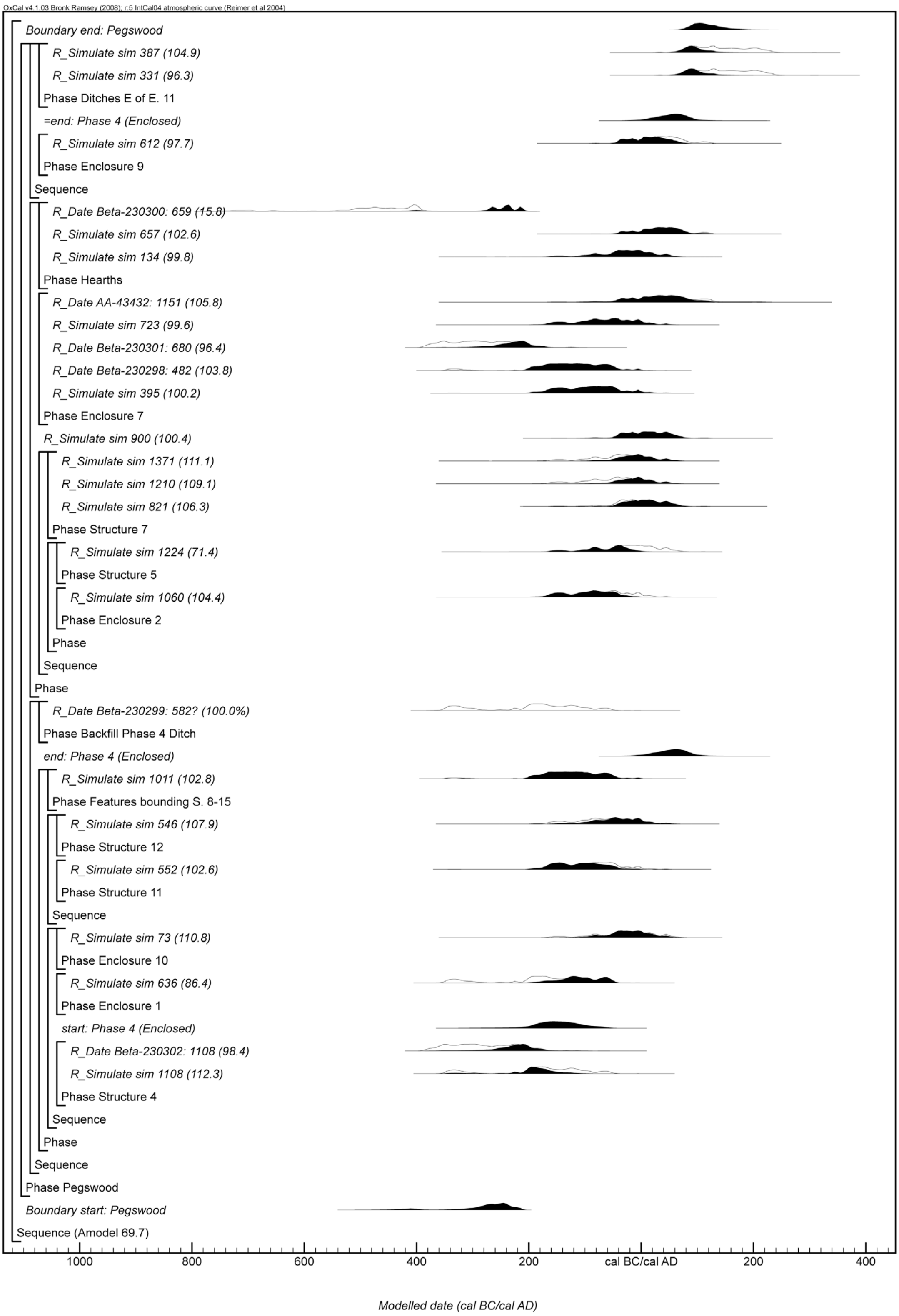

Figure 3.6: Probability distributions of simulated dates for later prehistoric activity at Pegswood Moor: each distribution represents the relative probability that an event occurs at a particular time. For each of the radiocarbon dates two distributions have been plotted, one in outline, which is the result of simple calibration, and a solid one, which is based on the chronological model used. Distributions other than those relating to particular samples correspond to aspects of the model. For example, the distribution *Boundary start: Pegswood* is the estimated date when that activity began at the site. The large square brackets down the left hand side along with the OxCal keywords define the model exactly site model is described fully in Chapter 6.4

and help determine whether the problem can be overcome with more samples, more direct stratigraphic relationships, or both.

A simulation for Pegswood Moor is presented in Figure 3.6. In this case, the emphasis was on trying to provide as precise a date as possible for the beginning and end of the enclosed phase of settlement (Phase 4). The simulation includes a second date from context 1108 on Structure 4 as that was the only pre-enclosed phase context with suitable material and was intended to provide a means to check that the pre-existing radiocarbon date was not residual.

Replication

After the suitable number of samples has been determined by simulation, the contexts were re-evaluated and one in every seven to ten contexts had a second, replicate, sample submitted for dating. This second sample was of a different species or material type and was chosen so that the result could be used in a statistical comparison with the first result as a means to assess the security of the deposit or the accuracy of an earlier date. Oftentimes this second sample was submitted to a different laboratory than the first, as a further means to independently verify the accuracy of the results. If the two samples are of the same actual age, the two radiocarbon measurements should pass a chi-square test (Ward and Wilson 1978). When they do not pass it is often because one of the dates is residual, but it is still necessary to look at other data, and it is here that the individual indices of agreement for each modelled date are most useful.

Multiple dated samples from the same context often facilitate the determination of outliers in the suite of dates. The reasons for one of two measurements from a context being an outlier usually come down to one sample being either residual or intrusive and so not actually dating the formation of that context. Other potential problems may need considering such as old-wood or marine offsets, and even the addition of exogenous carbon in such things as carbonized residues on pottery sherds. Errors in sampling or processing and measuring at the laboratory must also not be ruled out without a thorough investigation. While the detection of outliers can be done manually, it is also possible to apply formal outlier detection models in many instances (Bronk Ramsey 2009b).

Radiocarbon sample selection

For all newly acquired dates, the initial step in sample selection was to identify material that was probably not residual in the context from which it was recovered. This included primarily:

Macrofossils that were of short-lived material (e.g. seeds, roundwood charcoal, etc.). Macrofossils primarily were targeted from features/deposits where a functional relationship could be made between the sample and the context. In many cases this relationship would appear obvious (i.e. charcoal from a hearth, grain cache in a pit), but in other cases a discussion of the taphonomic processes is necessary to argue for a relationship. Macrofossil material is often submitted from the fills of post-pipes and post-pits. The assumption here is that the material either made its way into the posthole during the general activity surrounding the associated feature or that it fell into the feature when a post was removed or had rotted (Reynolds 1995). Similarly, material might be submitted from occupation layers or rubbish deposits where given the amount and the size and preservation of the material an argument can be made for either primary deposition or secondary deposition that presumably was not too much later than the initial deposition (i.e. hearth cleaning deposit in ditch). These arguments are best handled on a site-by-site and deposit-by-deposit basis in the individual site models in Chapters 4–7.

Bone selected was either identified during excavation as *articulated* – indicating tendons were attached when two or more segments were deposited and buried – or else *articulating* – groups of bone found to articulate during the post-excavation analysis. The assumption with the *articulating* bone is that it was articulated in the ground and either not recognized as such during excavation or slightly disturbed post-deposition to the point that they were not readily identifiable as having been articulated.

Carbonized food residues on pottery sherds. The sherds in these instances were usually well-preserved and where possible the residue was from conjoining sherds – or deposits with conjoining sherds. In some cases the sherds were from post holes and incorporated in the lowest fills, presumably as part of the post-pit packing material. Preservation – unabraded edges and/or heavy, encrusted residue adhering to the surface – was of paramount importance as it would seem to indicate that the sherds were not being moved around too much over time, and especially in the case of deposition layers it should be indicative of an untrampled surface.

Pre-existing dates

While the above criteria were applied when choosing samples for the newly acquired radiocarbon dates, the same criteria also were used, where possible, to evaluate the certainty of pre-existing dates being related to the context from which they derived. When there is not enough information to make a confident assessment a date can be included as a *terminus post quem* date for the context, thus allowing for residuality. The archaeological interpretation and contextual confidence of pre-existing dates is discussed in depth for each site in presented in Chapters 4–7.

The modelling loop

Once the simulation model has been constructed and the samples selected and submitted, the process enters a loop. When the first round of results is returned they are entered into the model and it is run. The model is evaluated based on the OxCal-produced indices of agreement (see above) and also through the evaluation of the radiocarbon dates and the archaeological expectation of those dates. While this first round of dating is almost always selected so that a spread of dates is produced through the sequence or across the site to provide an initial framework, the second and later rounds will invariably be used to further refine the dating and assess areas of the model where the initial archaeological information is not necessarily in agreement with the results. This process of dating, revising, and dating some more continues for as long as the project allows.

Once the modelling process is complete and the model has been evaluated and described it is time to use that chronological framework to construct a narrative account – a "believable story" – of the site. The Bayesian process is an interpretative one. It is important to remember the date estimates produced by any model can change as new data are added or as the existing data are modelled in new ways.

3.3 Conclusion

The current 'failure' of Iron Age chronology is largely one of mindset. While in the past there were issues with the precision of calibrated radiocarbon dates, these problems have been overcome through increased precision of measurements and the use of Bayesian statistical analysis. In light of this, new problems have arisen with regard to selecting the 'perfect' radiocarbon sample. This often results from poorly understood (or poorly considered) taphonomy. This new problem can be easily overcome though through the implementation of a Bayesian framework for analysis that requires taphonomy be carefully considered and evaluated for each and every sample.

As I will show, by following this methodology it is possible to construct robust chronologies for each settlement. The methods employed require that decisions be made explicit in order for the resulting model to be fully analysed and interpreted. The results in the following chapters and sections for each site reflect this methodological approach, and the information should certainly be consulted and queried.

CHAPTER 4: TEES VALLEY (SITE RESULTS)

4.1.1 Geography

The Tees valley sub-region drops down from the northern edge of the North York Moors, stretches across the broad expanse of the river valley and rises again at the southern edge of the Durham plateau. The underlying geology is primarily Pleistocene gravel deposits with the surface deposits in the valley being mainly loamy sandy and loamy clayey soils, with the clayey soils considered today to be well-suited to mixed agriculture. Today, it is only on the higher ground of the western portion of the area that stock rearing is practiced with any intensity (Still and Vyner 1986, 11–12).

4.1.2 History of research

Compared to other areas included in this thesis – Northumberland, East Lothian, and the Scottish Borders – there was little research in the Tees valley, until the latter half of the 20th century. The fortified earthwork site of Stanwick, North Yorkshire, is perhaps the most visible upstanding monument surviving from prehistory in the region and although first surveyed in 1816 (Haselgrove et al. 1990a), was not excavated until 1951–52 by Sir Mortimer Wheeler (Wheeler 1954).

Since Wheeler excavated at Stanwick, the Tees valley has seen an increase in research, starting with much of the valley being intensively surveyed from the air. The results of the aerial survey up to the mid-1980s have been summarized by Still and Vyner (1986). They show that the area is dominated by subrectangular enclosures, although D-shaped enclosures along with strongly defended and developed open settlements also occur. The 1980s also saw much of Teesdale being surveyed, and selected sites excavated, by Fairless and Coggins (Coggins 1985; 1986), but the Durham Archaeological Survey conducted from 1983–87 by Haselgrove (2002) stands as a reminder of just how difficult it can be to retrieve a substantial dataset through fieldwalking.

4.1.3 Iron Age settlement in the region

The aerial survey of enclosure cropmarks has shown that nearly all the identified settlements lie above the 200ft (60m) contour (Still and Vyner 1986, fig. 1). As stated above, the settlement pattern of the area is dominated by enclosures, probably for no other reason than they are most visible. But two very different sites in the region figure in nearly every discussion of later prehistoric settlement and society: Stanwick and

Thorpe Thewles. The ‘fortified’ enclosure of Stanwick was thought by Wheeler (1954) to be the location where the Brigantes made their final stand against the Romans, while Thorpe Thewles, excavated and reported by Heslop (1987), is at first glance an enclosed homestead, but one that refutes the simplistic sequence of open settlements becoming enclosed, as it is an apparent reversal of this progression. These two sites, however, sit within a landscape richly populated with later prehistoric settlements of many types.

Other enclosed sites in the area include Forcegarth Pasture North (Fairless and Coggins 1980), Forcegarth Pasture South (Fairless and Coggins 1986), Rock Castle (Fitts et al. 1994), Roxby (Inman et al. 1985), and Street House Farm (Sherlock 2007). Unenclosed houses and settlements are attested to in the region at the sites of Dubby Sike (Coggins and Gidney 1988), Kilton Thorpe Lane (Johnson and Sherlock forthcoming), Melsonby (Fitts et al. 1999), Roxby (Inman et al. 1985), and Scotch Corner (Abramson 1995). The Iron Age site at Catcote has so far proved devoid of any traces of major enclosures, but the excavator does not rule out the possibility that one existed beyond the excavation bounds (Long 1988). Finally, the site of Quarry Farm, Ingleby Barwick is especially interesting in that there late Iron Age enclosures are superseded by a Roman villa (Heslop 1984).

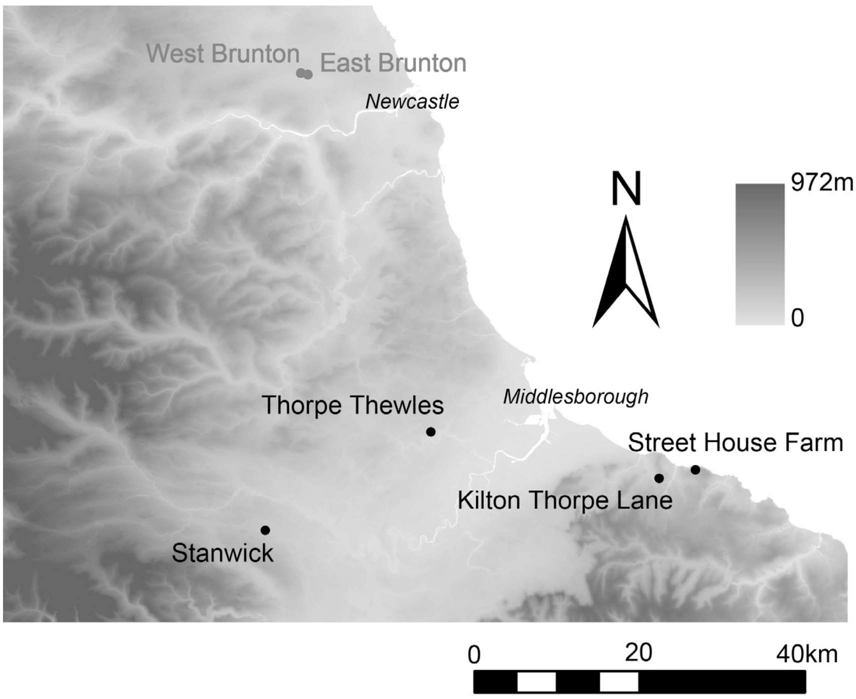

Figure 4.1: Shaded relief map showing the location of the settlements modelled from the Tees valley and discussed in the text. Two sites from the Northumberland coastal plain sub-region appear with their names in grey text

Site selection

Three sites were initially selected from the Tees valley sub-region: Thorpe Thewles, Kilton Thorpe Lane, and Street House Farm (Fig. 4.1). The importance afforded Thorpe Thewles when discussing and interpreting both enclosed farmsteads and open settlements in the region made it a clear choice. Furthermore, the fact that it displays a transition from enclosed to open was felt to be an important reason to date it more precisely. Kilton Thorpe Lane and Street House Farm are two recently excavated sites with ample material archives that are well-suited to Bayesian modelling. While Kilton Thorpe presented the chance to date a putatively single-phase open settlement that did not have any non-Iron Age material, Street House is an enclosed settlement with multiple phases of occupation. Moreover, the inhabitants were involved directly in the production of salt. The site of Stanwick was added in the second year of the Ph.D., with the dating provided by English Heritage as a contribution to the monograph being produced on the excavation, including those funded by the DoE in the 1980s.

4.2 Kilton Thorpe Lane

4.2.1 Site description

Kilton Thorpe Lane (NZ 692 185) is a later prehistoric open settlement located approximately 4km west of Loftus in Redcar and Cleveland. Six circular structures, identified by post-settings and ring-gullies, were excavated in an area of *c.* 0.3 hectare in 2000 (Fig. 4.2.1). A further four circular structures were excavated in an area of *c.* 0.2 hectares in 2001.

The structures range in size from *c.* 5.5–10.0m in diameter with no intercutting between them. All indications are of a single-phase settlement, although it is unclear how large the site was at any one time as it is impossible to be certain how many structures were standing at any given point of time in the past.

Nothing in the material culture recovered suggested that the site continued into the Roman Iron Age. There was little evidence for any local trade other than a small fragment of worked shale and briquetage.

The objective of the scientific dating of Kilton Thorpe Lane was to determine the start and end of settlement use. Moreover, since the site has no features that pre- or post-date this phase it provides a very good opportunity to examine the duration of a Iron Age settlement without worrying too much if there is intrusive or residual material.

More detailed information about the site and the excavation is provided by Johnson and Sherlock (forthcoming).

4.2.2 Sample specifics

A total of 17 results are available from 15 samples submitted from the Iron Age settlement at Kilton Thorpe Lane. There are 12 results on carbonized residues that were robust accretions either found adhering to the inside of pottery sherds or at/near the rim or shoulders – and so indicative of charred foodstuff that has spilled or boiled over. A further three samples of bulked carbonized seeds (Cerealia) and two samples of short-lived roundwood charcoal (species unidentified) were submitted.

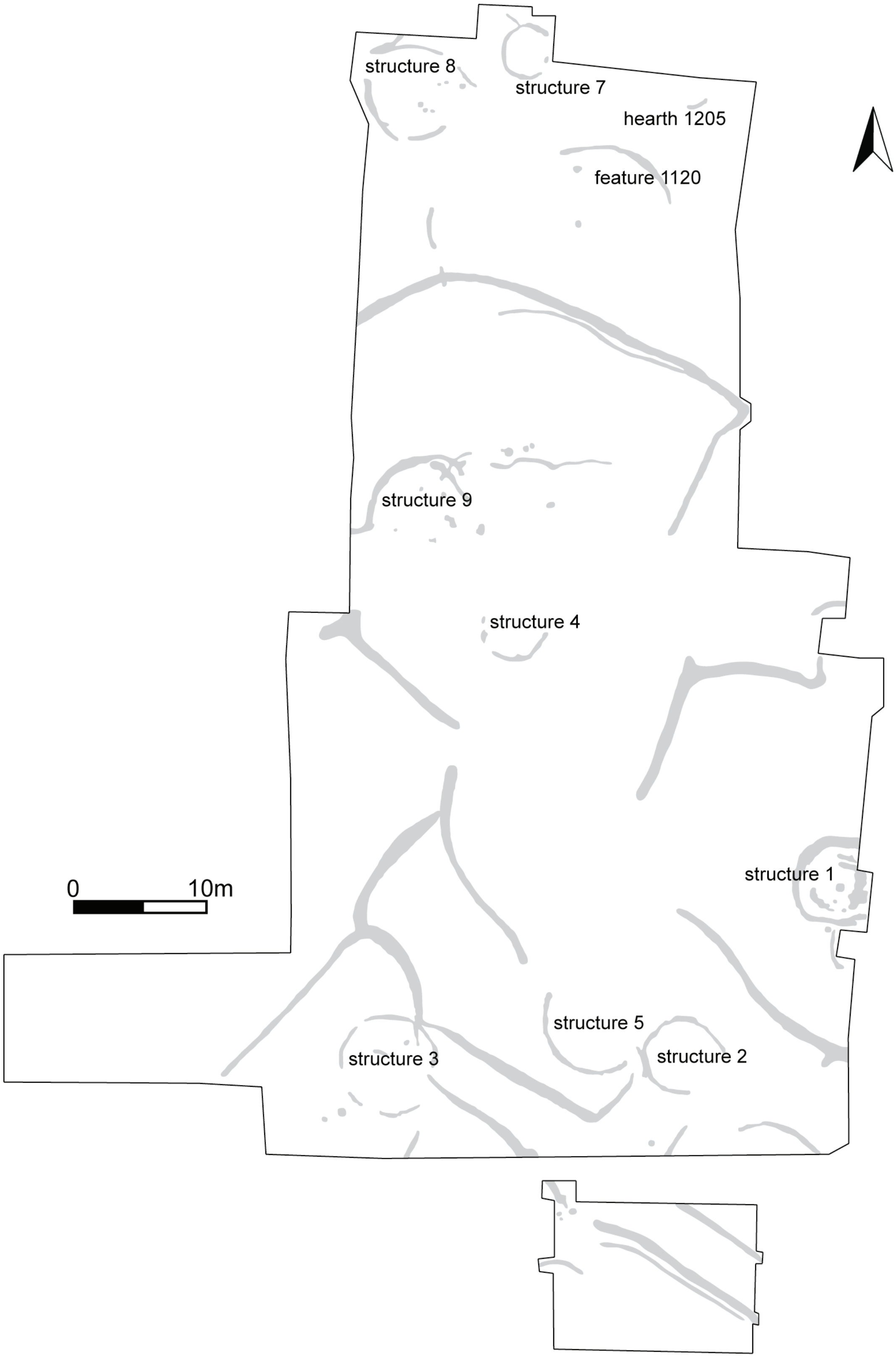

Figure 4.2.1: Site plan for Kilton Thorpe Lane (after figure provided by S. J. Sherlock)

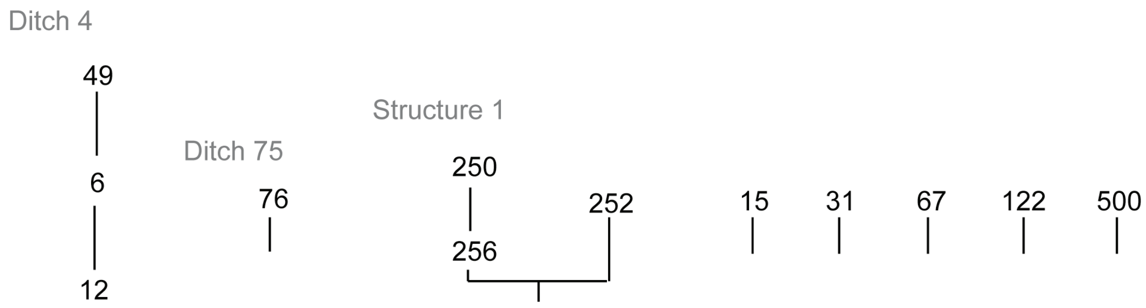

Figure 4.2.2: Site matrix for dated and modelled contexts from Kilton Thorpe Lane

4.2.3 Model description

The excavation at Kilton Thorpe Lane revealed a single-phased open settlement. As such, it provides a window into the timing and duration of activity for this site type in the later Iron Age in the Tees valley. This is highly useful when compared to the enclosed settlement of Street House Farm that lies less than 5km to the east.

All the pottery appeared to have been deposited fairly fresh in its contexts and the carbonized residues that were dated were very robust. This increases the likelihood of rapid entry into the archaeological site matrix. While there is a possibility for redeposition and, therefore, residuality, the measurements on the residues nevertheless are all indicative of a general use of the entire site in the Iron Age.

There were direct stratigraphic relationships between samples at two locations on the site. These are shown in the matrix in Figure 4.2.2:

- The first sequence was through ditch [4]. This began with a sample of bulked carbonized seeds (Cerealia) from the primary fill (12AA: OxA-10653), followed by a pot sherd with carbonized residue in the secondary fill (Pot 6: SUERC-19213 and OxA-18758), and finishing with a pot sherd with carbonized residue in the upper fill (Pot 49: SUERC-18813 and OxA-18743/4);

- The second sequence was the ring gully of Structure 1. Pot 256 (OxA-18759/60) was recovered with carbonized residue from the primary fill (251). This was sealed be a secondary deposit (250) from which bulk seeds had been submitted for dating (OxA-10518).

The three measurements made on the carbonized residue from Pot 49 (SUERC-18813 and OxA-18743/4) are statistically consistent (T'=4.0; ν=2; T'(5%)=6.0) and form the **mean Pot 49** result of 2050 ±17BP.

The two measurements on the carbonized residue from Pot 256 (OxA-18759/60) are statistically consistent (T'=0.4; ν=1; T'(5%)=3.8) and form the **mean Pot 256** result of 1997 ±19BP.

Three carbonized residue measurements from two pottery sherds returned unexpected dates (Pot 6: SUERC-19213/OxA-18758; Pot 31: OxA-18756). While Pot 31 may be residual in its context, the discrepancy with dates on Pot 6 are most likely the result of sample contamination, either through the leaching in of 'old' carbon, or more likely from geological carbon being present in the sherd matrix and becoming dislodged when the residue was scraped (Hedges et al. 1992; Nakamura et al. 2001). All three of the results have all been excluded from further modelling – even Pot 31: OxA-18756 simply because it is impossible to know if it is anomalously early as a result of residuality or contamination.

Two results on carbonized plant remains have also been excluded from the model. OxA-10518 on roundwood charcoal could be residual in its context, the secondary fill of a ring gully. OxA-11186 is from a section of the site that is spatially removed and is on bulked seeds in homogenous fill of many postholes and is a poorly understood and contextualized sample.

4.2.4 Model results

The model has good overall agreement (A_{model}=77) between the radiocarbon dates and the prior information. The model estimates that activity at Kilton Thorpe Lane began in *70 cal BC–cal AD 5* (*95% probability*; Fig. 4.2.3; *start: Kilton Thorpe Lane*) and probably in *50–15 cal BC* (*68% probability*). Activity ended in *40 cal BC–cal AD 55* (*95% probability*; Fig. 4.2.3; *end: Kilton Thorpe Lane*) and probably in *30 cal BC–cal AD 20* (*68% probability*).

The duration of activity at Kilton Thorpe Lane is estimated at *1–105 years* (*95% probability*; Fig. 4.2.4; *use: Kilton Thorpe Lane*), and probably *1–45 years* (*68% probability*).

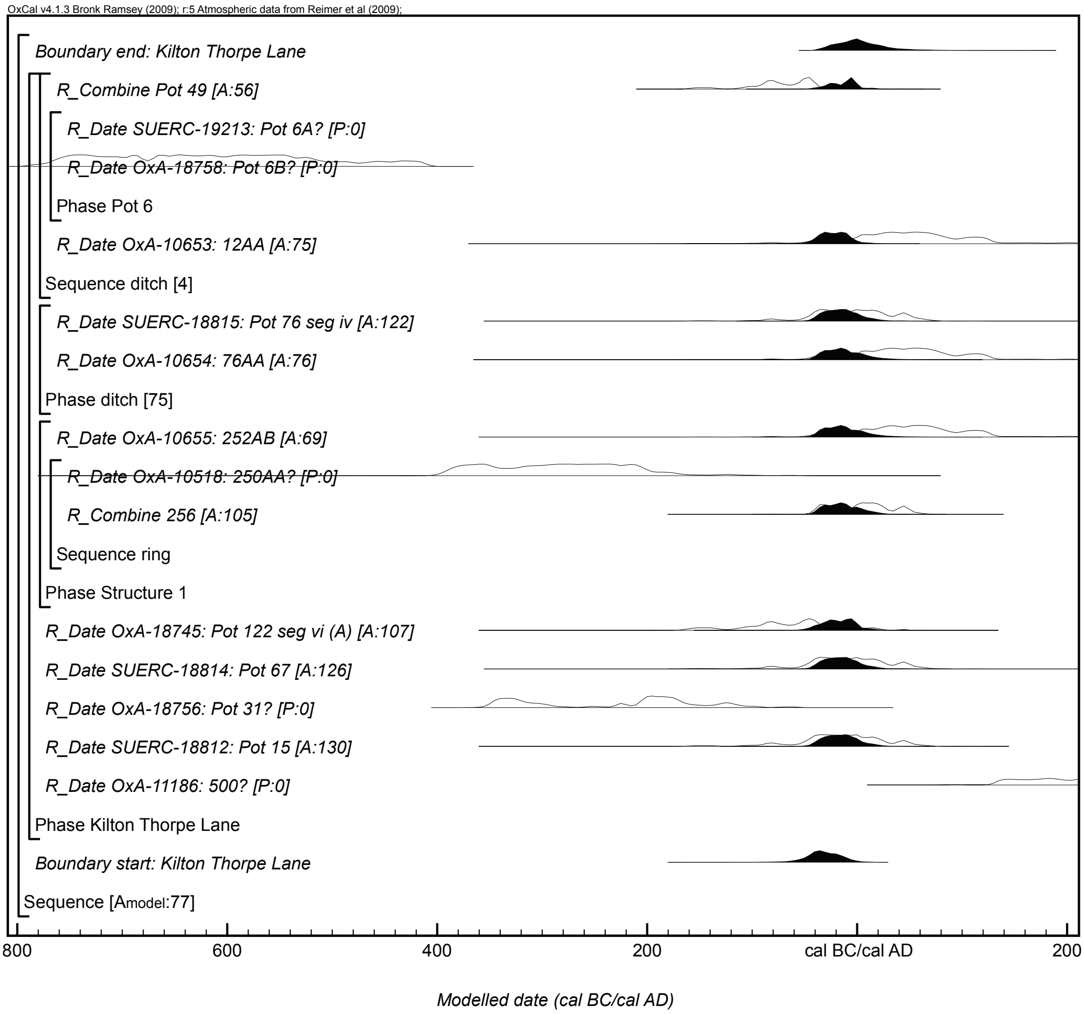

Figure 4.2.3: Chronological model for Kilton Thorpe Lane. Each distribution represents the relative probability that an event occurred at some particular time. For each of the radiocarbon measurements two distributions have been plotted, one in outline, which is the result of simple radiocarbon calibration, and a solid one, which is based on the chronological model used. The other distributions correspond to aspects of the model. For example, the distribution '*Boundary start: Kilton Thorpe Lane*' is the estimated date for the start of activity at the site, based upon the radiocarbon dating results. The large square 'brackets' along with the OxCal keywords define the overall model exactly

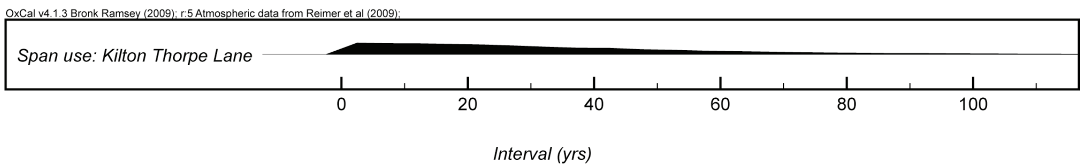

Figure 4.2.4: Probability for the overall span of use of Kilton Thorpe Lane as derived from the chronological model shown in Figure 4.2.3

4.3 Stanwick

4.3.1 Site description

The site of the settlement at Stanwick (Fig. 4.3.1, NZ 183 118) is marked by extensive upstanding earthwork fortifications. The banks and ditches enclose nearly three square kilometres (Haselgrove et al. 1990a). The complex was identified by Sir Mortimer Wheeler as an 'oppidum' and was first excavated by him in 1951–2 (which was Wheeler's last major excavation in Britain). Wheeler's excavations were focused on trenches through the ditches and ramparts to build up a picture of their developing complexity.

The site was revisited in the 1980s by Colin Haselgrove et al. (1990a). Further excavations took place in 1981–89, focused on an area known as The Tofts (Site 9), believed to have been the core from which the site grew, and so ideally retaining traces of the settlement's inception. It is from these excavations that much of the stratigraphic sequencing of the site derives (Fig. 4.3.2).

The sequence at the Tofts (Site 9) has been phased into five main periods of settlement activity and a sixth post-settlement phase.

Period 1 (Fig. 4.3.3) is characterized by Enclosure 1, associated with two successive circular structures (CS10, CS1). Multiple phases were identified in the Enclosure 1 ditch.

Period 2 sees Enclosure 1 go out of use and the 'hook-shaped' enclosure ditch, Enclosure 2, come into use. The enclosure is thought to have been in use for some time as two re-cuts of the ditch were identified. CS2, at the mouth of the enclosure, and CS11 which precedes CS2 here, have been assigned to this phase of activity.

Period 3 sees the site reorganized, with features that are of a different character to those that came before. Two rectilinear L-gullies were constructed, each associated with a rectangular structure. Other components include, a single circular structure (CS9), a substantial cut-feature (F3037), and a build-up of soil/midden material began. The period is thought by the excavators to be shorter-lived than the preceding periods.

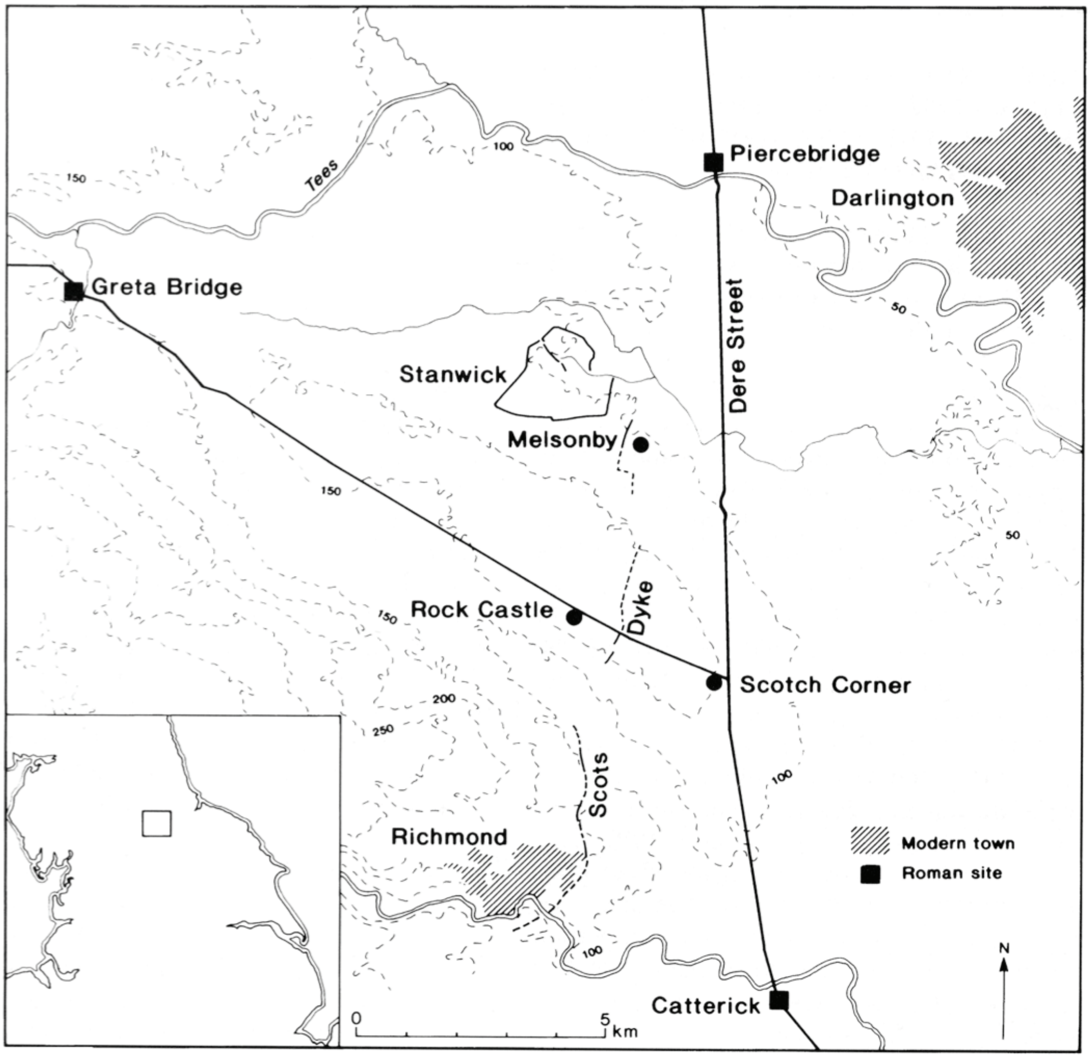

Figure 4.3.1: Location of Stanwick in relation to other important later prehistoric and early Roman sites and the Roman road system (after Haselgrove et al 1990-a, fig. 1)

Period 4 (Fig. 4.3.4) begins with the construction of a substantial enclosure (Enclosure 3). The 1981 geophysical survey indicated that this feature was oval in form and measured *c.* 42m by 75m. The later stages of the enclosure (3C) saw the boundary reconstructed as a palisade, with a narrow flat-bottomed trench running its course. The northern side of the enclosure was bisected by the excavations.

North of the enclosure, on lower ground that had seen little previous structural activity, two successive monumental circular structures were constructed (LS1, LS2). The post-pits of these structures were in excess of 1.5m across. The size of the post-pipes suggests posts of over 0.5m in diameter.

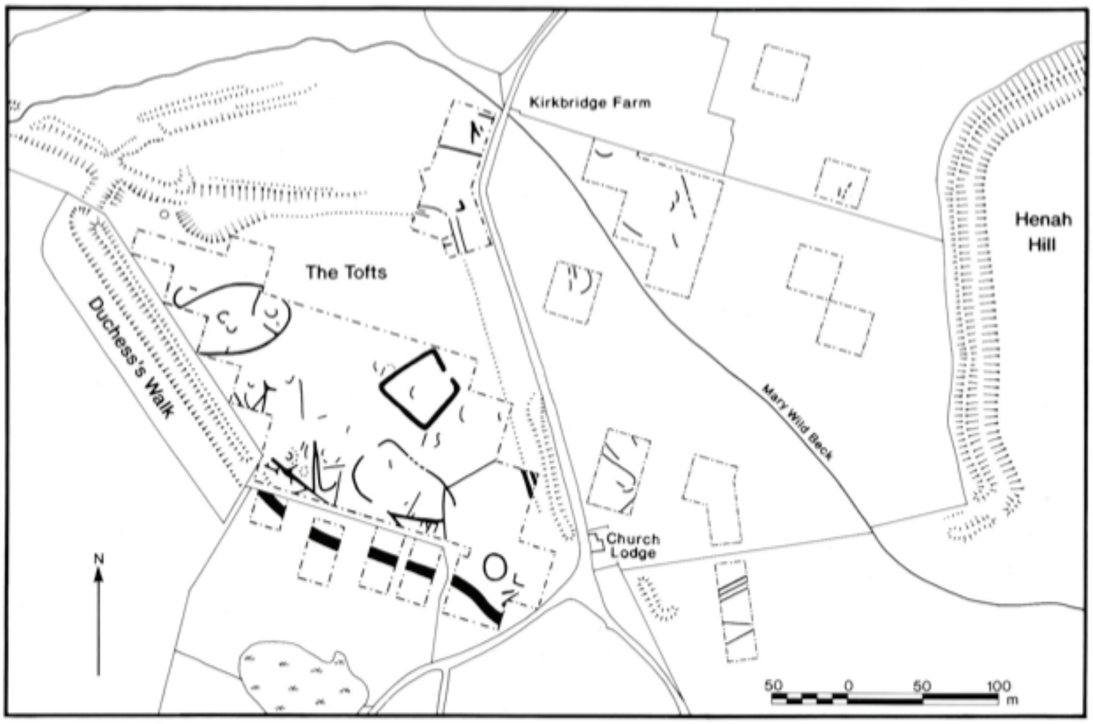

Figure 4.3.2: Plan of The Tofts at Stanwick and the location and interpretation of the geophysical surveys (after Haselgrove et al 1990-b, fig. 11)

Period 5 begins when LS2 has gone out of use and the area is turned over to activity associated with hearths within a pennanular gully. A stone-built structure (SS2) was later constructed in this same area. Stone walling (SS3) was constructed over the Enclosure 3 palisade and just outside the enclosed area another stone-built structure (SS1) was constructed. Prior to the construction of the stone structures, the vestigial traces of the earlier enclosure ditches were infilled, perhaps deliberately, with occupation debris. The settlement sequence appears to finish with stone and rubble spreads in and around SS1 and SS3. These did not appear to form an occupation surface and are likely derived from the tumbled stone walls after the settlement was abandoned.

Two 1986 trenches through the ramparts (Sites 3 and 4) are also included here and provide data for estimating when those ramparts were constructed. In addition, Site 3, context 10, which is a pre-rampart context has been extrapolated to equal part of the Period 3–4 soil horizon in Site 9 main.

A second portion of Site 9 (Site 9 south-east), within the oval enclosure, contains circular and rectangular structures along with a linear gully, that are not stratigraphically

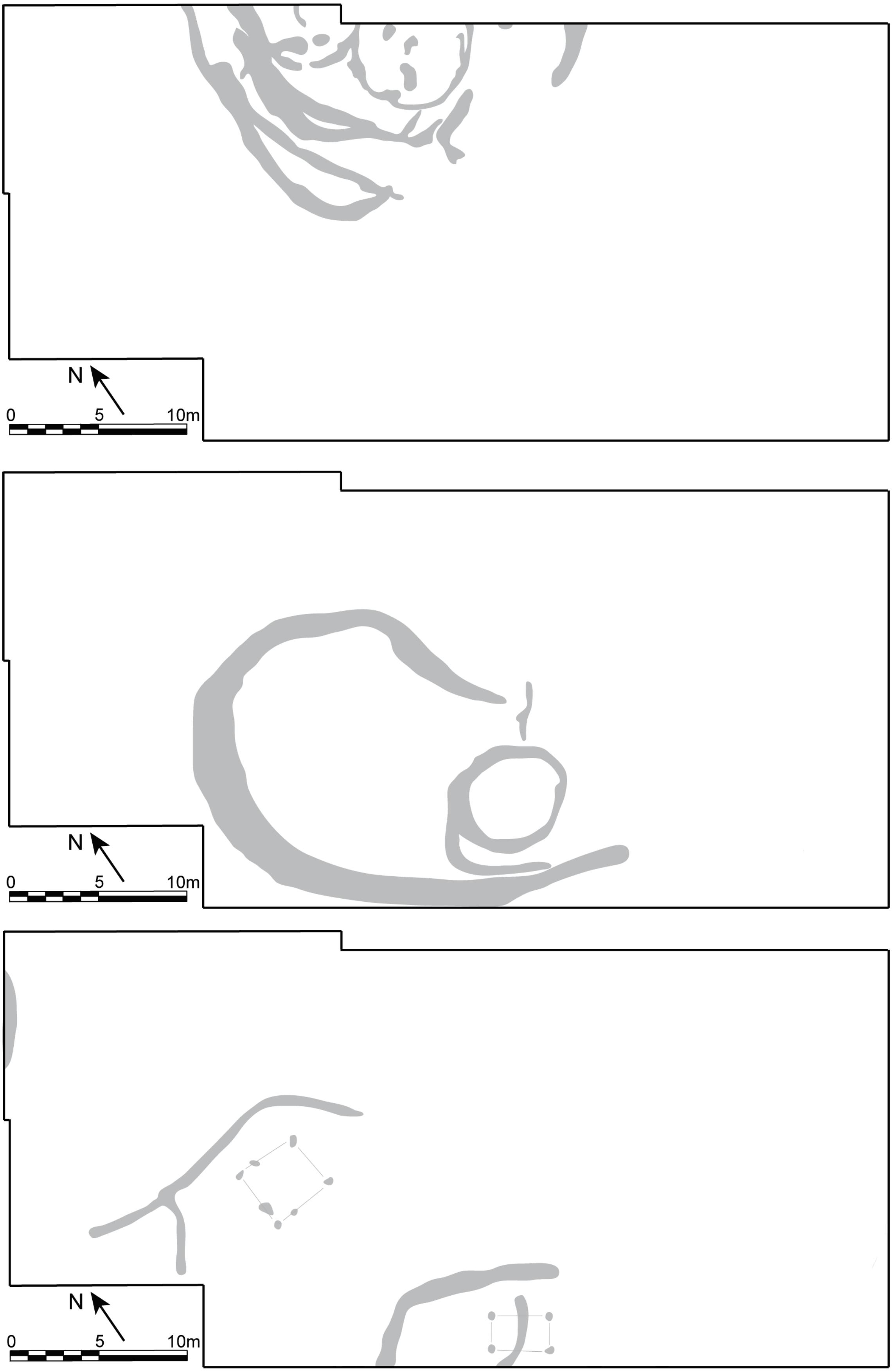

Figure 4.3.3: Site plans for Periods 1–3 (top to bottom) for Stanwick

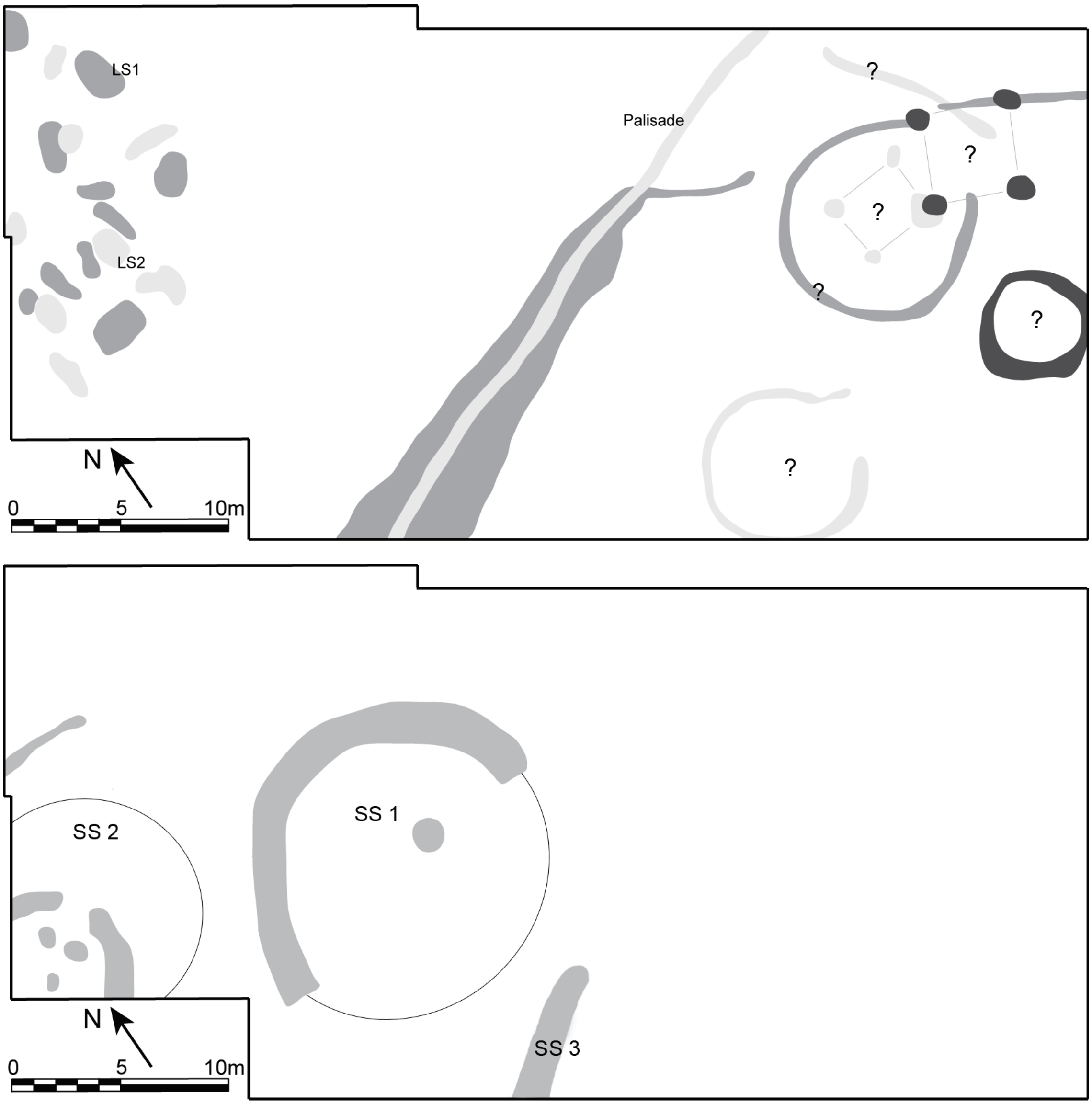

Figure 4.3.4: Site plans for Periods 4 (top) and 5 (bottom) for Stanwick

tied into the main site phasing but which have been provided with a chronological framework through the dating and Bayesian modelling.

More detailed descriptions of the site and the features are available in Haselgrove (forthcoming-b).

4.3.2 Sample specifics

A total of 58 samples were submitted for radiocarbon dating between 1988 and 2009 from 39 individual archaeological contexts from Stanwick. These samples are comprised of charred seeds, charcoal, human and animal bone, and carbonized residues adhering to pottery sherds. They come from a variety of contexts including pits and postholes, hearths, habitation/midden layers, discrete fills in ditches, and inhumations. Furthermore, the contexts are derived from four excavated areas at Stanwick and extend throughout the well-defined stratigraphic sequence.

4.3.3 Model description

The chronological model for the Tofts comprises four components: the principal Site 9 sequence (Site 9 Main); the floating sequence in the southeastern part of the site (Site 9 South-east); and the Site 3 and Site 4 rampart sequences. The Period 3–4 soil horizon enables the main Site 9 sequence to be linked to that from Site 3. The four sequences are dealt with here separately with any connecting points highlighted where they occur.

Site 3

Five radiocarbon dates were obtained from four contexts in the Site 3 rampart section. The dated sequence (Fig. 4.3.5) begins with a soil accumulation (10), which appears to be equivalent to the Period 3–4 soil horizon in the Site 9 Main sequence. Layer (10) is cut by Inhumation 2 (SUERC-24038). A sample of articulating sheep/goat vertebra was submitted from context (16) (OxA-20783), which is part of a sequence of deposits that accumulated as the rampart was constructed. Unfortunately, no datable samples were available from ditch 1, which apparently cuts layer (10), and underlies the rampart.

Two determinations on Inhumation 1 (SUERC-24037 and OxA-20776), cut into the rampart, are statistically consistent (T’=0.9; ν=1; T’(5%)=3.8) and have been combined

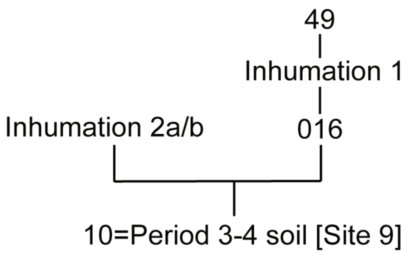

Figure 4.3.5: Site matrix for the dated and modelled feature groups in Site 3, Stanwick

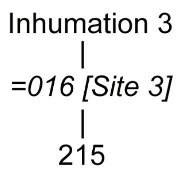

Figure 4.3.6: Site matrix for the dated and modelled feature groups in Site 4, Stanwick

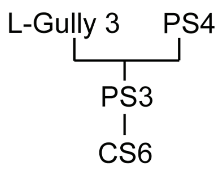

Figure 4.3.7: Site matrix for the dated and modelled feature groups in Site 9 south-east, Stanwick

prior to calibration (2037 ±21BP). This burial had a horse skull (49) placed on top (SUERC-24049).

At Site 3, the posterior density estimate for (16) provides the best estimate for the building of the rampart as the articulating animal bone dated was likely to have been discarded in the rampart during construction.

Site 4

Pairs of dates were obtained from two contexts that between them sandwich the Site 4 rampart (Fig. 4.3.6). Two dates are from articulated members of sheep and pig bone from a layer (215) beneath the rampart (SUERC-24048 and OxA-20780). The other two were obtained from Inhumation 3, cut into the rampart (SUERC-24039 and OxA-20777). This time, the measurements are not statistically consistent ($T'=5.9$; $\nu=1$; $T'(5\%)=3.8$). However, at 3.8, the C:N ratio for SUERC-24039 falls outside the acceptable range of 2.9–3.5 (DeNiro 1985); it has therefore been excluded from the model.

Site 9 South-east

Four radiocarbon dates were obtained from as many contexts in a floating sequence in the south-eastern part of the excavation (Fig. 4.3.7). One result comes from a charred oat grain in the fill (5338) of posthole F5339, possibly associated with the entrance to CS6 (OxA-20788). CS6 is cut by a post structure (PS3), for which one result on poplar/willow charcoal (OxA-20786) comes from the primary fill 5364 of one of its post-pits, F5211. In turn, PS3 was cut by two features not stratigraphically relatable to one another. OxA-20784 is from articulating cattle bone in the fill of linear gully 3 (F5154), while OxA-20787 is from Maloideae charcoal retrieved from the post-pipe fill (5357) of post-pit F5331 of PS4. Regrettably, most features in this part of the site were devoid of datable material.

Site 9 Main

The principal Site 9 sequence has two main branches (Fig. 4.3.8). These are linked by two layers, the early soil horizon and the Period 3–4 soil horizon, the latter also apparently equivalent to Site 3 layer (10).

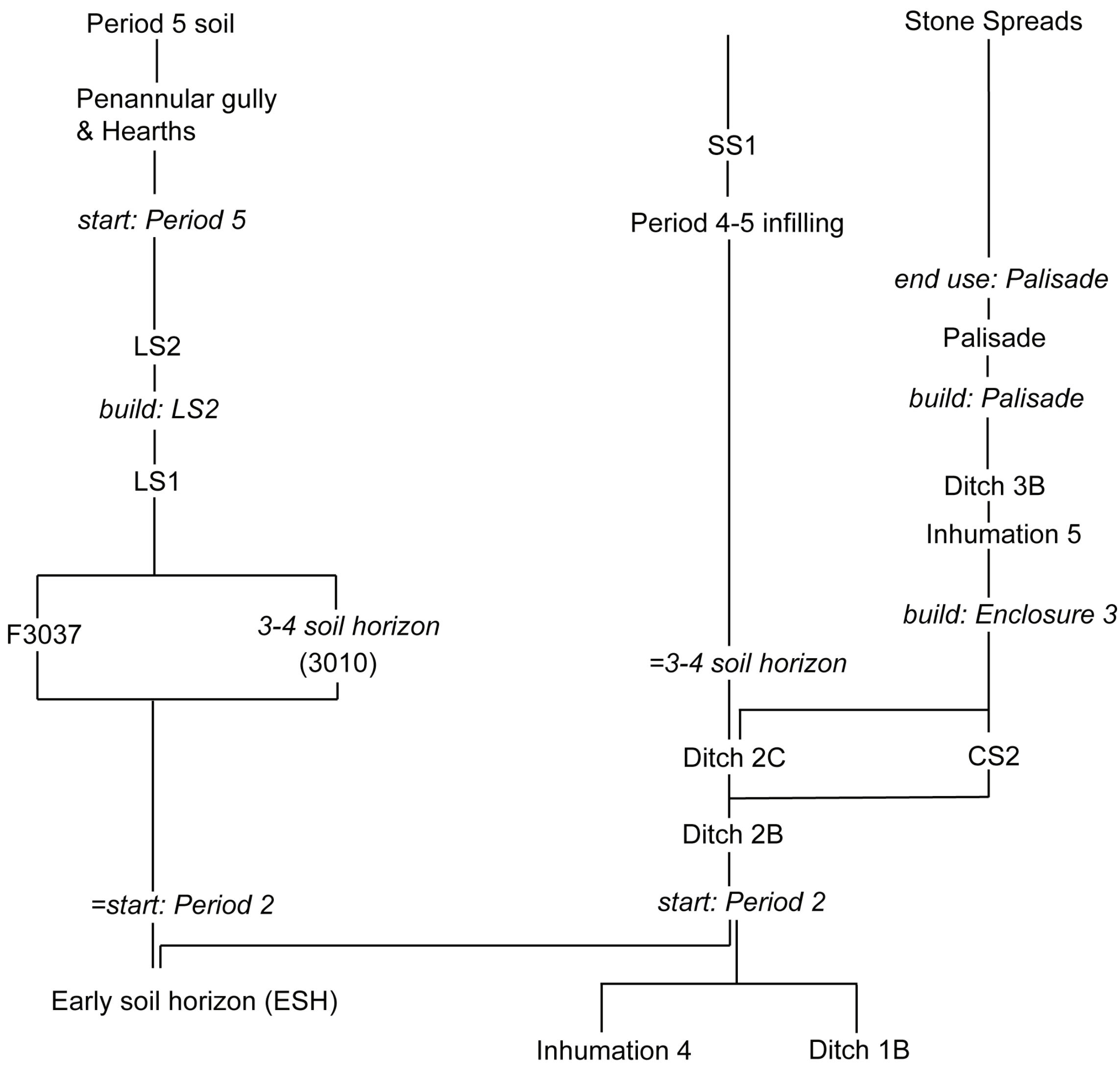

Figure 4.3.8: Site matrix for the dated and modelled feature groups in Site 9 Main, Stanwick

Sequence 1

The first sequence begins with the early soil horizon, from which results are available from two contexts (1085: OxA-3379; 2167: OxA-3380). In this sequence, Period 2 is not represented, and the early soil horizon is overlain by the Period 3–4 soil horizon, and cut by the deep feature F3037. Two radiocarbon results are available from the former (3010) (SUERC-24033 and OxA-20794), and two more come from lower fill 3036 of F3037, which is also assigned to Period 3–4 (OxA-21389; SUERC-26417).

Both the Period 3–4 soil horizon and F3037 are cut by post-pits of the first of the Period 4 timber buildings, LS1. Seven measurements are available from charred macrofossil remains recovered from LS1 features: two from one of the outer post-pits (2124: SUERC-26467 and OxA-21847), two more from its post-pipe (2126: SUERC-24057 and OxA-20791) and three from the post-pipes of two other pits (2179: OxA-21848; 3144: SUERC-24061 and SUERC-26468). One of the two dates from post-pipe fill 3144 (SUERC-24061) has a low individual index of agreement, indicating it may be, as it appears, too recent for its stratigraphic position. The context appears secure, so this sample may be intrusive, either in antiquity or because of contamination during excavation; it has been excluded from the modelling.

In the course of Period 4, LS1 was succeeded by LS2. Five results are available from this building phase, although two Groningen dates are included in the model only as *terminus post quem* dates for their contexts, since both were from unidentified bulk charcoal. One date was obtained from charcoal in the fill of one of the LS2 post-pits (2209: GrN-15664), while two dates were obtained on charred macrofossil remains from the lower fill of its post-pipe (2150: SUERC-24051 and OxA-21388). The fourth sample was hazel charcoal from the top of a second post-pit from the main ring of LS2 (1090; SUERC-24050), whilst the fifth was charcoal from the fill (1095: GrN-15665) of one of the post-pits that form the outer circuit.

When LS2 went out of use, the area was used in Period 5 for activity centred on three hearths, enclosed by a penannular gully (P5a). Six results from three contexts are available from this feature group. Two results are on charcoal from Hearth 3, apparently the earliest hearth (2195: SUERC-24058 and OxA-20792) and two on charcoal from a nearby spread of burnt material (1022: SUERC-24052 and OxA-20789). The final pair come from the uppermost fill (1067) of the post-pipe of another LS2 post-pit. The results (SUERC-24053 and OxA-20790) are too recent for their stratigraphic position and re-evaluation of the records suggests that the material actually derives from the same activity as the hearths – whether through a deliberate infilling or levelling of a depression created after the pipe fill subsided, or coincidental accumulation. Alternatively, the infill of this depression might post-date the hearths altogether, but when modelled this way the individual agreement indices are below the accepted 60% threshold.

The sequence in this area is capped by a *terminus post quem* provided by a bulk sample date (GrN-15666) on unidentified charcoal from a soil deposit (1005) overlying the gully and hearths and thought to be contemporary with the use of the later stone structures on the site.

Sequence 2

The second sequence encompasses several successive phases of enclosure ditches and gullies and the palisade extending from Periods 1–4, followed by the stone building phase and associated deposits of Period 5.

The sequence begins with three dates from fill 3183 of the Period 1 enclosure (Ditch 1B). Two dates are on spelt glume bases (OxA-3377/-3378) and the third on a piece of articulated cattle bone (SUERC-24047). The radiocarbon measurements on the spelt glume bases were originally bulked measurements. They are statistically consistent (T'=0.0; ν=1; T'(5%)=3.8) and so have been combined prior to calibration (2070 ±46BP). The result on the cattle bone, however, was more recent than expected. Reassessment suggests that the bone was intrusive or misattributed on account of a later pit containing Roman pottery sherds, which cut through the ditch. A few tiny Roman pottery sherds attributed to 3183 have previously been rejected as intrusive. The glume bases were, however, from a very rich environmental sample, suggesting that they were securely *in situ*.

Another of the Period 1 enclosure ditches (Ditch 1C) contained a burial (Inhumation 4), which pre-dates the final cut of the ditch (Ditch 1D). This generated two statistically consistent results (T'=0.0; ν=1; T'(5%)=3.8; SUERC-24040 and OxA-20778), which have been combined prior to calibration (2075 ±22BP).

The beginning of Period 2 is defined by the laying out of Enclosure 2, which cut through Enclosure 1 and other early deposits (*start: Period 2*). There were no samples from the earliest phase of the ditch, but the two recuts are represented by three results: two on charcoal from the lower fill of Ditch 2B (4168: SUERC-24059 and OxA-20793, and one on spelt glume bases from the fill of Ditch 2C (2045: OxA-3381).

The infilled Enclosure 2 ditch was cut by a gully associated with CS2. A barley grain was dated from the fill of the CS2 ring gully (5136: OxA-3382), but the date appears too recent for its stratigraphic position and the grain is likely to be intrusive. There is little soil cover in this part of the site and any overlying stratigraphy has been lost to ploughing. The result has been excluded from the modelling.

Period 3 is represented by a number of gullies post-dating Enclosure 2, but unfortunately no suitable material for dating was available from these gullies to complement the two dates obtained for F3037 in Sequence 1, which likely dates late in Period 3 or early in Period 4.

The start of Period 4 is represented by the oval enclosure (Enclosure 3), which cut Enclosure 2. The new enclosure had two phases of ditch (3A, 3B), followed by a palisade (3C). There was unfortunately no material suitable for dating in the fills of Ditch 3A, but Inhumation 5, which was inserted into the very largely infilled ditch can be used to provide an estimate for when Enclosure 3A went out of use, and indirectly for when it was in use. Two results from Inhumation 5 (SUERC-24041 and OxA-20779) are statistically consistent (T'=0.0; ν=1; T'(5%)=3.8) and have been combined prior to calibration (2054 ±22BP).

Soon after the burial of Inhumation 5, the enclosure was redefined by the digging of Ditch 3B, for which one radiocarbon result is available on a grain of carbonized *Triticum* sp. from the upper fill (4111: SUERC-26418). Two further dates on charred macrofossil remains were obtained from the palisade trench (F5034), which replaced Ditch 3B (5017: SUERC-24060 and OxA-20557).

Over the top of the Enclosure 3 circuit were a series of sinkage fills, over which a linear stone structure (SS3) was constructed on the same line as the palisade. Outside Enclosure 3, equivalent deposits accumulated over the infilled Enclosure 2 ditch; these are overlain by the circular stone structure (SS1). This infilling cannot be more precisely assigned than Periods 4–5, whilst the stone structures (SS1, SS3) – and another (SS2), over the Period 5 penannular gully and hearth complex in Sequence 1 – are assigned to a secondary phase within Period 5 (P5b).

Two results (SUERC-24042 and OxA-20785) are available on an articulating cattle vertebra and carbonized residue adhering to a pottery sherd from the Period 4-5 infilling (2007). A single date (SUERC-24043) is available from an articulated cattle tarsal recovered from the wall matrix (3022) of SS1, while a bulk charcoal result (GrN-15667) provides a *terminus post quem* for the last use of the hearth (1013) within the structure.

SS1–SS3 were subsequently covered by a series of stone spreads (Period 5c). These are likely to relate to the collapse or demolition of the walls in antiquity. Two results are available from articulated animal bones recovered in separate contexts within the stone

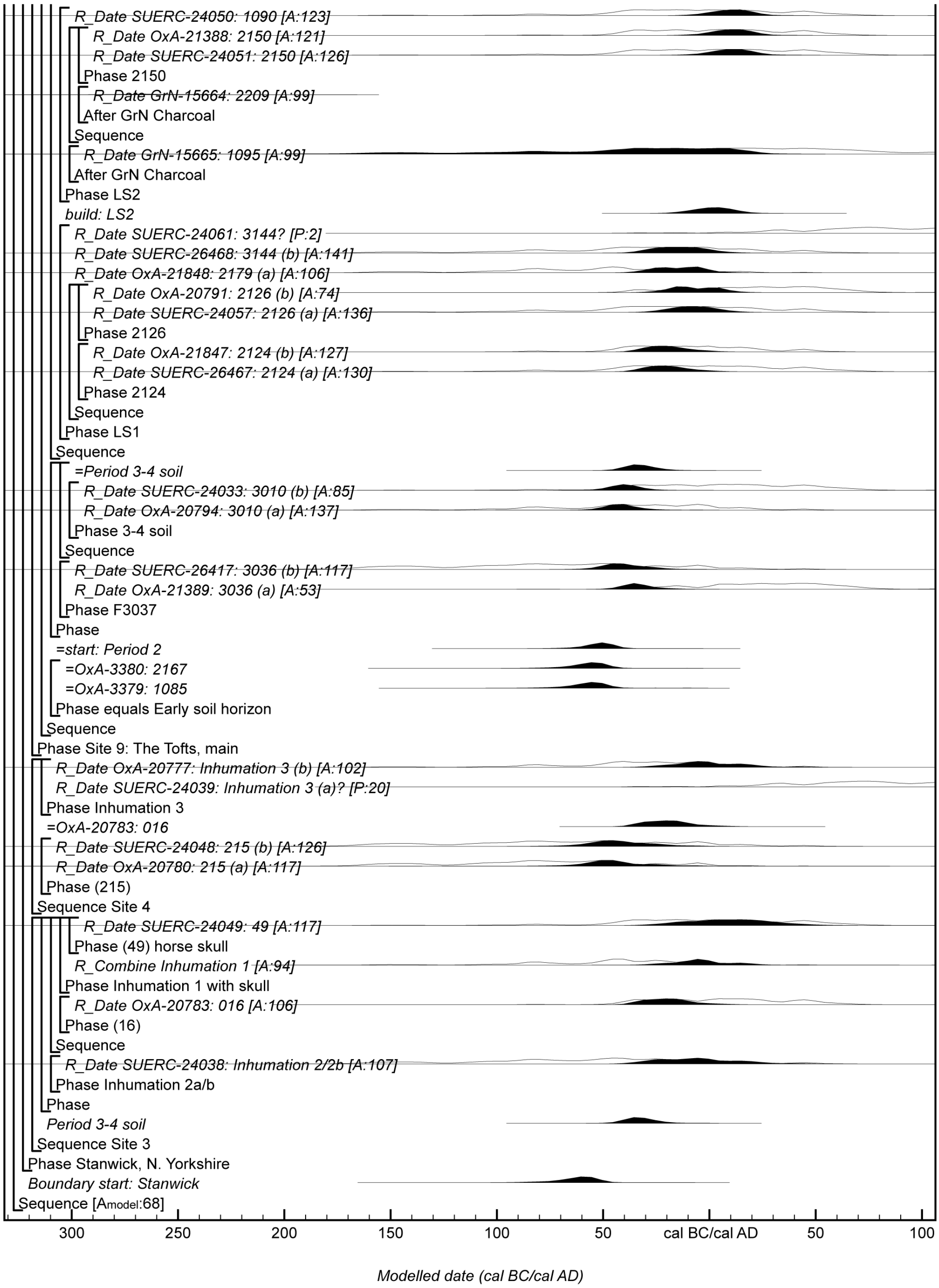

Figure 4.3.9: Chronological model for Stanwick (continued on next page). The model structure is defined by the brackets and the keywords. The format is as described in Figure 4.2.3

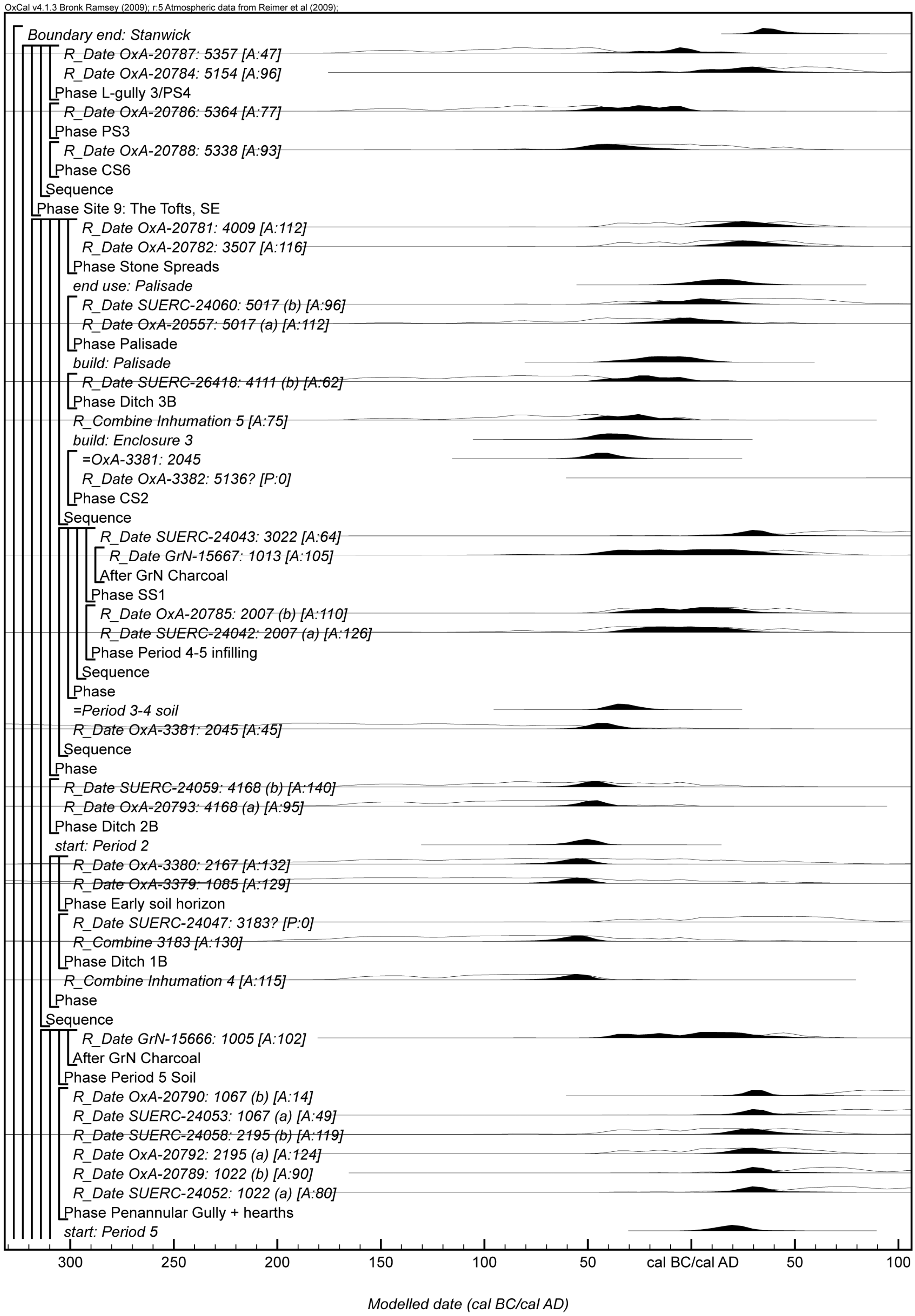

Figure 4.3.9 (cont.): Chronological model for Stanwick (continued from previous page)

spreads over SS3 (and so over the palisade as well), an articulated cattle vertebra (4009: OxA-20781) and an articulated sheep/goat femur (3507: OxA-20782). The material in these contexts also overlies the palisade and so has been used to cap that sequence. The other stone spreads that overlie the structures had no suitable *in situ* material for dating. A late phase of postholes in the northern corner of Site 9 unfortunately yielded no datable material.

4.3.4 Model results

The model (Fig. 4.3.9) shows good agreement between the stratigraphic position of the samples and the radiocarbon results (A_{model}=68). The model estimates that activity associated with Enclosure 1 had begun by *100–40 cal BC* (*95% probability*; Fig. 4.3.10; *start: Stanwick*) and probably in *75–50 cal BC* (*68% probability*). Period 2 is estimated to have begun in *80–30 cal BC* (*95% probability*; Fig. 4.3.10; *start: Period 2*) and probably in *60–40 cal BC* (*68% probability*).

The model indicates that Enclosure 3, the Tofts rampart (Sites 3 and 4) and LS1 all date to approximately the last half of the 1st century cal BC. According to the model, Enclosure 3 was constructed by *60–10 cal BC* (*95% probability*; Fig. 4.3.10; *build: Enclosure 3*) and probably by *50–25 cal BC* (*68% probability*), whilst the rampart was built in *40 cal BC–cal AD 10* (*95% probability*; Fig. 4.3.10; *OxA-20783: 016*) and probably in *35–10 cal BC* (*68% probability*). The *Period 3–4 soil* horizon provides a *terminus post quem* for the construction of LS1, estimated by the model as taking place in *50–10 cal BC* (*95% probability*; Fig. 4.3.10; *Period 3–4 soil*) and probably in *45–25 cal BC* (*68% probability*). LS1 was replaced by LS2 in *20 cal BC–cal AD 25* (*95%

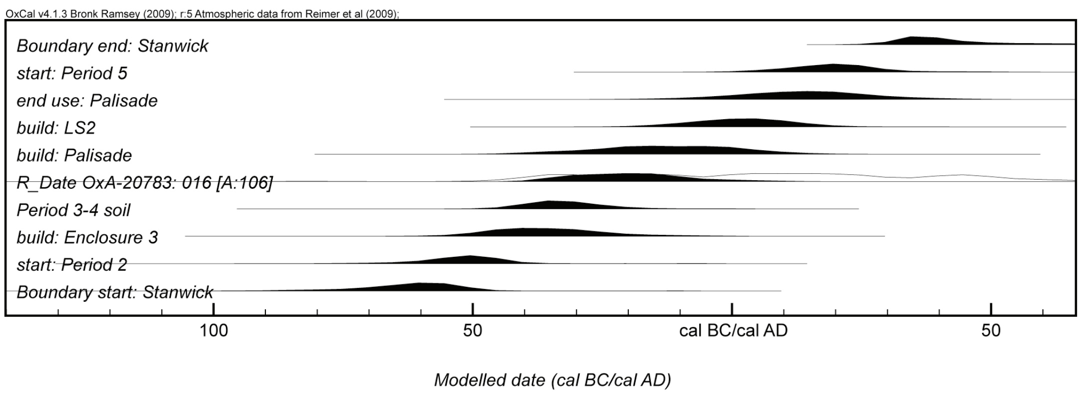

Figure 4.3.10: Probability distributions for the identified events in use-life of the settlement at Stanwick as derived from the chronological model shown in Figure 4.3.9

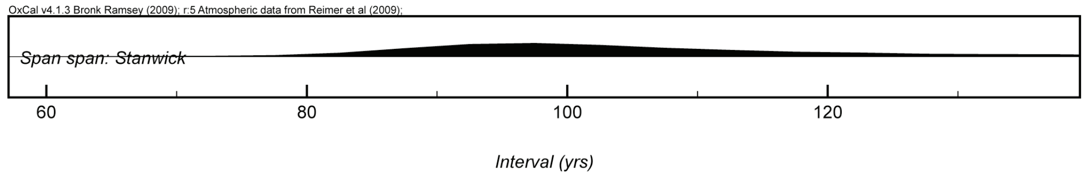

Figure 4.3.11: Probability distribution for span of overall use of Stanwick as derived from the chronological model shown in Figure 4.3.9

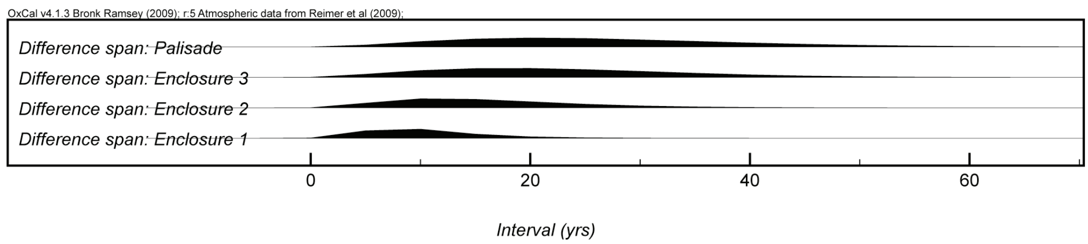

Figure 4.3.12: Probability distributions for span of the use of three enclosure ditches and the palisade at Stanwick as derived from the chronological model shown in Figure 4.3.9

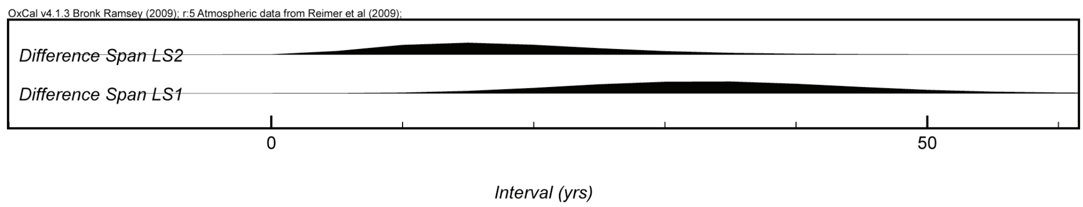

Figure 4.3.13: Probability distributions for span of use of LS 1 and LS 2 as derived from the chronological model shown in Figure 4.3.9

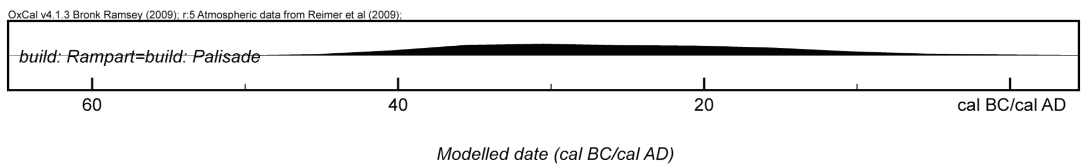

Figure 4.3.14: Probability distribution for construction of the Rampart and Palisade given an alternative model that posits the two were coeval. The Alternative model maintains the same structure as the main model, except that it places “OxA-20783: 016” equal to the event “build: Palisade”

probability; Fig. 4.3.10; *build: LS2*) and probably in *10 cal BC–cal AD 15* (*68% probability*).

The sequence of dates in Enclosure 3 makes it possible to estimate both when the palisade was constructed and when it went out of use. The palisade was constructed in *45 cal BC–cal AD 15* (*95% probability*; Fig. 4.3.10; *build: Palisade*) and probably in *30 cal BC–cal AD 5* (*68% probability*). The palisade appears to have gone out of use by *15 cal BC–cal AD 45* (*95% probability*; Fig. 4.3.10; *end use: Palisade*) and probably by *cal AD 1–30* (*68% probability*), around the same time as or slightly later than Period 5 began, estimated as *5 cal BC–cal AD 45* (*95% probability*; Fig. 4.3.10; *start: Period 5*) and probably in *cal AD 10–30* (*68% probability*). This potential overlap need not present any archaeological difficulties, as the earliest Period 5 activity is represented by the penannular gully and hearths, which lie outside the palisaded enclosure, both subsequently being succeeded by the stone building phase.

Dated activity in the Tofts ends in *cal AD 20–80* (*95% probability*; Fig. 4.3.10; *end: Stanwick*) and according to the model, probably in *cal AD 25–50* (*68% probability*). The latter estimate seems early, given the amount of Roman pottery of Neronian date present in Period 5 deposits. This result may, however, be a function of the relative paucity of dates from the latest stratigraphic contexts. The overall span of the dated occupation is estimated at *65–160 years* (*95% probability*; Fig. 4.3.11; *span: Stanwick*) and probably *80–120 years* (*68% probability*).

Given the rarity of Iron Age inhumations the modelled probabilities are provided below in Table 4.3.1.

Inhumation	***95% probability***	***68% probability***
1	*35 cal BC–cal AD 30*	*20 cal BC–cal AD 20*
2/2b	*45 cal BC–cal AD 35*	*30 cal BC–cal AD 20*
3 (b)	*35 cal BC–cal AD 35*	*20 cal BC–cal AD 20*
4	*90–40 cal BC*	*70–45 cal BC*
5	*55–1 cal BC*	*50–20 cal BC*

Table 4.3.1: Modelled probabilities for the death and burial of the five inhumed individuals from Stanwick

The model was also used to calculate the span of use for Enclosures 1–3 and the palisade (Fig. 4.3.12), along with the span of use for the two LS buildings (Fig. 4.3.13). The results are given in Table 4.3.2.

Span	**Equation**	***95% probability (years)***	***68% probability (years)***	***median***
span: Enclosure 1	*start: Period 2 – start: Stanwick*	*1–25*	*1–15*	*10*
span: Enclosure 2	*build: Enclosure 3 – start: Period 2*	*1–35*	*5–25*	*15*
span: Enclosure 3	*build: Palisade – build: Enclosure 3*	*1–50*	*5–35*	*22*
span: Palisade	*end use: Palisade – build: Palisade*	*1–55*	*10–40*	*25*
span: LS1	*build: LS2 – Period 3–4 soil*	*10–55*	*20–45*	*34*
span: LS2	*start: Period 5 – build: LS2*	*1–35*	*5–25*	*17*

Table 4.3.2: Calculated spans for the use of various enclosure features and the two LS buildings from Stanwick

The question was raised as to whether it is possible for the palisade and rampart to be coeval in use. A second, alternative model, was constructed that set *build: Palisade* equal to *OxA-20783: 016*, the articulating animal bone in the rampart construction fill. This model has good overall agreement (A_{model}=86) and estimates that if the palisade and rampart were constructed at the same time, this would have taken place in *50–1 cal BC* (*95% probability*; Fig. 4.3.14; *build: Rampart=build: Palisade*), and it probably occurred in *40–15 cal BC* (*68% probability*).

The probabilities that each of the 10 modelled events is before another has been calculated using the `Order` function in OxCal, with the results provided in Figure 4.3.15. Additionally, specific historic dates were included in the ordering: the date of the Claudian invasion (AD 43); the dates for the reign of Nero (AD 54 and 68); and the date that the Roman army put down the Brigantian revolt (AD 70). It was mentioned earlier that the Period 5 deposits had a relative high quantity of Neronian pottery. The modelling estimates that Period 5 began *25–75 years* before AD 70 (*95% probability*; =AD 70 – *start: Period 5*) and probably *40–60 years* (*68% probability*). Furthermore, the modelling provides an 81% probability that settlement activity ceased at Stanwick prior to AD 54, the beginning of the reign of Nero, but only a 61% probability that it ended prior to the Claudian invasion. Given the stratigraphic controls, the confidence in the security of the contexts sampled, and the agreement of the model constraints and the dates, this suggests that this material culture is coming into the area quickly: perhaps either overland or up the Tees, through the routes of normal trade in the area, or possibly given the historical circumstances as a form of tribute offering to the elite rulers of a group on the then fringes of the Empire.

The excavator has expressed concern that the radiocarbon dating and modelling has placed the construction of LS1 perhaps 50 years earlier than expected based on the conventional Continental dating of some of the artefactual material recovered from the postholes. A total of four sherds of Roman pottery were recovered from the fills of LS1 postholes.

Three of these sherds, recorded as coming safely from the base of the post-pits, may conceivably date from as early as *c*. 25–20 BC on the Continent, but would normally be thought not to date before the early decades AD in Britain, especially in northern England (Haselgrove pers. comm.). However, as Reynolds (1993) has pointed out when discussing the dismantling of the Pimperne experimental house after 15 years, most of the posts were all decayed all the way through with an intact and open post-pipe left beneath the remains of the post. In fact, within about eight years most of the post was likely to have been decayed to the inert heartwood, leaving an actual gap of air between the original packing around what remained of the post. For a post of 50–60cm in diameter, the thickness of the sapwood was perhaps 10% and maybe more depending on the species of tree and how fast-grown the timber (R. Howard pers. comm.). This would equate to a minimum expected gap of 5–6cm, or perhaps 2 inches, all around. Not only would seeds and bits of debris swept near the base during the life of the structure fall down, but so could things such as pottery sherds and metalwork.

The fourth sherd is viewed as most problematic as it is identified as early South Gaulish samian Drag 15/17. This was recovered from the main fill (3098) of the post-pit for posthole 3143. This type of pottery is supposed to start being made no earlier than AD 15–20 on the Continent. The upper fills of this posthole produced two radiocarbon dates (SUERC-24061 and SUERC-26468) that are not in agreement, and SUERC-24061 was excluded as being too recent given all of the other dating. However, while this one date would appear too recent it is likely a statistical outlier as

Probability $\tau_1 < \tau_2$	τ_2														
τ_1	start: Stanwick	start: Period 2	build: Enclosure 3	Period 3-4 soil	OxA-20783: 016	build: Palisade	build: LS2	end use: Palisade	start: Period 5	end: Stanwick		AD 43	AD 54	AD 68	AD 70
start: Stanwick		100	100	100	100	100	100	100	100	100		100	100	100	100
start: Period 2	0		100	100	100	100	100	100	100	100		100	100	100	100
build: Enclosure 3	0	0		65	90	100	100	100	100	100		100	100	100	100
Period 3-4 soil	0	0	35		100	93	100	100	100	100		100	100	100	100
OxA-20783: 016	0	0	10	0		67	94	98	100	100		100	100	100	100
build: Palisade	0	0	0	7	33		83	100	99	100		100	100	100	100
build: LS2	0	0	0	0	6	17		80	100	100		100	100	100	100
end use: Palisade	0	0	0	0	2	0	20		65	100		98	100	100	100
start: Period 5	0	0	0	0	0	1	0	35		100		97	100	100	100
end: Stanwick	0	0	0	0	0	0	0	0	0			61	81	92	94

Figure 4.3.15: Order matrix between modelled probabilities of events at Stanwick and various historically significant dates. The probabilities are derived from the model presented above in **Figure 4.3.9**

all seven of the radiocarbon measurements from the LS1 postholes are statistically indistinguishable (T'=9.9; v=6; T'(5%)=12.6).

The possibility exists that even given all of the radiocarbon dating and stratigraphic controls, six of the seven results from LS1 postholes are on residual material. However, as the structure appeared to have been deliberately dismantled and then rebuilt as LS2 the possibility also exists for this single sherd to have made its way into the pit late in the use-life of the building and then been incorporated into the mixed loam and sandy clay fills that initially surrounded the post as the building was being dismantled. There appears to be evidence that this first iteration of the large structure was collapsing under its own weight as some of the post-pipes show signs of being thrust outward from the centre of the building.

This would, of course, mean that the vessel from which this sherd is derived was introduced to the site very shorty after it was produced. I would argue here that this is very likely the case. Given the importance of Stanwick and its position as a unique settlement within the landscape of north-east England, I believe it is quite possible that much of the Roman pottery found on the site may have constituted part of an offering from Rome in an effort to gain the patronage of the Brigantians as a client kingdom. As such, it likely involved very little lag time between production in Gaul and consumption in central Britain of some of these vessels, and probably best explains not only the three sherds at the base of the post-pits but the early South Gaulish samian Drag 15/17 as well.

4.4 Street House Farm

4.4.1 Site description

Street House Farm (NZ 739 196) lies approximately 5km to the east of the settlement at Kilton Thorpe Lane near the coast. It is a rectangular enclosure site of later Iron Age date with a secondary enclosure to the southwest (Fig. 4.4.1). The site contains the ring ditches of six structures, with an annexe to Structure 6 that contained material associated with salt production through evaporation (e.g. briquetage, evaporation vessels, etc).

Although it has been suggested that there are four phases of settlement, the clear relationships between structural groups include: Structure 3 is stratigraphically later than Structure 2; Structure 1 lies within the ring ditch of Structure 2 and cuts the ring ditch of Structure 4; Structure 2 cuts the ring ditches of Structure 4 and 6.

More detailed information about the site and the excavation is provided by Sherlock (2007).

Figure 4.4.1: Site plan for Street House Farm (after Sherlock 2007, fig. 3)

4.4.2 Sample specifics

A total of 19 results are available from samples submitted from Street House Farm. Twelve results on carbonized residues were robust accretions either found adhering to the inside of pottery sherds or at/near the rim or shoulders – and so indicative of charred foodstuff that has spilled or boiled over. A further 6 samples were submitted of single carbonized seeds (4 wheat and 2 barley) and one sample of short-lived roundwood charcoal (hazel).

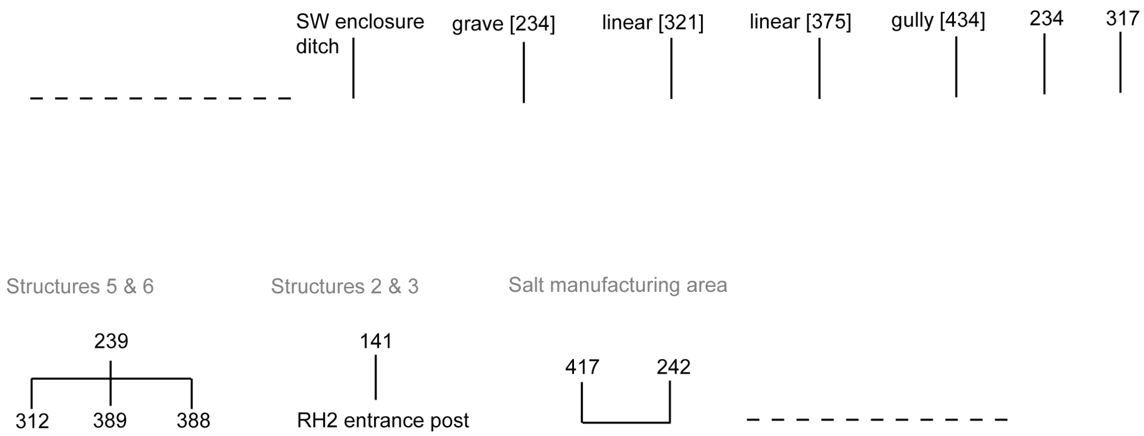

Figure 4.4.2: Site matrix for dated and modelled contexts from Street House Farm

4.4.3 Model description

Despite the fact that the excavation showed clear stratigraphic relationships between feature groups, there were no direct relationships between the contexts within which any individual sample was retrieved (Fig. 4.4.2). Furthermore, once the phasing had been deconstructed it became clear that given the number of samples available it would be impossible to examine the timing or duration of any individual phase.

The decision was made to group the dates together as one continuous phase of Iron Age activity within a rectangular enclosure site in the Tees valley. This is useful for comparison to the open settlement of Kilton Thorpe Lane that lies less than 5km to the west.

All the pottery from Street House Farm appeared to have been deposited fairly fresh in its contexts and the carbonized residues that were dated were very robust. This further indicates the likelihood of rather rapid entry into the site deposits. However, as the pottery came from the fills of ditches, a post-hole, a *Grubenhaus*, and an Anglo-Saxon grave there is the obvious, and demonstrated, possibility for redeposition. So while the material may be residual in some contexts, the measurements on the residues, being from Iron Age pottery, are all indicative of a general use of the entire site in the Iron Age.

SUERC-11125 was a single carbonized seed of barley, and while it could be residual in its context (fill of Structure 3 ring ditch) does provide a date for general activity on the site. SUERC-13793 was a piece of hazel roundwood charcoal in the fill of a briquetage pit and is likely to represent the fuel used to evaporate sea-water during salt production.

SUERC-18790 and OxA-18727 are measurements on single seeds of wheat from the lower fill (312) of a hearth in Structure 6. The two measurements are statistically consistent ($T'=0.5$; $\nu=1$; $T'(5\%)=3.8$) and could be the same actual age.

SUERC-18791 and OxA-18728 are measurements on single seeds of wheat from the fill (389) of a second hearth in Structure 6. The two measurements are statistically consistent ($T'=0.0$; $\nu=1$; $T'(5\%)=3.8$) and could be the same actual age.

Beta-200337 is problematic for two reasons: (1) it is a date on bulked seeds from the fill of a ditch, and (2) the particular ditch is only related to the remainder of the site by being in the same vicinity. After exclusion from the model, it has only a 1% probability of being temporally related to the other suite of measurements.

4.4.4 Model results

The model for Street House Farm has a good overall agreement ($A_{model}=107$). The model estimates that activity associated with the main rectangular enclosure began in *135–10 cal BC* (*95% probability*; Fig. 4.4.3; *start: Street House Farm*), and probably in *110–45 cal BC* (*68% probability*). Activity in this area of the site ended in *cal AD 75–165* (*95% probability*; Fig. 4.4.3; *end: Street House Farm*) and probably in *cal AD 90–135* (*68% probability*).

The overall span of dated activity associated with the rectangular enclosure covered *100–290 years* (*95% probability*; Fig. 4.4.4; *use: Street House Farm*) and probably *145–230 years* (*68% probability*).

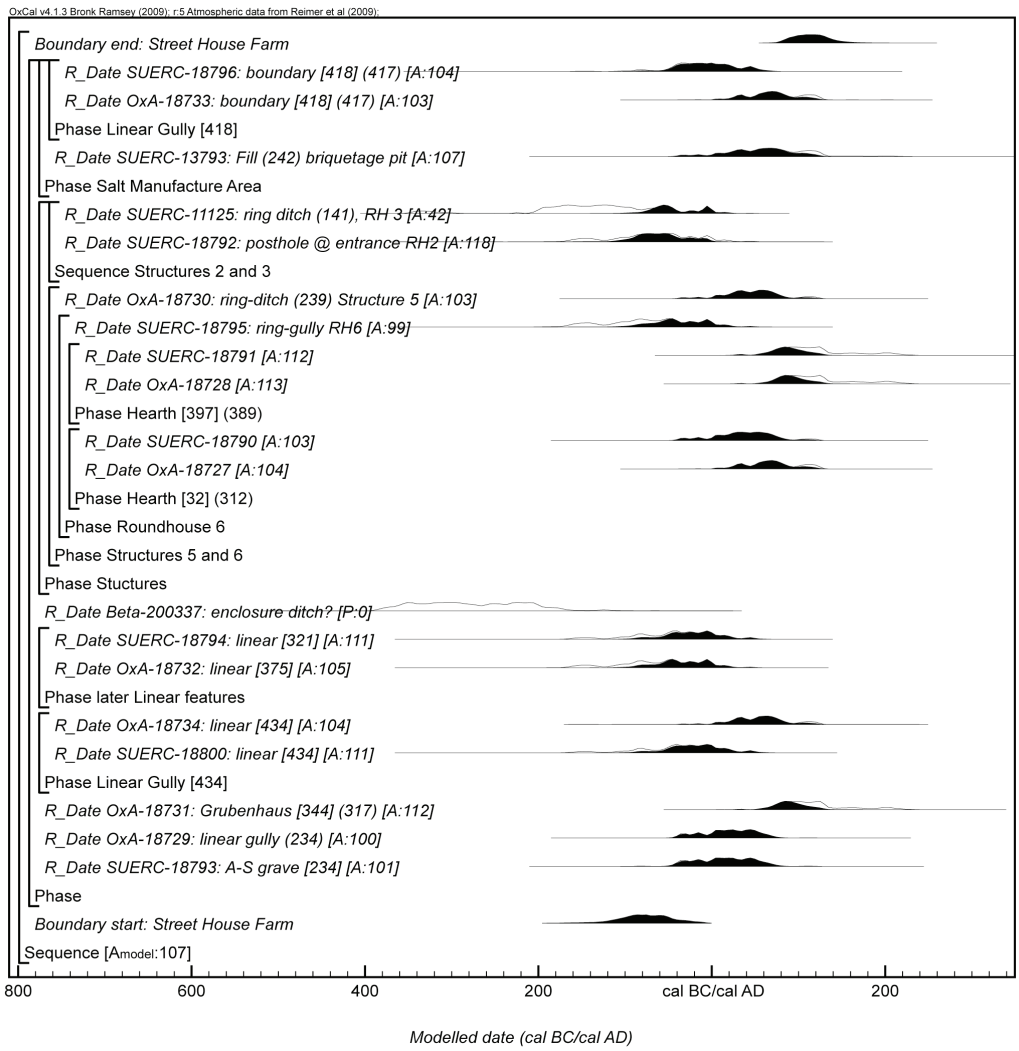

Figure 4.4.3: Chronological model for Street House Farm. The model structure is defined by the brackets and the keywords. The format is as described in Figure 4.2.3

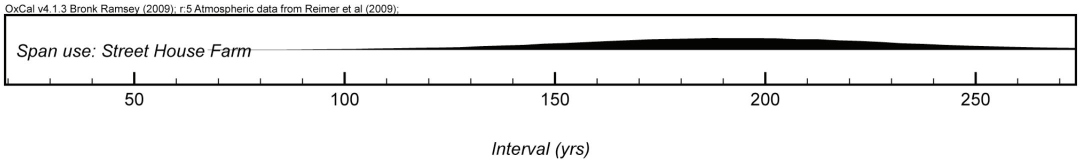

Figure 4.4.4: Probability for the overall span of use of Street House Farm as derived from the chronological model shown in Figure 4.4.3

4.5 Thorpe Thewles

4.5.1 Site description

The site of Thorpe Thewles (NZ 397 243) was excavated in 1980–82, over a period of 114 continuous weeks. Four Phases were identified and were labelled I–IV, the descriptions that follow will maintain the same nomenclature (Heslop 1987) (Fig. 4.5.1).

Phase I at Thorpe Thewles consists of a linear feature (and possibly a second). This feature pre-dates the main settlement activity as it is cut by later activity and so is securely placed before all other dated features on the site. Phases II and III are periods of 'settlement' on the site and contain the bulk of the dated material.

The Phase II site is a 'classic' lowland single rectilinear enclosure with a large roundhouse in the middle. Material was available for dating from cuttings across the Main Enclosure Ditch, the Main Structure Ditch, and from features associated with the Main Structure.

The Main Structure has at least two rebuilds that could be confidently documented through excavation. While the artefactual dating is not useful for determining when the site began other than sometime in the later Iron Age, it does suggest the enclosed settlement ended at about the turn of the millennium (Heslop 1987, 111). The excavation revealed a dump of charcoal approximately midway up the profile of the Main Enclosure Ditch, presumably a hearth cleaning deposit (A102). After this discrete dump the ditch appeared to have been rapidly infilled. This context has been used to indicate the ultimate stage of the enclosed phase (Phase II) of the site.

By Phase III the site had expanded and been transformed into an open settlement. Here there is material available from the upper rapid filling of the Main Enclosure Ditch, various circular structures, a cobbled entranceway, masking midden deposits, and a couple of smaller activity delineating enclosures. Here the artefact dating suggests that the site went out of use as a place of habitation in the later 1st century AD (Heslop 1987, 111). Only ultimate Phase III and later deposits contain Romano-British pottery.

The sequence of settlement is thought to have covered a span of perhaps 400–500 years with Phase II persisting for approximately 300 years and Phase III lasting for about one hundred years or so.

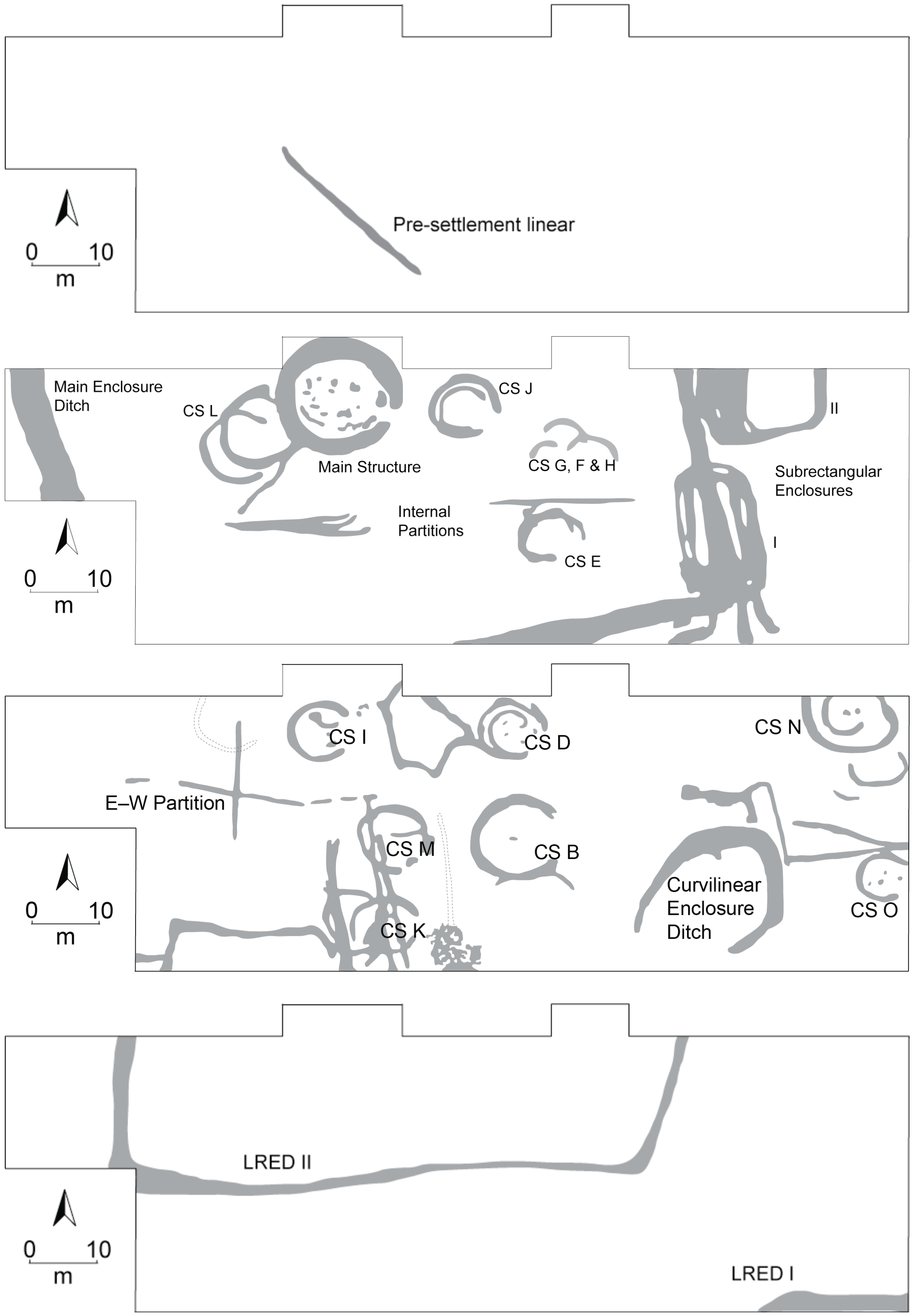

Figure 4.5.1: Site plan for Thorpe Thewles separated by Phases I-IV from top to bottom (after Heslop 1987, fig. 6)

Phase IV is the latest phase of activity and is characterized by two large rectilinear stock enclosures on the site that cut/cover much of the settlement archaeology. This period has Romano-British pottery throughout the features and is thought to persist until perhaps the mid 2nd century AD by when the ditches were likely full.

4.5.2 Sample specifics

A total of 40 radiocarbon and 12 thermoluminescence (TL) results is available from samples from the Iron Age settlement at Thorpe Thewles. Ten radiocarbon results are from material submitted in the 1980s. Of these, six results are on bulk unidentified charcoal, two are on identified charred cereal grains, and two are on bulked spelt chaff. The remaining 30 radiocarbon results are from material submitted as part of this project. Sixteen results are from carbonized residues that were robust accretions either found adhering to the inside of pottery sherds or at/near the rim or shoulders – and so indicative of charred foodstuff that has spilled or boiled over. The remaining 14 samples were single pieces of identified short-lived charcoal.

The thermoluminescence (TL) dating was all undertaken on Iron Age pottery sherds. The procedures are described in Bailiff (1988) with the results presented in Heslop (1987, 71–2) and Appendix I, Table 2.

4.5.3 Model description

The model for Thorpe Thewles combines the radiocarbon and TL dating results together with both the stratigraphy and the site phasing (Fig. 4.5.2).

Not enough information was available in the site archive to determine if the unidentified bulk charcoal samples might have contained old wood and assign a probability for any possible offset. Also, at the time the luminescence dating was undertaken the procedure was still very much in its infancy and there is a possibility that erroneous results exist within the dataset. Furthermore, as the pottery for the luminescence dating was selected without the foresight of Bayesian analysis, the taphonomic association between the pottery sherd and the context is dubious. It is not possible to demonstrate why the date of the sherd should likely date the context from which it was recovered. As a result, all of the bulked unidentified charcoal results and the

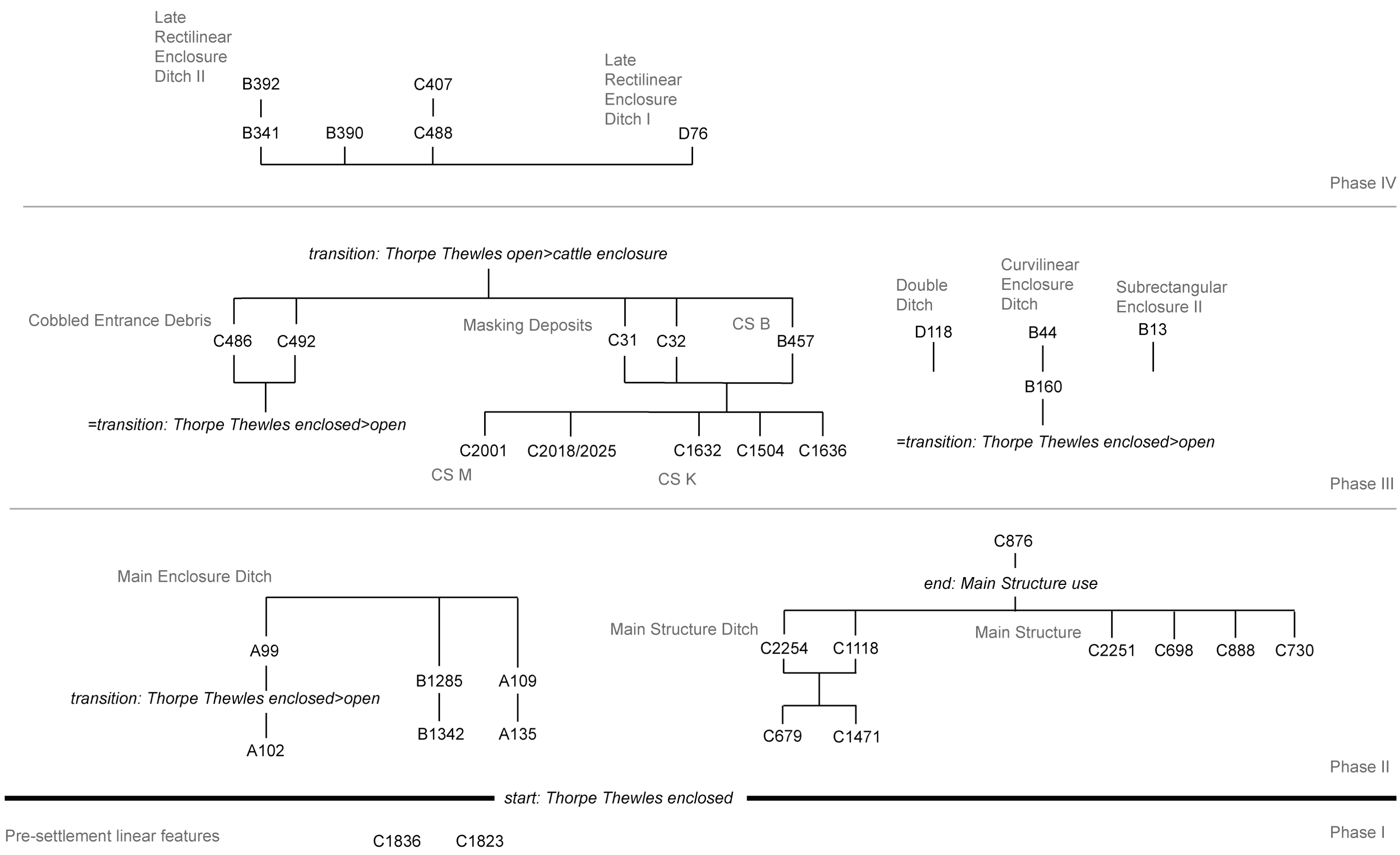

Figure 4.5.2: Site matrix for dated and modelled contexts from Thorpe Thewles

TL results have been included as *terminus post quem* dates for their respective contexts.

The model matrix is separated into the four identified phases of activity with Phase I comprising what have been identified as pre-settlement features. One result on carbonized bread wheat (OxA-1745; 720 ±70BP) is available from the secondary fill (C1823) of a linear feature (LS265). The result is medieval in date and so has been excluded from the modelling as it is likely to be intrusive to this deposit. Two results (OxA-1731 and GrN-15659) are available from bulk spelt chaff and bulk unidentified charcoal, respectively, from the fill (C1836) of a second early linear feature (LS268).

The pre-settlement features are stratigraphically earlier than the enclosed and unenclosed settlement features. The model places a contiguous boundary between the pre-settlement linear features and the later features, with the boundary between the two used to estimate the beginning of enclosed settlement activity at the site (*start: Thorpe Thewles enclosed*).

There are three feature groups that have been dated in Phase II: Main Structure, Main Structure Ditch, and Main Enclosure Ditch. Furthermore the Main Structure and Main Structure Ditch have been placed together as a coherent spatial group.

Four contexts were dated from the Main Structure, none of which can be stratigraphically related. Two results (OxA-19897 and SUERC-21765) are available from carbonized food residue on refitting pottery sherds that were recovered from the floor (C698) of the structure. Two results (OxA-18737 and SUERC-18802) are available from single fragments of *Prunus* sp. and Pomoideae charcoal from a spread (C730) of highly concentrated charcoal from the structure floor. One result (SUERC-18811) is available from a carbonized residue on a pottery sherd that was recovered from a layer inside the structure doorway and with another refitting sherd. Two results (OxA-18738 and SUERC-18804) are available from single fragments of *Corylus* sp. and *Salix/Populus* sp. charcoal from the fill (C2251) of an entrance posthole.

A total of six dates from five contexts in the Main Structure Ditch are available. Three results are from the lowest fills with three results from upper fills. A carbonized food residue (SUERC-21766) was dated from a pot sherd recovered from the primary silting

(C1471) of the Main Structure Ditch. From a second deep fill (C679) came two results (OxA-18739 and SUERC-18805) on single fragments of *Betula* sp. and *Prunus* sp. charcoal and a TL date (DurTL TT8). These lowest fills were followed by results on bulk unidentified charcoal (GrN-15658) in a middle layer of fill (C1118) and bulk spelt chaff (OxA-1732) from a secondary fill (C2254) in the Main Structure Ditch. Although the spelt chaff is a bulked sample, it was originally felt that the fragility of the chaff would reduce the chances of residual material being found in the context. However, the result is too early for the context given the stratigraphic constraints and so has been excluded from the model. The dating sequence of the Main Structure and its Ditch is capped by a TL date (DurTL TT7) from the final fill (C876) of the Ditch, which likely filled in after the structure was no longer in use.

The model for the Main Enclosure Ditch has three sequences that are not related stratigraphically to one another. The first sequence has a result on a carbonized grain of spelt (OxA-1733) from the charcoal and grain rich second ditch layer (A135) followed by a TL result (DurTL TT6) from a layer (A106) further up in this section of the ditch. The second sequence has two results from carbonized residues. One result (SUERC-21762) is from the primary fill (B1342) and the other (SUERC-21761) is from a middle layer (B1285) in this ditch section.

The third sequence has two results (OxA-18736 and SUERC-18806) on single fragments of *Prunus* sp. and *Corylus* sp. charcoal from a spread (A102) of highly concentrated charcoal/carbonized material in the middle fills of the ditch. These are followed by two results (OxA-18735 and SUERC-18810) on single fragments of *Betula* sp. and Pomoideae charcoal from a hearth (A99) that was in the ditch just above A102. These four results have poor agreement in the sequence. It is only by excluding OxA-18736 as being too recent that the sequence conforms. It is possible that the *Prunus* charcoal is intrusive in its context, but more plausible that the result is a statistical outlier.

Not only was the hearth presumably used when the ditch no longer served its original purpose, but the characteristic of the fills indicate the ditch rapidly infilled at and after this point. The model estimates the transformation of the site from enclosed to open between these two contexts (*transition: Thorpe Thewles enclosed>open*).

Phase III of the site is characterized as an open settlement. Although the Phase III features are presumably later than Phase II, the model does not require the two to be contiguous and so allows for some degree of overlap. The Phase III dating is represented by contexts from two structures, two small enclosure ditches, and three areas of midden deposit.

A TL result (DurTL TT15) is available from a pottery sherd recovered from a layer (D118) in the Double Ditch.

A carbonized residue was dated (OxA-20004) from a pottery sherd recovered from a layer (B160) in the Curvilinear Enclosure Ditch that cuts the Main Enclosure. The ditch was subsequently covered by an occupation layer (B44) from which a TL date is available (DurTL TT14) and another carbonized residue was dated (OxA-19894).

One radiocarbon result (OxA-18685) is available from a carbonized residue while a TL date (DurTL TT1) is available from another pottery sherd recovered from an upper layer in Circular Structure B and likely to date from the end of the structure's use.

A TL date (DurTL TT2) is available from a pottery sherd that was recovered from stratigraphy that directly overlies Subrectangular Enclosure II.

Two contexts were dated from CS M. One result comes from bulk unidentified charcoal (GrN-15661) from a layer (C2001) in the ring ditch. Similarly, two results are available on single fragments of Pomoideae and blackthorn charcoal (OxA-18741 and SUERC-18803 respectively) from occupational dumps of carbonized material (C2018/2025) in the ditch[9].

Three contexts were dated from CS K. The first result (GrN-15660) is from bulk unidentified charcoal recovered from the main layer of fill (C1504) in the structure. A TL date (DurTL TT13) is available from a pottery sherd recovered from a second layer of occupation debris within the structure. The third result (SUERC-21767) is from a

[9] Contexts (C2018/2025) formed a single environmental sample. As it is not common practice to bulk samples from different contexts for environmental analysis it was originally thought that these two contexts had been combined into a single context upon re-evaluation in post-excavation. The later discovery of a profile drawing in the archive that shows the two contexts raises some doubts as to whether the two contexts were one, although they were shown as two thin layers one on top of the other.

carbonized food residue on a pot sherd recovered from the primary silting of the ring gully of CS K (C1636).

Various midden-type deposits were identified across the site and referred to in general as the “Masking Deposit”. These were rich in organic material and void of Romano-British material. They have been dated in two different areas. The first area is referred to as the “Masking Deposit” and yielded a date each on carbonized food residue on pottery sherds from two contexts (C31: OxA-19895 and C32: OxA-20005) that overlie Iron Age features in the vicinity of CS K and M. The second deposit is the “Cobbled Entrance Debris” that represents rapid accumulation of midden debris over the cobbling that was placed over the Main Enclosure Ditch when it went out of use. Four carbonized food residues on pottery sherds from two contexts were dated. Three results (OxA-19896, -20006, and SUERC-21763) are available from context C486 and one (SUERC-21764) from C492. The accumulation of these deposits also marks the point when the settlement was likely abandoned before being reused as stock enclosures (*transition: Thorpe Thewles open>cattle enclosure*).

The final phase of activity at Thorpe Thewles (Phase IV) is characterized by two large rectilinear enclosure ditches (Late Rectilinear Enclosure Ditch [LRED] I & II). This phase has been modelled so that it can overlap in time with Phase III.

Six dates are available from LRED II. A single result (GrN-15663) on bulk unidentified charcoal from a lower fill (C488) in a ditch section is overlain by another bulk charcoal result (GrN-15662) and luminescence result (DurTL TT18) in an upper fill (C407) of the third recut of the ditch. Three further luminescence dates are available from other sections through the ditch. DurTL TT3 is from a lower fill (B341) while DurTL TT16 is from the upper fill (B392) of the section. DurTL TT17 is from a stratigraphically unrelated fill (B390) in the ditch.

Two radiocarbon results (OxA-18740 and SUERC-18801) are available from single fragments of *Fraxinus* sp. and *Quercus* sp. roundwood charcoal from a layer (D76) of highly concentrated carbonized material that was interpreted as an occupational debris dump in LRED I. Since the results from contexts in LRED II are either luminescence dates or radiocarbon results on bulk unidentified charcoal that provide *terminus post quem* dates, the results from LRED I effectively cap the sequence of settlement activity on the site.

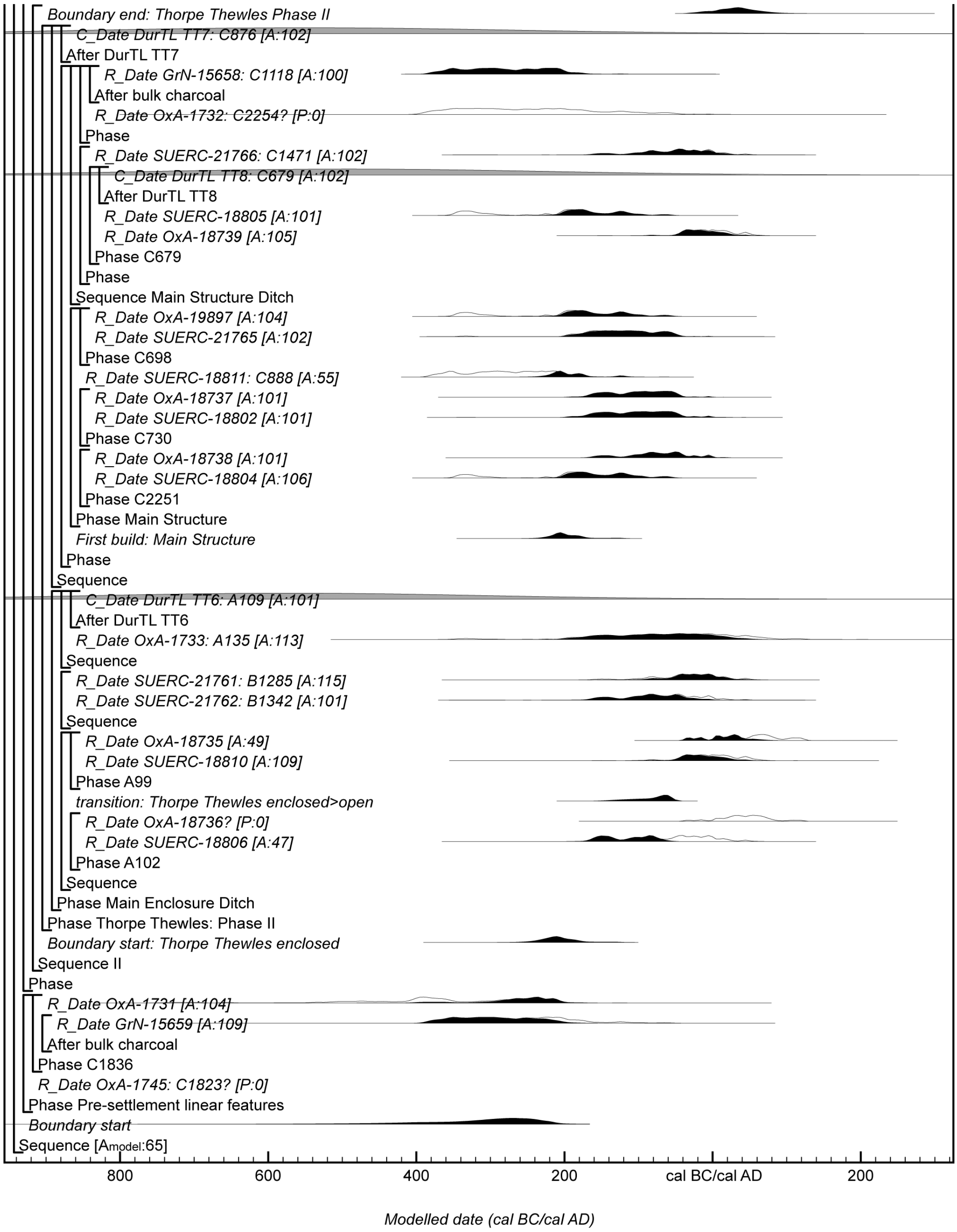

Figure 4.5.3: Chronological model for Thorpe Thewles (continued on next page). The TL dates are displayed in 40% grey to make the underlying model structure visible. The model structure is defined by the brackets and OxCal keywords and described in Figure 4.2.3

4.5.4 Model results

The model for Thorpe Thewles (Fig. 4.5.3) shows good agreement between the scientific dating results and the stratigraphy and phasing (A_{model}=65).

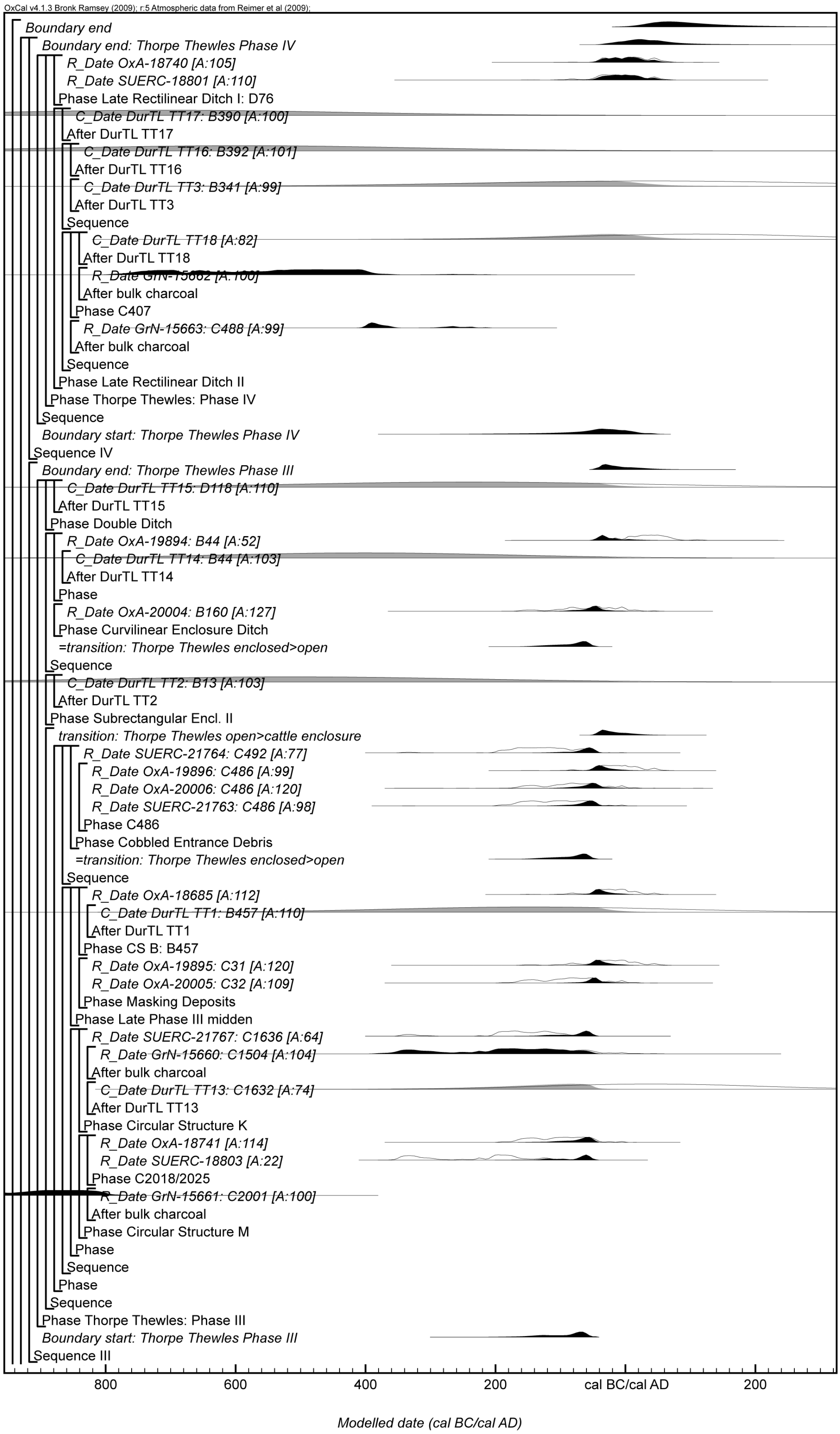

Figure 4.5.3 (cont.): Chronological model for Thorpe Thewles (continued from previous page)

The model estimates the beginning of the enclosure in *260–130 cal BC* (*95% probability*; Fig. 4.5.4; *start: Thorpe Thewles enclosed*), and probably in *235–185 cal BC* (*68% probability*). The Main Structure was built at about this time as well in *240–120 cal BC* (*95% probability*; Fig. 4.5.4; *build: Main Structure*) and probably in *220–175 cal BC* (*68% probability)*.

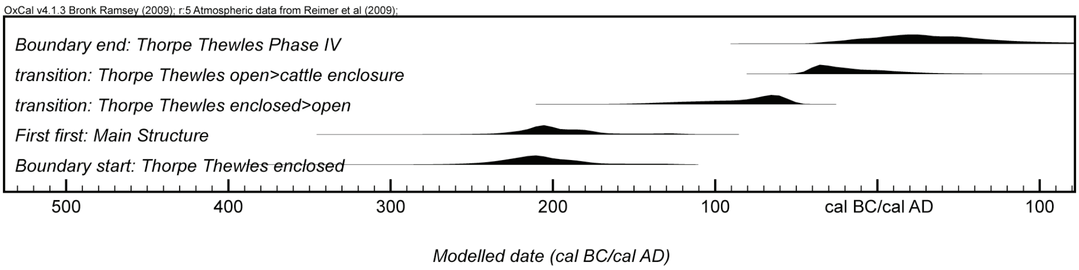

Figure 4.5.4: Probability distributions for the identified settlement transformations at Thorpe Thewles as derived from the chronological model shown in Figure 4.5.3

After a period of *40–190 years* (*95% probability*; Fig. 4.5.5; *span Phase II*) and probably *85–160 years* (*68% probability*) the main enclosure ditch went out of use and the site was opened up. This transition took place in *140–45 cal BC* (*98% probability*; Fig. 4.5.4; *transition: Thorpe Thewles enclosed>open*) and probably in *100–50 cal BC* (*68% probability*).

The open phase at Thorpe Thewles was likely shorter than the enclosed phase and lasted for *10–165 years* (*95% probability*; Fig. 4.5.5; *span Phase III*) and probably for *20–105 years* (*68% probability*). The site was once again transformed into stock

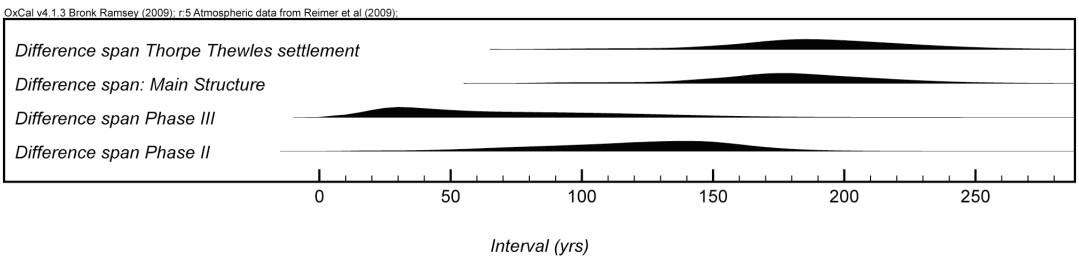

Figure 4.5.5: Probability distributions for span of the two phases of settlement at Thorpe Thewles and the overall use of the site as derived from the chronological model shown in Figure 4.5.3

enclosures in *50 cal BC–cal AD 40* (*95% probability*; Fig. 4.5.4; *transition: Thorpe Thewles open>cattle enclosure*) and probably in *45–1 cal BC* (*68% probability*).

The radiocarbon dating and Bayesian modelling estimates that the overall settlement occupation span of Thorpe Thewles was *110–280 years* (*95% probability*; Fig. 4.5.5; *span: Thorpe Thewles settlement*) and probably for *160–235 years* (*68% probability*).

4.6 Tees Valley Discussion

The results of the modelled probabilities of the four sites are summarized in Figure 4.6.1 and the order matrix is given in Figure 4.6.2.

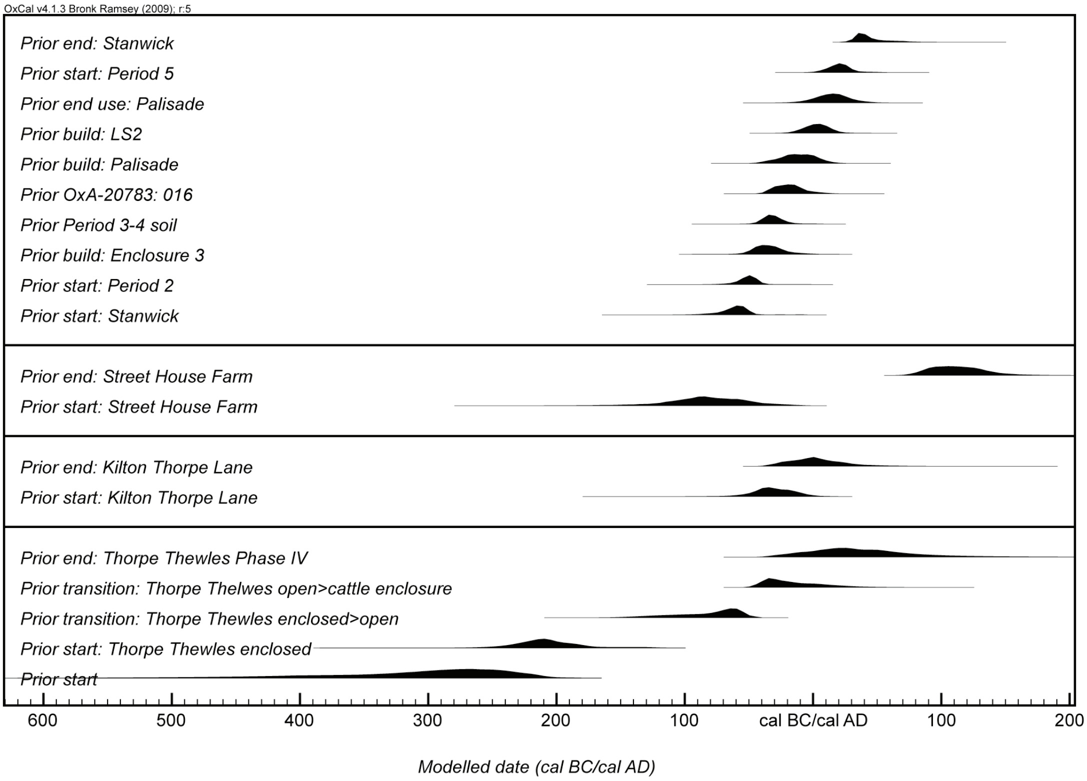

Figure 4.6.1: Probability distributions for the dated events from the four sites in the Tees valley: Kilton Thorpe Lane, Stanwick, Street House Farm, and Thorpe Thewles. The probabilities are derived from the models presented in the preceding sections in this chapter

Kilton Thorpe Lane and Street House Farm have both had initial rangefinder dating complemented by a more robust programme of dating and modelling, while the sites of Stanwick and Thorpe Thewles have had extensive new radiocarbon dating programmes undertaken. There is very little similarity between these four sites in the Tees valley. Kilton Thorpe Lane is a small, yet extensive single phase open settlement. The settlement at Street House Farm is an enclosure with multiple phases and rare in the fact that salt was being produced on site. Thorpe Thewles began life as a typical later prehistoric homestead that eventually spilled over the ditches, after they were deliberately infilled, and became an extensive open settlement. Stanwick is not really comparable to any of these, except for the fact that it was “enclosed”; it was massive in extent and vertical size with what would have been imposing ramparts.

Of the four sites, the enclosed phase of Thorpe Thewles is the earliest. It is really in the 1st century cal BC, when Thorpe Thewles transitions into an open settlement, that habitation begins at the other three sites. Of the three open settlements/phases, *transition: Thorpe Thewles enclosed>open* probably occurred before *start: Kilton Thorpe Lane* (97% probability) and *start: Period 2* (open phase) at Stanwick (92% probability). Furthermore, the data provide an 86% probability that *start: Period 2* at Stanwick predates *start: Kilton Thorpe Lane*.

The open settlement of Thorpe Thewles is similar in the morphology of features to the open phase of Stanwick. While the dating suggests that the open settlement at Stanwick began after the transition to an open settlement at Thorpe Thewles, it also gives a 97% probability that it began prior to *transition: TT open>cattle enclosure*, or the essential end of habitation directly at this location. This suggests that the open settlements at both sites may well have been contemporary. What is unclear is what was happening at Thorpe Thewles when the Stanwick fortifications were being constructed. There is a 50% probability that *transition: TT open>cattle enclosure* occurred prior to the construction of the rampart (*OxA-20783: 016*). If Thorpe Thewles fluoresced as an open settlement and then declined, it was probably in decline at this time. By the time of *end use: Palisade* at Stanwick, there is only a 14% probability that the open settlement at Thorpe Thewles was still inhabited.

The data from Kilton Thorpe Lane suggest a similar pattern. While there is only an 18% probability that *end: Kilton Thorpe Lane* occurs prior to the construction of the rampart at Stanwick (*OxA-20783: 016*), there is a 70% probability that habitation at Kilton Thorpe Lane had ended by the time of *end use: Palisade* at Stanwick.

At the time Thorpe Thewles and Kilton Thorpe Lane are in decline, Stanwick is entering its final phase (Phase 5) of use with roundhouses and walls of dry-stone construction appearing. Through all this time, activity at Street House Farm appears to remain consistent and persist into the 2nd century cal AD. This has made it difficult fully to grasp reasons for the depopulation of the settlements at Thorpe Thewles, Kilton Thorpe Lane, and eventually Stanwick, which is depopulated in the 1st century cal AD.

The sites themselves cover an overall distance of over 50km. The two closest are approximately 5km apart (Street House Farm and Kilton Thorpe Lane), with Stanwick lying just over 25km from Thorpe Thewles, which is just over 30km from Kilton Thorpe

Probability $\tau_1 < \tau_2$	τ_2																		
τ_1	end: Stanwick	start: Period 5	end use: Palisade	build: LS2	build: Palisade	OxA-20783: 016	Period 3-4 soil	build: Enclosure 3	start: Period 2	start: Stanwick	end: Street House Farm	start: Street House Farm	end: Kilton Thorpe Lane	start: Kilton Thorpe Lane	end; Thorpe Thewles Phase IV	transition; TT open>cattle enclosure	transition: TT enclosed> open	start: Thorpe Thewles enclosed	start: Thorpe Thewles
end: Stanwick		5	4	0	0	0	0	0	0	0	100	0	7	0	41	3	0	0	0
start: Period 5	95		36	9	2	1	0	0	0	0	100	0	22	0	64	9	0	0	0
end use: Palisade	96	64		23	8	3	0	0	0	0	100	0	30	1	69	14	0	0	0
build: LS2	100	91	77		20	8	1	1	0	0	100	0	48	3	81	22	0	0	0
build: Palisade	100	98	92	81		35	12	11	2	1	100	1	71	18	90	41	0	0	0
OxA-20783: 016	100	99	97	92	65		18	16	2	1	100	2	82	26	94	50	0	0	0
Period 3-4 soil	100	100	100	99	88	82		40	5	3	100	5	95	51	98	72	0	0	0
build: Enclosure 3	100	100	100	99	89	84	60		12	4	100	6	95	58	98	77	1	0	0
start: Period 2	100	100	100	100	98	98	95	88		22	100	16	99	86	100	97	8	0	0
start: Stanwick	100	100	100	100	99	99	97	96	78		100	26	100	93	100	98	23	0	0
end: Street House Farm	0	0	0	0	0	0	0	0	0	0		0	0	0	9	0	0	0	0
start: Street House Farm	100	100	100	100	99	98	95	94	84	74	100		99	93	100	97	50	1	0
end: Kilton Thorpe Lane	93	78	70	52	29	18	5	5	1	0	100	1		9	78	26	0	0	0
start: Kilton Thorpe Lane	100	100	99	97	82	74	49	42	14	8	100	7	91		97	70	3	0	0
end: Thorpe Thewles Phase IV	59	36	31	19	10	6	2	2	0	0	91	0	22	3		11	0	0	0
transition: TT open>cattle enclosure	97	91	86	78	59	50	28	23	3	2	100	3	74	30	89		0	0	0
transition: TT enclosed>open	100	100	100	100	100	100	100	99	92	77	100	50	100	97	100	100		0	0
start: Thorpe Thewles enclosed	100	100	100	100	100	100	100	100	100	100	100	99	100	100	100	100	100		5
start: Thorpe Thewles	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	

Figure 4.6.2: Order matrix between modelled probabilities of events identified at Stanwick, Kilton Thorpe Lane, Street House Farm, and Thorpe Thewles. The probabilities are derived from the models presented in the sections above

Lane. They do, however, lie along a line that is perpendicular to the Roman northward advance through Britain, and it is here that the data become very interesting. With the exception of Street House Farm, the other three settlements were almost certainly depopulated at or by the time the Roman army was crossing the Tees in AD 70. While the model gives a 0% probability that *end: Street House Farm* is earlier than AD 70, it calculates that there is a 94% probability that *end: Stanwick*, a 98% probability that *end: Kilton Thorpe Lane*, and a 100% probability that *transition: Thorpe Thewles open>cattle enclosure* all occur prior to AD 70.

The settlement at Thorpe Thewles ceased *30–120 years* before AD 70 (*95% probability*; =AD 70 – *transition: Thorpe Thewles open>cattle enclosure*) and probably *70–115 years* (*68% probability*), although it continued being used for stock enclosure. Similarly, activity at Kilton Thorpe Lane ended *15–110 years* before AD 70 (*95% probability*; = AD 70 – *end: Kilton Thorpe Lane*) and probably *50–95 years* (*68% probability*). Stanwick, on the other hand, appears perhaps to have been inhabited right up to the moment of the Roman incursion to the area and abandoned no more than *50 years* before AD 70 (*95% probability*; =AD 70 – *end: Stanwick*) and perhaps *15–40 years* (*68% probability*). The sheer quantity of closely datable Roman deposits in the final phases does suggest that the occupation probably stretched into the AD 50s if not AD 60s.

It is unfortunate that there was not more suitable material from secure contexts, from both Street House Farm and Thorpe Thewles, so that developments within the enclosed phases could be investigated in greater detail. The modelling at Stanwick has shown that although a settlement has a great deal of complexity and vertical stratigraphy it can span a shorter period of time than many would imagine, although much longer than the *c.* 25 years proposed by Wheeler (1954). The tempo of change within later Iron Age settlements is dealt with in more detail in Chapter 8.

CHAPTER 5: CHEVIOT HILLS (SITE RESULTS)

5.1.1 Geography

The Cheviot Hills lie to the west of the Northumberland coastal plain and south of Scotland's Southern Uplands. The steep but smooth and rounded Cheviot Hills, most of which rise above 400m OD and can reach over 800m OD, stand in sharp contrast to both the coastal plain and the rolling Southern Uplands. The Cheviots are not just different in physical appearance but also their underlying geology which is composed almost completely of igneous rock (granite and andesite) surrounded by carboniferous limestone, rather than the sandstone, mudstone, and limestones that make up much of the remaining areas in this study.

5.1.2 History of research

The Cheviot Hills have been a region of active research for over 70 years. The earliest recorded excavation took place at the Iron Age and Romano-British settlement of Greave's Ash, in the Upper Breamish Valley near Linhope (Tate 1863). A. H. A. Hogg (1942; 1956) undertook a series of excavations at the Iron Age settlement on Ingram Hill. George Jobey spent much of his career writing to great lengths from data collected surveying across Co. Durham, Northumberland, the Borders and into the Cheviots (1962b; 1962a; 1964; 1965; 1966b; 1966a; 1983a; 1985). He also excavated such sites as the Iron Age hilltop settlement at Ingram Hill and at Brough Law (1971), and the unenclosed Bronze Age settlement at Standropp Rigg (1983b). More recent research has been undertaken by the Royal Commission on the Historical Monuments of England (RCHME) with their South-East Cheviot Survey that combined aerial photography and ground survey to record sites across the landscape including settlements, burial cairns, and early field systems (Frodsham and Waddington 2004).

Quite a large amount of landscape-based research has been carried out in the past 20 years in and around the Cheviot massif. The aerial photography of Tim Gates (1983; 2004) has been critical in identifying sites in the hills. Work by English Heritage as part of the Discovering Our Hillfort Heritage project (Oswald et al. 2006; 2008) has opened up our understanding of this specific monument type in the Northumberland National Park. The Breamish Valley Archaeology Project, much of which is summarized by Frodsham and Waddington (2004), has been invaluable in understanding later prehistoric settlement in the region, and in providing two of the excavated sites presented in this thesis.

5.1.3 Iron Age settlement in the region

The Cheviot Hills were settled heavily throughout the 1st millennium BC. Cunliffe (2005, 320) puts the number of hillforts in the region between the Tyne and Forth at over 1000, while also raising the question of the use of the term "hillfort" in this region as most are less than 1.2ha and should more likely be characterized as palisaded or ramparted homesteads. While the area is well-known for the visible earthworks of these 'fortified' hilltop settlements, there are also settlements on the hill slopes and in the well-watered river valleys (Topping 1999).

This landscape that was once thought to have been the domain of shepherds – or Piggott's "Celtic Cowboys" (1958) – is now known to have been under arable cultivation throughout the later Bronze Age and the pre-Roman and Roman Iron Age. The naked hills we see today devoid of trees are probably the result of ongoing cultivation on the hills since the later prehistoric field systems, attested to through archaeological excavation, were constructed. Pollen evidence shows that the area saw decreases in forest cover throughout this period and Tipping (1997) has suggested that in the later Bronze Age and the Iron Age this was likely to have been intermittent in areas across the landscape with the widespread deforested hills we see today largely the result of 18th century farming practice.

5.1.4 Site selection

Three sites were selected to represent the Cheviot Hills region in this project (Fig. 5.1). All three sites lie in a roughly straight line (approximately 2km in length) that runs from the top of Wether Hill north-east and down the hill toward Ingram following between the courses of Fawdon Dean and Middledean Burn. The sites include Wether Hill hillfort, the twin enclosures (both curvilinear and rectilinear) of Fawdon Dean, and the double-ditched enclosure of Ingram South. The three sites are separated at approximately 1km intervals.

These three sites had all had some ^{14}C dates made and the result showed them all to date to between the latter half of the 1st millennium cal BC and the 2nd century cal AD. They provide a unique opportunity to investigate the timing of changing settlement types in a very small area, while also providing a glimpse at the possible contemporaneity of these different settlement types.

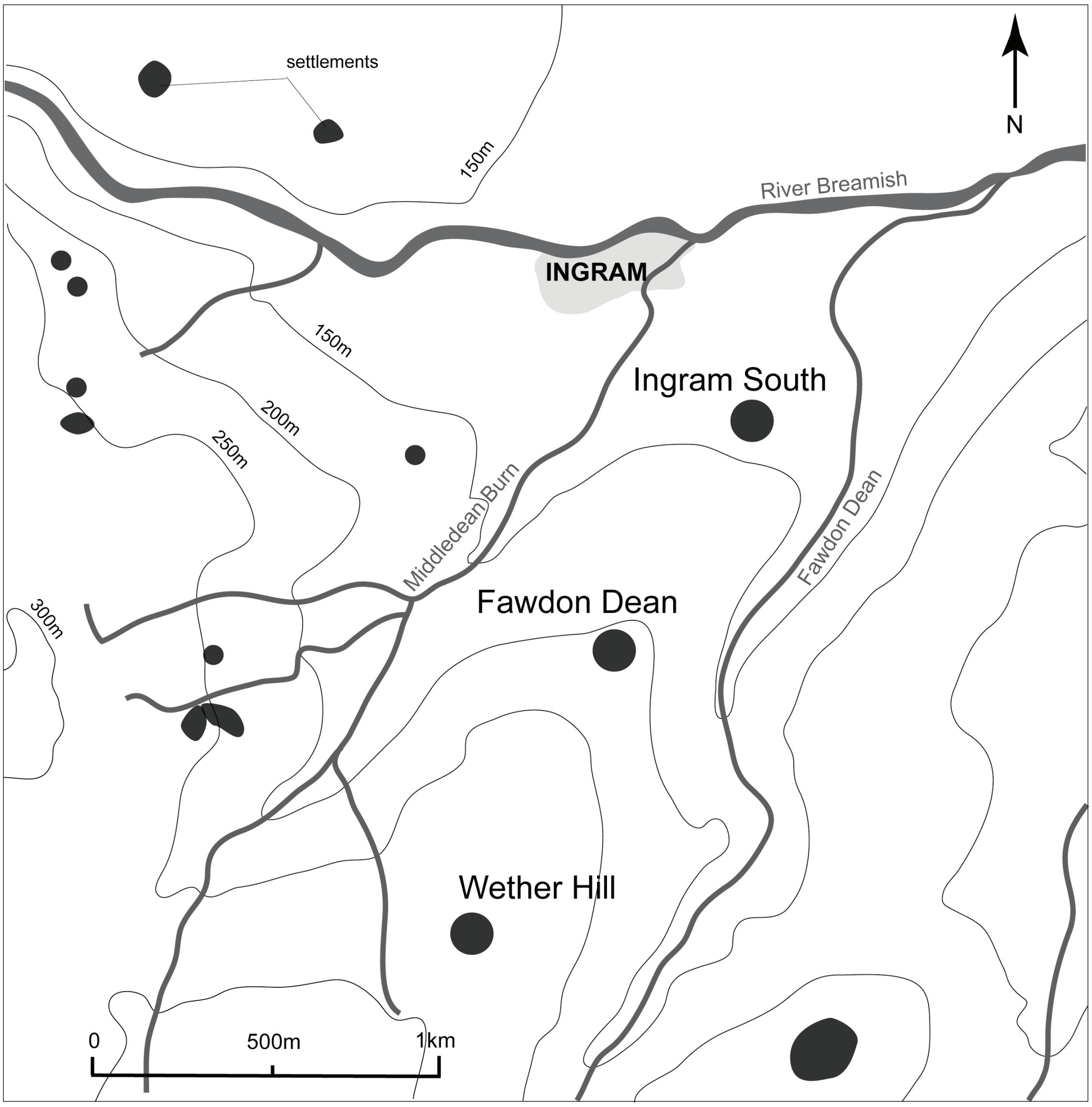

Figure 5.1: Map of the location of the three dated and modelled sites in the Cheviot Hills. The elevation contours, rivers, and location of other settlements derived from the Ordnance Survey mapping for the area are also shown

5.2 Fawdon Dean

5.2.1 Site description

Fawdon Dean (NU 017 152) is the site of two overlapping enclosures in Northumberland National Park (Fig. 5.2.1). The site lies near Ingram on a plateau to the northeast of Wether Hill, and was excavated in 2000–2 by members of the Northumberland National Park Authority, Northumberland Archaeological Group and Archaeological Services Durham University.

Two main phases of activity were identified within the main area of excavation (Area 1). The initial phase is a curvilinear enclosure (Enclosure 1) within which three circular structures (CS 1–3) were excavated (Fig. 5.2.2).

CS 1 Phase 1 is a timber structure that was replaced in timber by CS 1 Phase 2, which was rebuilt after the ground surface was remodelled through scooping the bedrock and

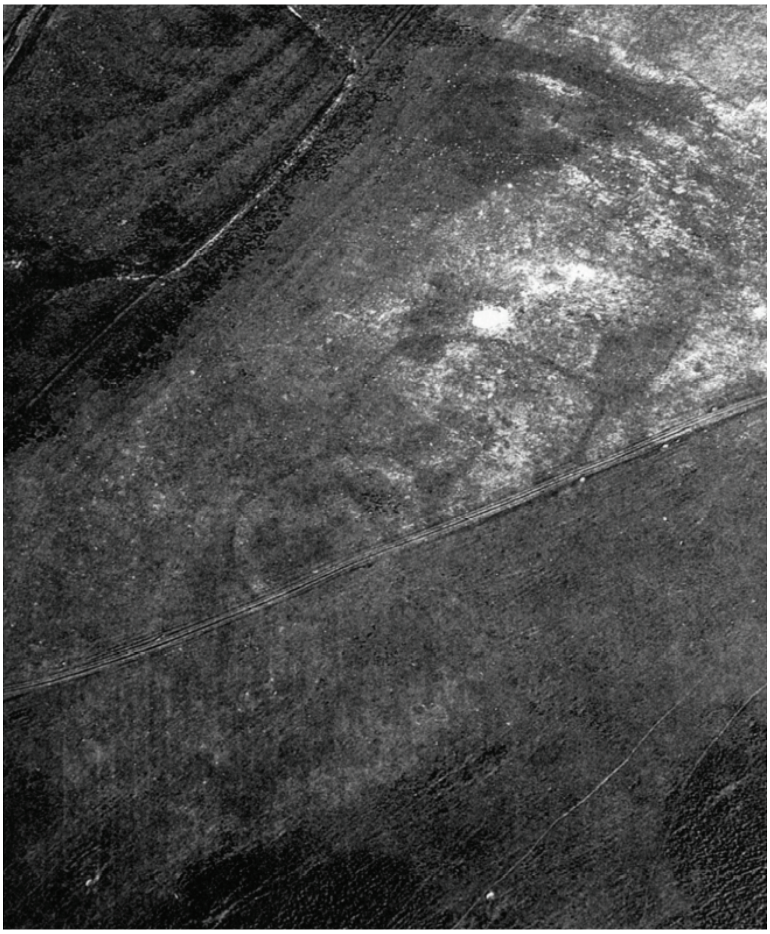

Figure 5.2.1: Aerial photograph of Fawdon Dean enclosures (fig. 3, ASUD 2001)

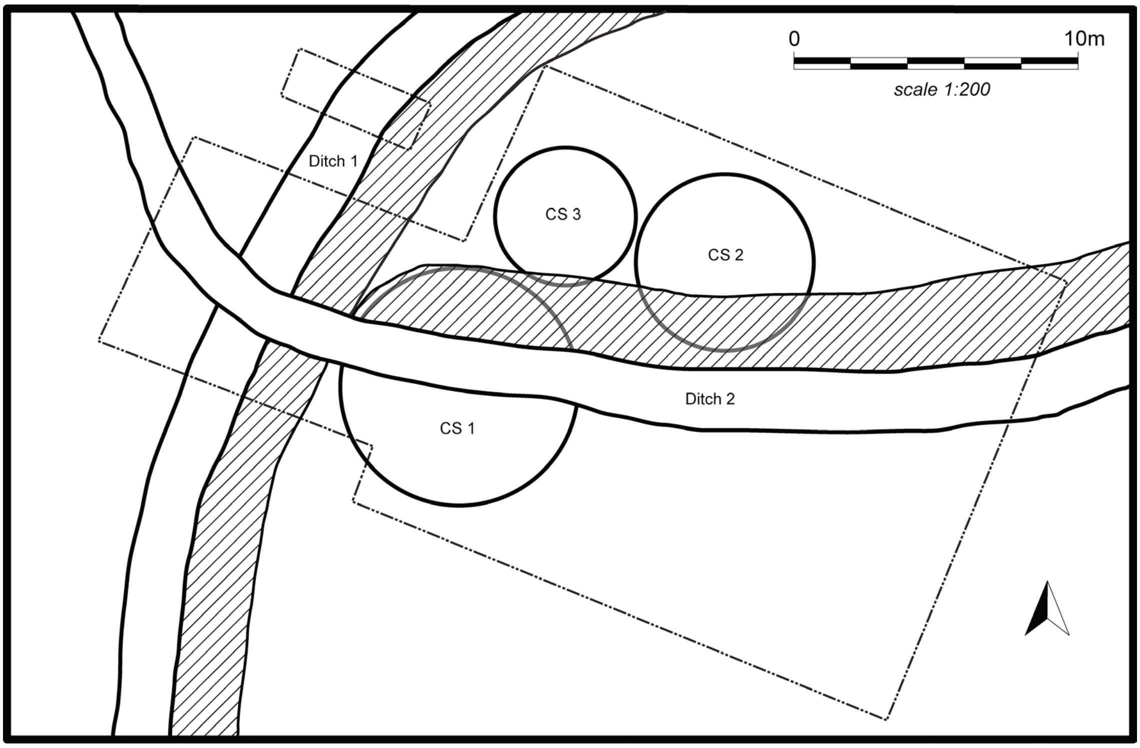

Figure 5.2.2: Site plan showing location of excavated ditches and structures of the Fawdon Dean enclosures (after ASUD 2002, fig. 4)

constructing a level platform. This earliest phase of CS 1, constructed prior to the scooping, is thought to possibly predate Enclosure 1. CS 1 Phase 3 is a final rebuild in stone that took place after the previous structure was burned.

CS 2 had two phases identified with the first being a timber-built structure in a scoop and the second being a structure built of stone. Curiously, the CS 2 Phase 2 deposits indicate a thin black layer of burned debris, perhaps associated with destruction, but of an earlier stone structure. It also appears that the building may have been burned in the end as it was filled with a black silty deposit above the flagging and compacted occupation debris.

CS 3 is the smallest of the three and appears to have been built in stone, with a single rebuild episode identified.

The ditch of Enclosure 1 was deliberately back-filled with the bank deposits prior to the construction of Enclosure 2, which was rectilinear in form. Enclosure 2 cuts directly through CS 1 and its bank overlies approximately a third of CS 2. It is possible that CS 3 was rebuilt at this time, having its roofline adjusted to accommodate the encroaching bank. Evidence for a fourth circular structure was identified through the vestiges of paving and a post hole/pit in a second, smaller trench (Area 2), and is spatially associated within Enclosure 2. Enclosure 2 appeared to have been deliberately back-filled as well.

The majority of pottery recovered from Fawdon Dean consisted of the generically typical Iron Age fabric and vessel form dating to *c.* 700 BC–AD 200 and with parallels at sites such as Thorpe Thewles and Stanwick. However, the excavations in 2002 did recover some sherds from a Roman vessel (dated *c.* AD 40–125) in an area of animal burrow disturbance through the Enclosure 2 bank and thought to date to the time, or just before, of its construction (ASUD 2002, 21–30).

More detailed information about the site and the excavation is provided by the interim reports (ASUD 2001; 2002).

5.2.2 Sample specifics

A total of 24 samples of charcoal and/or carbonized grain were submitted for radiocarbon dating from 21 discrete contexts, including fills of pits and post holes, layers in ditches, and occupation layers associated with structural remains.

5.2.3 Model description

The model sequence (Fig. 5.2.3) begins with a radiocarbon result (AA-40753) on willow charcoal recovered from a soil layer (120) sealed beneath the wall of Circular Structure (CS) 1. This is followed by a result (SUERC-24282) on *Alnus* sp. roundwood charcoal from the fill of a gully (171) associated with Phase 1 of CS 1. Unfortunately, the result from the gully pre-dates the material from under the wall and so must be residual. It has been excluded from the model. Therefore, *build: CS 1, Phase 2* more accurately reflects the date when CS 1, Phase 2 began as its calculation is a function of material from this next phase of the structure's use.

There are three contexts that are not stratigraphically related from Phase 2 of CS 1. These contexts have a total of three results. AA-54967 is from a bulk sample of charcoal and carbonized grains from the fill (233) of a pit (232), while OxA-20815 is result on a fragment of Poaceae charcoal that was recovered from the fill (239) of a posthole. Both features are sealed beneath the Phase 3 wall. Finally, SUERC-24279 is from a single carbonized *Hordeum* sp. grain in a burned layer (224) that was rich

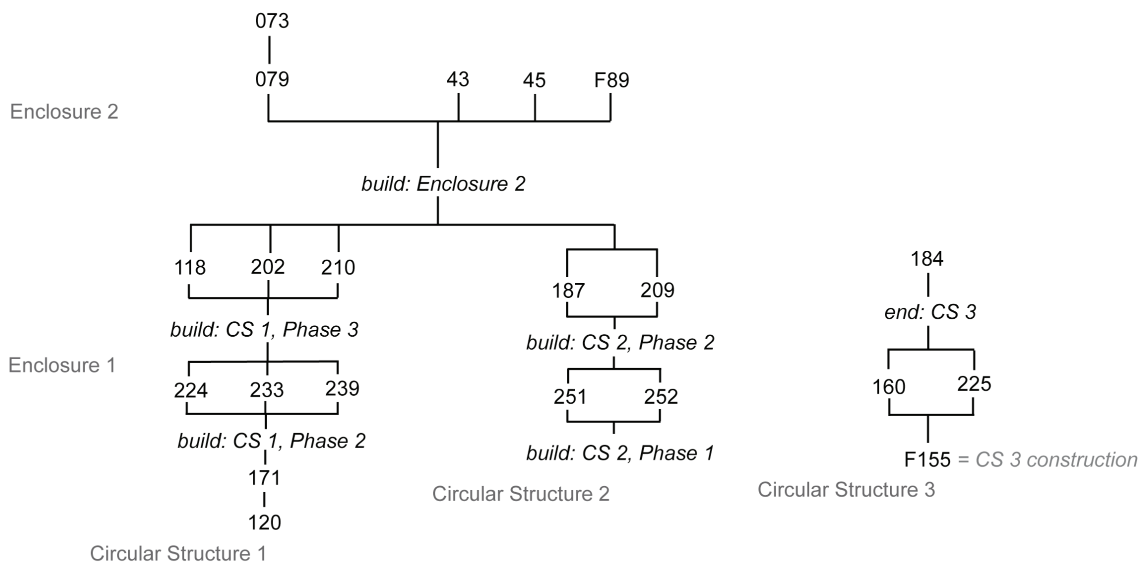

Figure 5.2.3: Site matrix for dated and modelled contexts from Fawdon Dean

with both grain and charcoal and was both over earlier wooden features and under the later stone Phase 3 structure. The dates show good agreement with the stratigraphy and the material is therefore not likely to be residual.

Four results are available from three CS1 Phase 3 contexts that are not stratigraphically related. Two results (OxA-20801 and SUERC-24277) are available from short-lived charcoal recovered from a charcoal-rich deposit (118) that overlies the cobbling. These two results are statistically consistent (T'=2.1; ν=1; T'(5%)=3.8) and could be the same actual age. One result (OxA-20874) is available from a charcoal concentration (202) in the paving slabs at the entrance, probably the result of accidental spillage of hearth debris when moving through the structure's entrance. The fourth result (AA-54965) is on a bulk sample of charcoal and carbonized grains that were in the upper fill (210) of a clay-lined pit in the structure (219). The dates show good agreement with the stratigraphy and the material is therefore not likely to be residual.

A second sequence of radiocarbon dates is available from CS 2, which is unrelated through stratigraphy to CS 1. The sequence begins with three results from two contexts associated with CS 2 Phase 1. AA-54968 is from bulk cereal grains and dock that was recovered from the fill (251) of a pit (250) in the structure platform. Two results (OxA-20814 and SUERC-24278) are available from the fill (252) of a posthole in the structure. OxA-20814 is too early for its stratigraphic position within the site and so is probably residual and has been excluded from the subsequent modelling. The construction date (*build: CS 2)* for Phase 1 of CS 2 has been modelled using the `First` function in OxCal within this group. Two results are available from two contexts associated with Phase 2 of the structure. OxA-20873 is on a fragment of Maloideae that was recovered from (187) that was made up of *in situ* burned material on the floor (156) of the structure. The result is too early given its stratigraphic position and so is probably residual and has been excluded from further modelling. A second result (SUERC-24281) is available from a different context (209) of the burned floor (156) that is in agreement with its stratigraphic position in the model. The construction of the second phase is estimated between CS 2, Phase 1 and CS 2, Phase 2 (*build: CS 2, Phase 2*).

CS 3 is dated by five results from four contexts. Only one result is available from Phase 1, while the remainder come from Phase 2 contexts. AA-54963 is a result on bulked grain, unidentified charcoal, and nut shell that was embedded in the Phase 1 wall during construction. The modelled result has been used as an estimate for the construction of the house. AA-54964 is another bulk date on grain and unidentified charcoal that was recovered from the Phase 2 inner wall and could be the result of both construction and possibly use of the structure. One result (AA-54966) is available on unidentified charcoal and seeds that were embedded in the clay-lining (225) of a pit (216) in the structure. Between these dates and the subsequent abandonment layer (184) the end of the use of CS 3 has been calculated (*end: CS* 3*).* Two results on single fragments of short-life charcoal (OxA-20872 and SUERC-24280) are available from the abandonment layer over the floor of the structure and so are modelled as later than the material in the pit and embedded during wall construction. The two results are not statistically consistent ($T'=7.8$; $\nu=1$; $T'(5\%)=3.8$) with OxA-20872 being too early given its stratigraphy, so that it has been excluded from the subsequent modelling as it is probably residual. The samples that included unidentified charcoal probably do not suffer an old-wood offset as they show good agreement with the other dates and the stratigraphy.

While there is no stratigraphic relationship between CS 1, CS 2, and CS 3, CS 1 and 2 are both earlier than the Enclosure 2 ditch and bank with CS 1 being both cut by the ditch and buried by the bank and CS 2 being slightly overlain by the bank. Five radiocarbon results are available from this period of activity, with four results being related to the use of the structure in Enclosure 2 and a fifth directly related to post Enclosure 1 activity.

One result (AA-40752) is available from a piece of alder charcoal recovered in the basal fill of a pit (89) that cut through the terminus of the then filled in Enclosure 1 ditch. AA-44597 is from a piece of willow charcoal recovered a fill (45) in a pit (46) that is thought to lie within the circumference of the structure in Enclosure 2. AA-44595 is from a piece of hazel charcoal that was recovered from within a fill (43) of a posthole (44) in the structure. Two results make up a sequence of layers in the structure with AA-40755 (hazel charcoal) coming from a layer (079) that is sealed by the wall of the structure and AA-40754 (willow charcoal) from a layer (073) that is sealed by the wall tumble.

5.2.4 Model results

The chronological model for Fawdon Dean shows good agreement (A_{model}=96) given the model properties described above and the radiocarbon dates. The model estimates activity at the site of Fawdon Dean, which focused on settlement in Enclosure 1, began by *130 cal BC–cal AD 10* (*95% probability*; Fig. 5.2.4; *start: Fawdon Dean*) and probably by *85–20 cal BC* (*68% probability*). Enclosure 2 was constructed in the late 1st or early 2nd century AD, in *cal AD 70–145* (*95% probability*; Fig. 5.2.4; *build: Enclosure 2, Fawdon Dean*) and probably in *cal AD 85–125* (*68% probability*). The dated activity at Fawdon Dean ended in *cal AD 130–265* (*95% probability*; Fig. 5.2.4; *end: Fawdon Dean, Northumberland*) and probably in *cal AD 140–195* (*68% probability*).

Although it is not possible to calculate the date for the initial construction of CS 1, the model is able to provide estimates for many of the construction phases of the circular structure.

CS 1, Phase 2 was constructed in *80 cal BC–cal AD 30* (*95% probability*; Fig. 5.2.4; *build: CS 1, Phase 2*) and probably in *50 cal BC–cal AD 5* (*68% probability*). The third phase of CS 1 was constructed in *10 cal BC–cal AD* 70 (*95% probability*; Fig. 5.2.4; *build: CS 1, Phase 3*) and probably in *cal AD 15–55* (*68% probability*).

CS 2 was constructed in *70 cal BC–cal AD 50* (*95% probability*; Fig. 5.2.4; *build: CS 2, Phase 1*) and probably in *45 cal BC–cal AD 10* (*68% probability*). The second phase

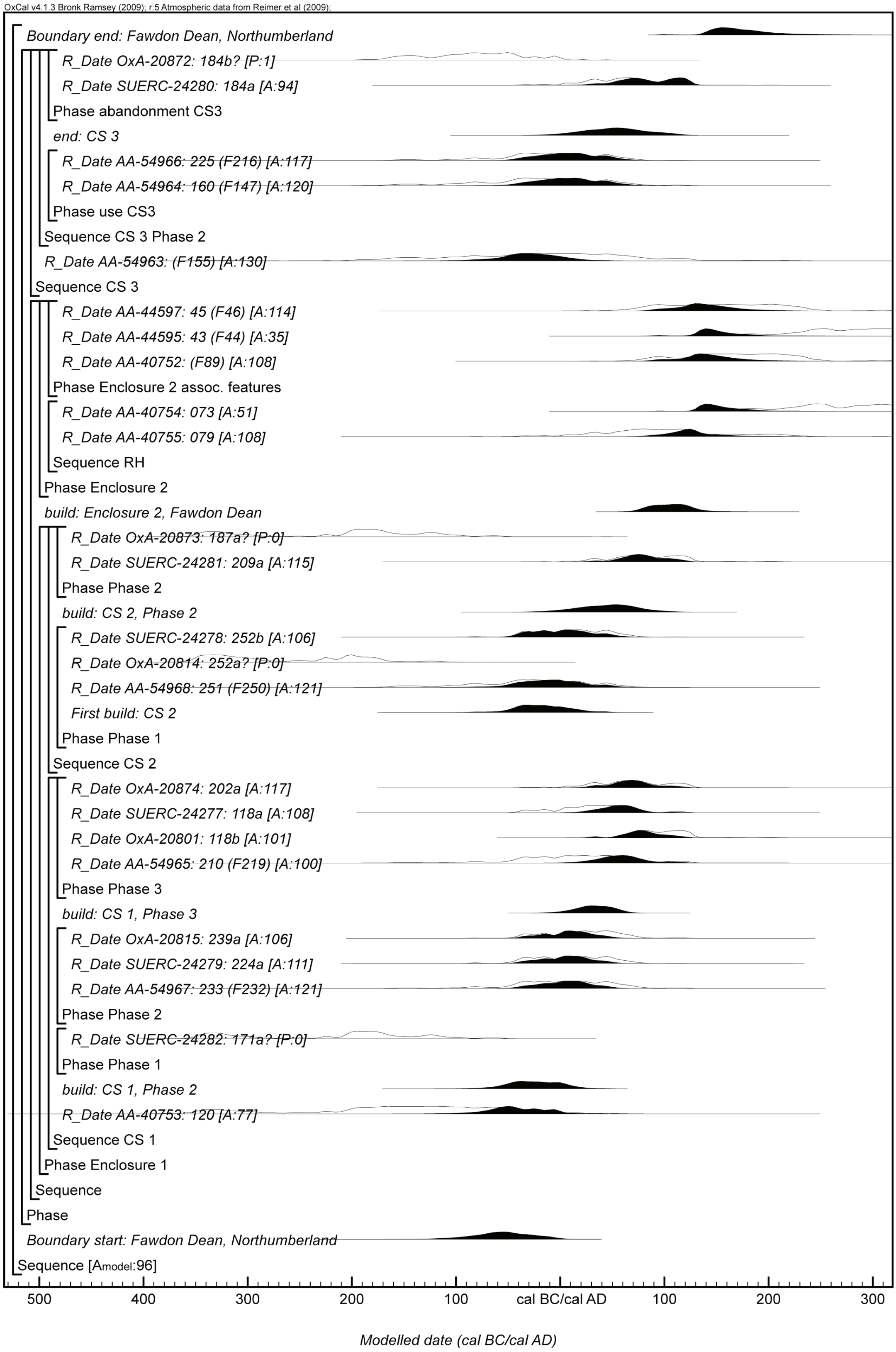

Figure 5.2.4: Chronological model for Fawdon Dean. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

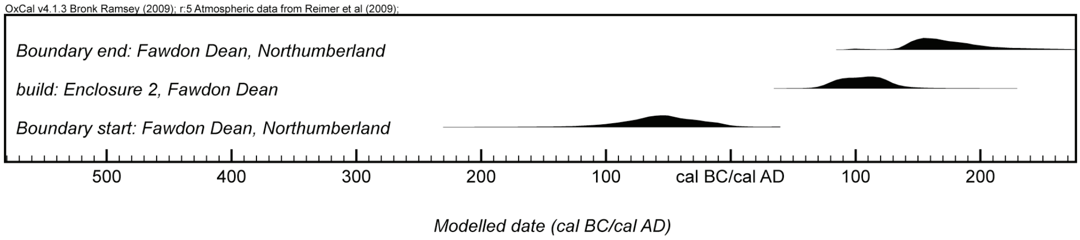

Figure 5.2.5: Probability distributions for the overall site start and end dates and the construction of Enclosure 2 at Fawdon Dean. The probabilities have been isolated from the model shown in Figure 5.2.4

was constructed in *15 cal BC–cal AD 105* (*95% probability*; Fig. 5.2.4; *build: CS 2, Phase 2*) and probably in *cal AD 20–80* (*68% probability*).

The construction of CS 3 as estimated from the modelled result of AA-54963: (F155) is *95 cal BC–cal AD 30* (*95% probability*; Fig. 5.2.4; *AA-54963: (F155)*) and probably in *55 cal BC–cal AD 5* (*68% probability*). The abandonment of CS 3 took place in *10 cal BC–cal AD 115* (*95% probability*; Fig. 5.2.4; *end: CS 3*) and probably in *cal AD 20–85* (*68% probability*).

It is possible to estimate the span of the dated activity associated with both the circular structures and the enclosures.

Calculating the difference between the probability for *start: Fawdon Dean, Northumberland* and *build: Enclosure 2* gives a span for the use of Enclosure 1. This activity spanned *85–250 years* (*95% probability*; Fig. 5.2.6; *span: Enclosure 1*) and probably for *120–200 years* (*68% probability*).

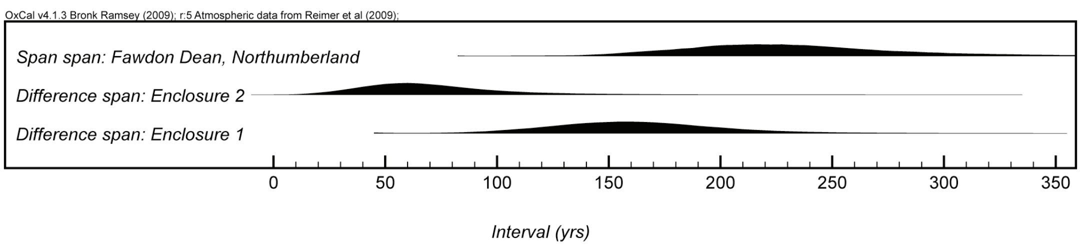

Figure 5.2.6: Probability distributions for span of the two enclosure phases at Fawdon Dean and the overall use of the site as derived from the chronological model shown in Figure 5.2.4

The span for activity associated with Enclosure 2 is similarly calculated by the difference between the probabilities for *build: Enclosure 2* and *end: Fawdon Dean, Northumberland*. This later activity lasted for *15–140 years* (*95% probability*; Fig. 5.2.6; *span: Enclosure 2*) and probably for *30–90 years* (*68% probability*).

The overall span of activity on site is estimated at *135–360 years* (*95% probability* ; Fig. 5.2.6; *span: Fawdon Dean, Northumberland*) and probably *175–270 years* (*68% probability*).

Span	**Equation**	***95% probability (years)***	***68% probability (years)***	***median***
CS 1, Phase 2	*build: CS 1, Phase 3 – build: CS 1, Phase 2*	*10–110*	*25–80*	*55*
CS 1, Phase 3	*build: Enclosure 2 – build: CS 1, Phase 3*	*20–125*	*45–100*	*73*
CS 2, Phase 1	*build: CS 2, Phase 2 – build: CS 2, Phase 1*	*5–125*	*20–90*	*60*
CS 2, Phase 2	*build: Enclosure 2 – build: CS 2, Phase 2*	*5–125*	*20–90*	*58*
CS 3 (2 phases)	*end: CS 3 – AA-54963: (F155)*	*15–155*	*35–115*	*78*

Table 5.2.1: Calculated spans for the phases of the circular structures. The median measurement for each posterior density estimate is also provided

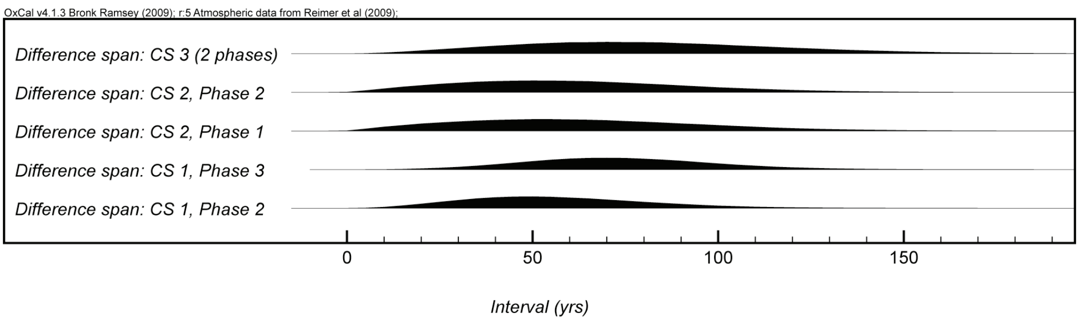

Figure 5.2.7: Probability distributions for spans of the various circular structure phases at Fawdon Dean as derived from the chronological model shown in Figure 5.2.4 and given in the table above

5.2.5 Alternative Fawdon Dean model

While the modelling above based upon the identified stratigraphic relationships between samples has placed the construction of the three circular structures at Fawdon Dean in the last half of the first century cal BC, the structural sequences for CS 1 and 2 witness transitions from timber-built to stone-built. For CS 1 that transition is probably *cal AD 15–55* (*build: CS1, Phase 3*; *68% probability*) and for CS 2 it is *cal AD 20–80* (*build: CS 2, Phase 2*; *68% probability*). Given the evidence that CS 1 and 2 were both burned prior to the construction of the stone-built structures, it seems likely that all three structures in stone are of the same archaeological horizon. However, the probabilities for the construction of the stone-built phases of CS 1 and 2 are nearly 100 years later than the estimated construction of CS 3, which was stone-built for each phase. This raises the possibility that the material dated from the wall matrix of CS 3 (AA-54963) is residual.

Given the archaeological evidence of burning for the timber-built structures on the site and that the stone-built structures are constructed in the same location, it seems extremely plausible that this stone-built phase was a single, planned build. A model that includes the proposal that *build: CS 1, Phase 3*, *build: CS 2, Phase 2*, and *build: CS 3* were all contemporary was constructed (Fig. 5.2.8).

This model has good agreement (A_{model}=80%). The model estimates activity at the site of Fawdon Dean began by *105 cal BC–cal AD 15* (*95% probability*; Fig. 5.2.9; *start: Fawdon Dean*) and probably by *65–5 cal BC* (*68% probability*). Enclosure 2 was constructed in the 1st or 2nd centuries AD, in *cal AD 65–135* (*95% probability*; Fig. 5.2.9; *build: Enclosure 2, Fawdon Dean*) and probably in *cal AD 80–120* (*68% probability*). The dated activity at Fawdon Dean ended in *cal AD 125–230* (*95% probability*; Fig. 5.2.9; *end: Fawdon Dean, Northumberland*) and probably in *cal AD 135–180* (*68% probability*).

CS 1, Phase 2 was constructed in *65 cal BC–cal AD 30* (*95% probability*; Fig. 5.2.9; *build: CS 1, Phase 2*) and probably in *45 cal BC–cal AD 10* (*68% probability*). CS 2 was constructed in *60 cal BC–cal AD 35* (*95% probability*; Fig. 5.2.9; *build: CS 2, Phase 1*) and probably in *40 cal BC–cal AD 10* (*68% probability*).

The stone-built roundhouse phase began in *10 cal BC–cal AD 60* (*95% probability*; Fig 5.2.9; *build: stone Roundhouses*) and probably in *cal AD 10–45* (*68% probability*). The

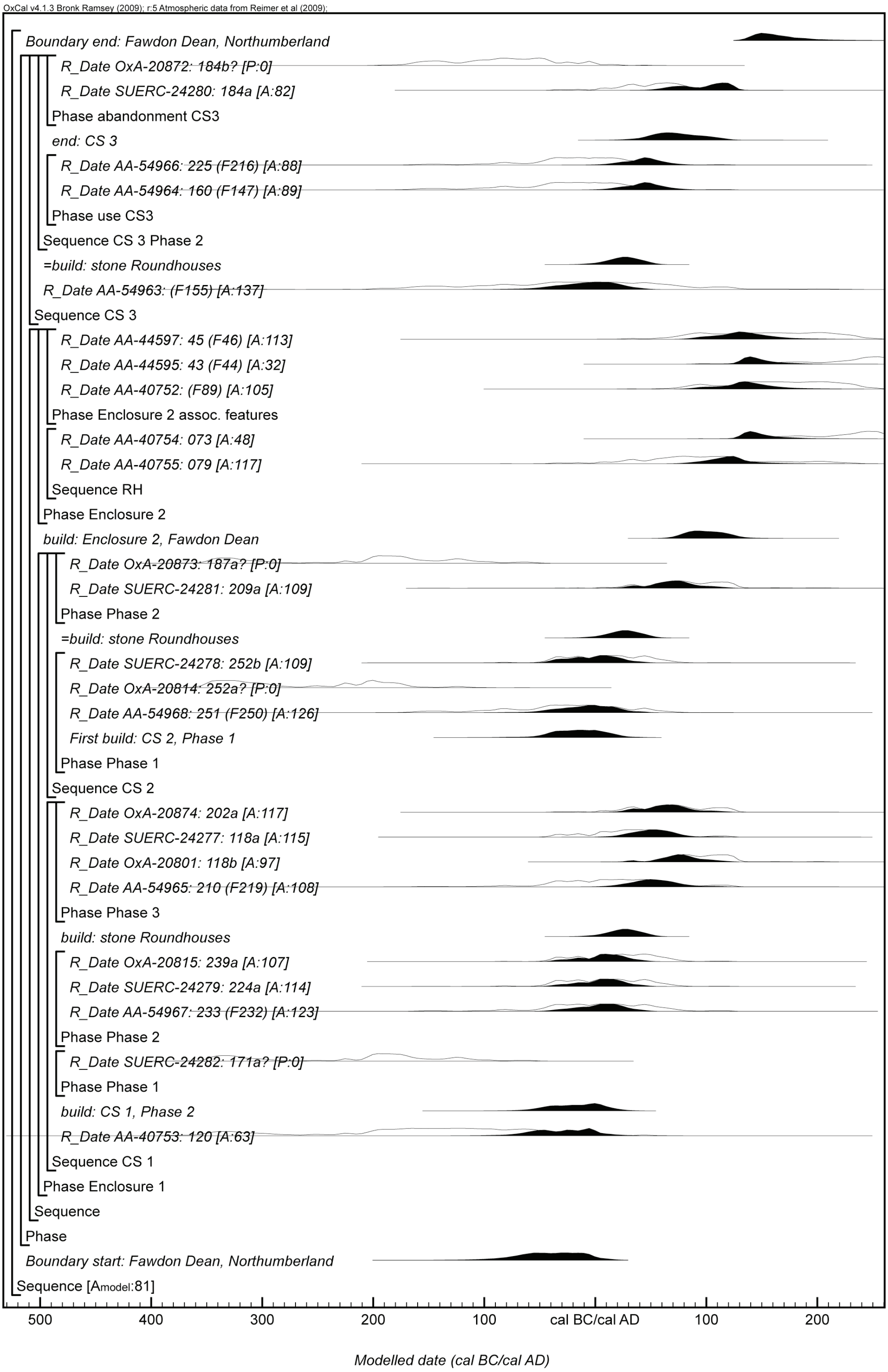

Figure 5.2.8: Alternative chronological model for Fawdon Dean. The model structure is defined by the brackets and the keywords. The format is as described in Figure 4.2.3

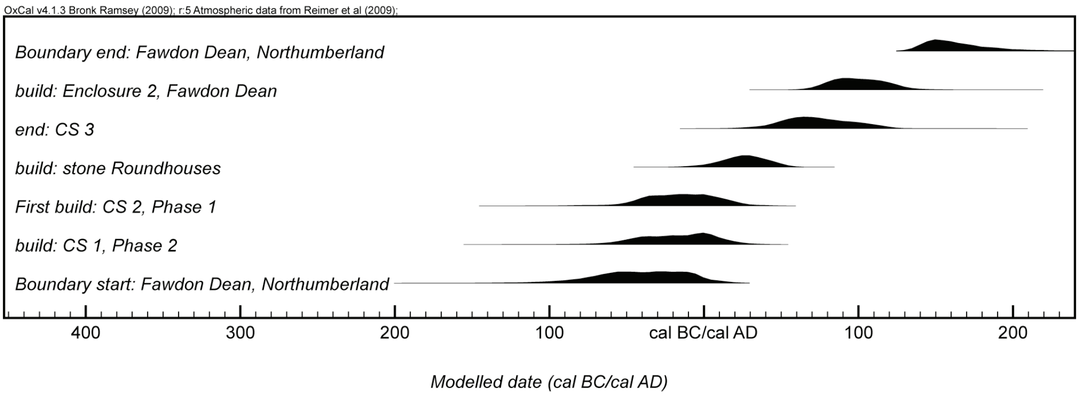

Figure 5.2.9: Probability distributions for the overall site start and end dates and the construction of Enclosure 2 at Fawdon Dean. The probabilities have been isolated from the alternative chronological model shown in Figure 5.2.8

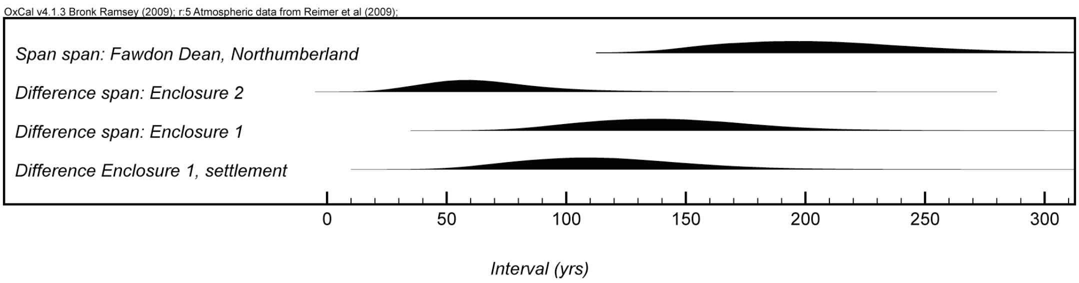

Figure 5.2.10: Probability distributions for span of the two enclosure phases at Fawdon Dean and the overall use of the site as derived from the alternative chronological model shown in Figure 5.2.8

abandonment layer of CS 3 provides an estimate that it went out of use in *cal AD 30–120* (*95% probability*; Fig. 5.2.9; *end: CS 3*) and probably in *cal AD 50–95* (*68% probability*).

Using the same calculations presented above for estimating the span of use for the two enclosures, the span for activity associated with Enclosure 1 was *70–215 years* (*95% probability*; Fig. 5.2.10; *span: Enclosure 1*) and probably for *100–175 years* (*68% probability*). If the stone structures all go out of use at the same time, however, then it is more reasonable to use the probability for the abandonment of CS 3 for calculating the span of Enclosure 1 settlement activity. In this case, Enclosure 1 was in use for *50–190 years* (*95% probability*; Fig. 5.2.10; *span: Enclosure 1, settlement*) and probably for *75–145 years* (*68% probability*). The span for Enclosure 2 was *20–125 years* (*95% probability*; Fig. 5.2.10; *span: Enclosure 2*) and probably for *35–85 years* (*68% probability*).

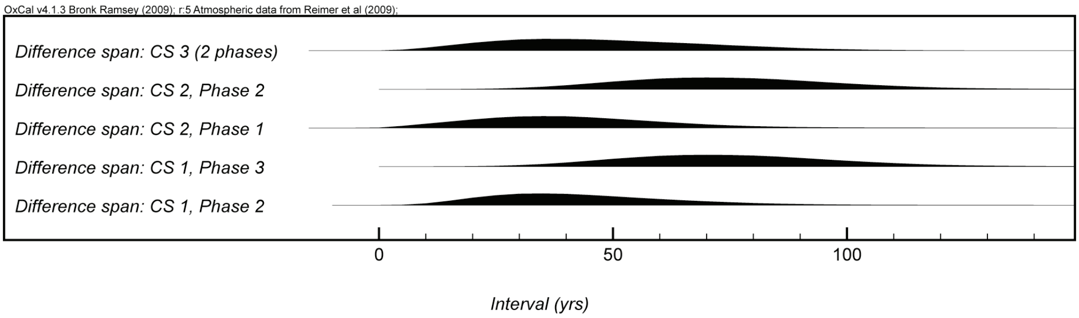

Figure 5.2.11: Probability distributions for spans of the various circular structure phases at Fawdon Dean as derived from the alternative chronological model shown in Figure 5.2.8 and given in the table below

The overall span of activity on site is estimated at *125–310 years* (*95% probability* ; Fig. 5.2.10; *span: Fawdon Dean, Northumberland*) and probably *150–240 years* (*68% probability*).

This alternative model also has impact on the overall span of use for the roundhouse phases, given in Table 5.2.2 below.

Span	**Equation**	***95% probability (years)***	***68% probability (years)***	***median***
CS 1, Phase 2	*build: CS 1, Phase 2 – build: stone Roundhouses*	*10–85*	*20–60*	*41*
CS 1, Phase 3	*build: Enclosure 2 – build: stone Roundhouses*	*30–125*	*45–95*	*74*
CS 2, Phase 1	*build: stone Roundhouses – build: CS 2, Phase 1*	*1–80*	*15–60*	*39*
CS 2, Phase 2	*build: Enclosure 2 – build: stone Roundhouses*	*30–125*	*45–95*	*74*
CS 3 (2 phases)	*end: CS 3 – build: stone Roundhouses*	*5–95*	*20–65*	*46*

Table 5.2.2: Calculated spans for the phases of the circular structures based upon the alternative model for Fawdon Dean. The median measurement for each posterior density estimate is also provided

While it is possible that the stone-built CS 3 was an ancillary building to the timber-built phases of CS 1 and 2, it seems unlikely. Firstly, the evidence for burning relates only to CS 1 and 2, which implies that CS 3 was not constructed at that time. Secondly, it seems unlikely that the two larger structures would be built in timber and the smaller structure nestled between would be built of stone, and then that same smaller structure be in disuse when the other structures are rebuilt in stone. The archaeological argument that the stone-built settlement is a unified build, as described in this alternative model is preferred for these reasons and is used in all further discussion.

5.3 Ingram South

5.3.1 Site description

Ingram South (NU 021 159) is a double rectilinear enclosure situated on a flat terrace above Ingram in Northumberland National Park (Fig. 5.3.1). The site lies to the northeast of Wether Hill and Fawdon Dean and was excavated in 2003 and 2004 by members of the Northumberland National Park Authority, Northumberland Archaeological Group and Archaeological Services Durham University.

Ingram South is a multi-phased site (Fig. 5.3.2). The earliest enclosure, the remains of which is not much more than a linear gully, is thought to date to the 4th century BC, but this rests on a single radiocarbon result on a single fragment of cf. Alder charcoal (SUERC-2410) from a fragmentary section of ditch or gully. This enclosure was replaced by a second ditch (Enclosure 1) perhaps in the 1st century BC, Enclosure 1 was fragmentary but rectilinear in form, and at roughly the same location as the first gully. This enclosure has associated cobbling and timber structures. One structure, constructed of wattle and daub and associated with this phase, has three identified phases.

Figure 5.3.1: Aerial photograph of Ingram South enclosures (fig. 2, ASUD 2005, © Tim Gates)

Enclosure 1 was eventually replaced by much more substantial rectilinear double-ditched and secondary single-ditched enclosures, perhaps in the 1st century AD. There are occupation features (e.g. pits, post holes and a section of probable wall slot) thought to be associated with this phase. Although it is clear through excavation that the inner ditch is earlier than the outer ditch or ancillary enclosure, it is not possible to demonstrate any further chronological separation. There was no evidence to suggest the ditches had been recut at any time.

Very little was recovered in the way of cultural artefacts from the site, a few sherds of pottery and a possible hoard of a few knives. A dark blue glass bead and pale blue translucent annular glass bead of Roman date were found. A silver *denarius* was recovered from (440) outside of the enclosure. The coin is of Vespasian mint (AD 72–3) and well-worn. The specific type is known to circulate into the 3rd century AD. The wear on the coin is similar to those found along Hadrian's Wall and so it was probably deposited at least 50 years after minting.

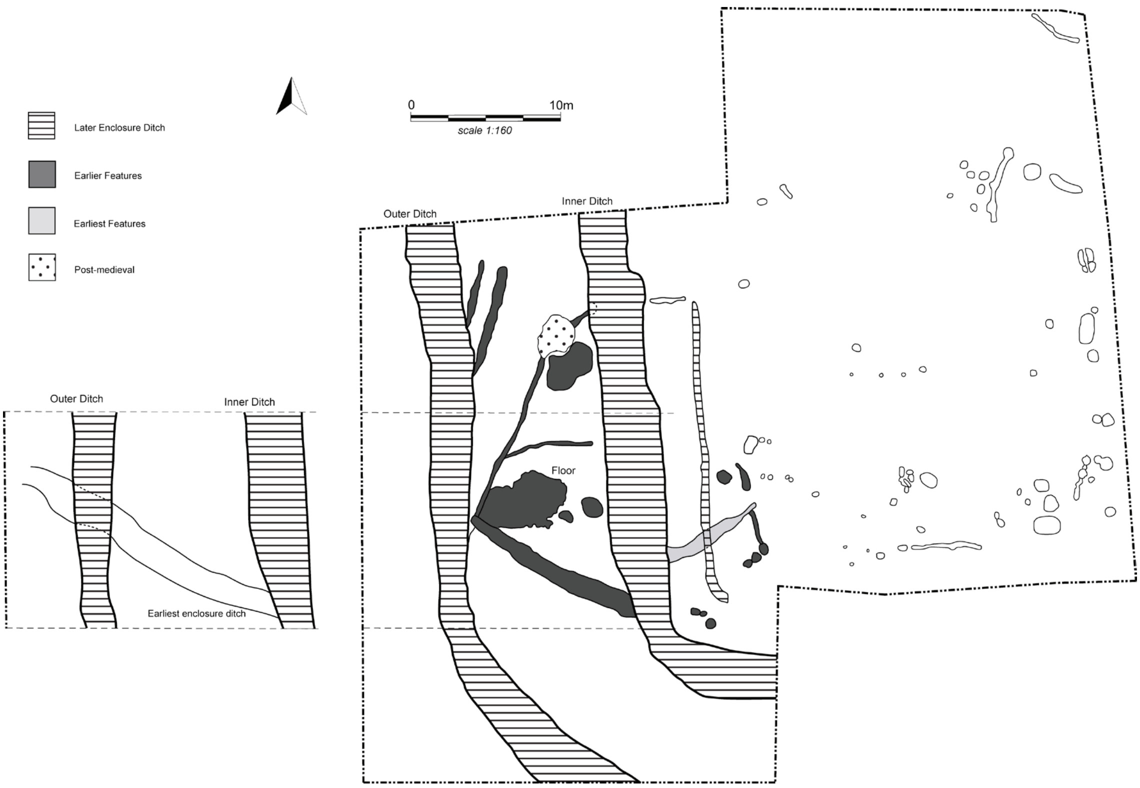

Figure 5.3.2: Plan of the Area 1 excavation (after ASUD 2005, fig. 4)

More detailed information about the site and the excavation is provided in the interim report (ASUD 2005).

5.3.2 Sample specifics

A total of 27 samples of charcoal and/or carbonized grain were submitted for radiocarbon dating from 20 discrete contexts, including fills of pits and post holes, layers in ditches, and occupation layers associated with structural remains.

5.3.3 Model description

Area 1 of the Ingram South excavations (SW corner) contained nearly all of the contexts which could be related by stratigraphy. For that reason, it was subjected to the bulk of the radiocarbon dating (Fig. 5.3.3).

In this area two very early enclosure gullies were excavated. A single fragment of cf. Alder sp. charcoal was submitted from fill (177) of gully F176 and the result (SUERC-2410; 2305 ±40BP) was substantially (~300 ^{14}C years) earlier than all other material dated from the site. The charcoal dated may have been residual in its context, but it is also possible that the feature is considerably earlier than the activity that has been the subject of the remaining dating. In either case, this result has been excluded from the modelling.

These earliest gullies were followed by Enclosure 1, which is associated with clay and cobbled flooring. A total of four contexts were dated from the pre-floor levels and the clay floor itself. One result (SUERC-4497) is available on bulked seeds and roundwood charcoal from a fill (544) of a gully under the floor. Two results (OxA-20803 and SUERC-24270) are available on single carbonized seeds that were recovered from the primary fill (431) of a pit F430 that is overlain by the clay floor and cut by the Phase 3 enclosure. Two results (Beta-182413 and -184070) are available on a charred piece of nut shell and a second unidentified piece of organic material from a layer (301) under the clay floor F19. Beta-182413 and -184070 are too recent and too old, respectively, for their stratigraphic position. Given that one is a nutshell and so durable enough to be transported around the site intact and the other is unidentified, both results have been excluded from the modelling as they are likely residual and intrusive, respectively. Three results (OxA-20816, -21849, and SUERC-26469) are available from material recovered in the matrix (143) of the clay floor, material thought to have

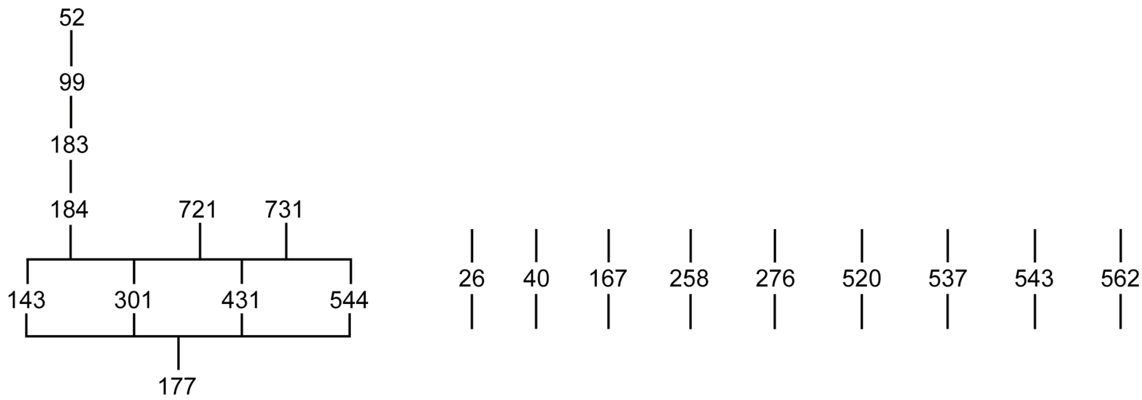

Figure 5.3.3: Site matrix for the dated and modelled contexts from Ingram South

become incorporated over time as debris trampled into the matrix. OxA-21849 was on a piece of *Alnus* sp. roundwood and is too early for its context, while the other two results are on carbonized seeds. Charcoal is more robust than the seeds and could be residual in the floor matrix from the construction. As such the charcoal result has been included as a *terminus post quem* in the model.

Enclosure 1 is followed by the Phase 3 double- and single-ditched enclosures. One result (SUERC-2405) is available on 25 barley grains from the lower fill (184) of the Inner Ditch F96. This is overlain by fill (183) from which two results (OxA-20817 and SUERC-24271) are available on single carbonized grains of *Hordeum* sp. This fill is overlain by (99) from which two more results (OxA-20802 and SUERC-24272) on single grains of *Hordeum* sp. are available. The sequence is finally capped by a single result (Beta-105609) on bulked barley grain from fill (52) of a late recut of the Inner Ditch.

The single-ditched enclosure was excavated in Area 2 (not shown in plan). One result (SUERC-4502) is available from a charcoal deposit (721) in the butt end of the ditch and a second (SUERC-4503) from a middle fill (731). Both samples were of unidentified bulk charcoal and have been included, providing a *terminus post quem* for their respective contexts. The two contexts are stratigraphically unrelated to one another.

Further radiocarbon results are available from nine unstratified features within the enclosures. There are two results (OxA-20945 and SUERC-24276) on single barley grains from the fill (40) of a large pit F39 within the bounds of the Phase 3 rectilinear enclosure. There are four results from fills of post holes and post pipes: SUERC-2404 is on 25 barley grains from a fill (276) in a post hole F275; SUERC-2406 is on five grains in a fill (258) in a second post hole F258, which is too young and likely contains some, if not all, intrusive material and so has been excluded from the model; SUERC-2411 is a result of alder charcoal recovered from the fill (167) of a post pipe F166; and SUERC-2412 is a result on 20 barley grains that were recovered from the fill (26) of a third post hole F27. SUERC-4494 is oak charcoal from the primary fill (543) of a gully F592. The result is too old for its context and given it is identified as small oak roundwood with greater than 15 rings it is possible that it is old wood, but more likely it is residual in its context and so has been excluded from the modelling. SUERC-4495 is a result on bulk unidentified charcoal and five grains from an early cobbled surface (537). This result is too early for the context and either contains residual material or given the charcoal was unidentified could have an old-wood offset. In either case, it has been excluded from the model. SUERC-4496 is a result on two barley grains that were recovered from a wall line with daub (520). SUERC-4501 is a result on charred seeds and twigs in the fill (562) of a outer boundary gully F561.

5.3.4 Model results

The model (Fig. 5.3.4) has good agreement between the radiocarbon dates and the observed archaeological relationships (A_{model}=74). Since the date from the earliest feature has been excluded from the modelling (see above), the model provides an estimate for the beginning of settlement activity associated with the second enclosure and the cobbled area and structure. This activity began in *10 cal BC–cal AD 85* (*93% probability*) or *cal AD 100–115* (*2% probability*; Fig. 5.3.5; *start: Ingram South, Northumberland*), and probably in *cal AD 30–75* (*68% probability*). This phase of activity, and so the enclosure, continued for up to *85 years* (*95% probability*; Fig. 5.3.6; *span: Earlier enclosure*) and probably *10–50 years* (*68% probability*) at which time the construction of the later rectilinear enclosure began.

The inner ditch of this enclosure was dug in *cal AD 65–120* (*95% probability*; Fig. 5.3.5; *build: Inner Ditch, Ingram South*) and probably in *cal AD 70–95* (*68% probability*). If we accept that the filling of the inner ditch was likely to have occurred in tandem with the other enclosure ditches then the model estimates that the activity associated with the double enclosure persisted for up to *95 years* (*95% probability*; Fig. 5.3.6; *span: Double enclosure*) and probably for *10–60 years* (*68% probability*).

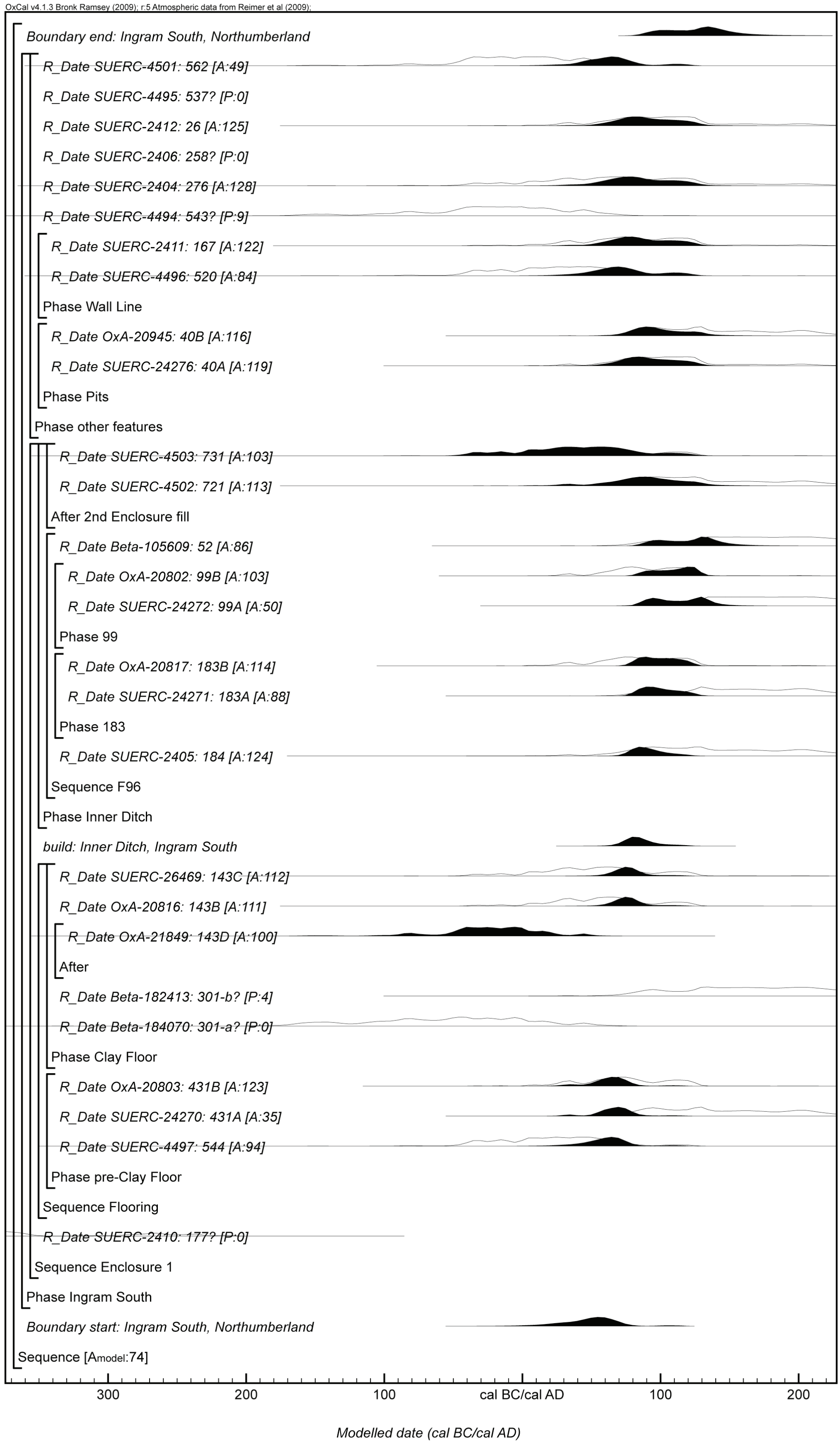

Figure 5.3.4: Chronological model for Ingram South. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

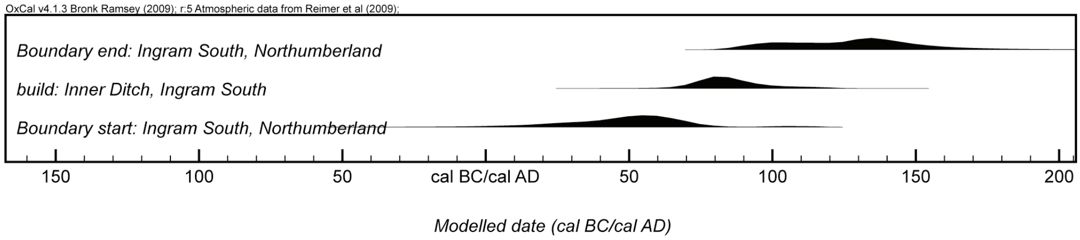

Figure 5.3.5: Probability distributions for the overall site start and end dates and the construction of the Inner Ditch at Ingram South. The probabilities have been isolated from the model shown in Figure 5.3.4

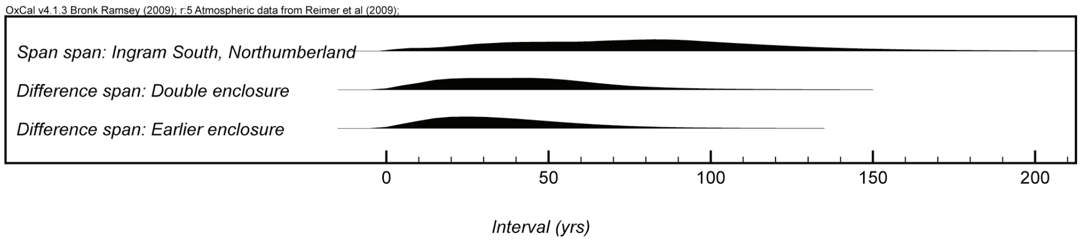

Figure 5.3.6: Probability distributions for the span of the two phases at Ingram South and the overall use of the site as derived from the chronological model shown in Figure 5.3.4. The probability for *span: Earlier enclosure = build: Inner Ditch, Ingram South – start: Ingram South, Northumberland*. Similarly *span: Double enclosure = end: Ingram South, Northumberland – build: Inner Ditch, Ingram South*.

The activity at Ingram South ended in *cal AD 80–175* (*95% probability*; Fig. 5.3.4; *end: Ingram South, Northumberland*) and probably in *cal AD 95–150* (*68% probability*). The overall span of dated activity associated with the second enclosure and cobbling through to the double enclosure is *1–160 years* (*95% probability*; Fig. 5.3.5; *span: Ingram South, Northumberland*) and probably *25–110 years* (*68% probability*).

5.4 Wether Hill

5.4.1 Site description

The multivallate hillfort on Wether Hill (NU 013 144) has had a complex sequence of development. Field survey and early excavation reports suggest that the sequence contains a timber-built roundhouse that was later cut by a palisade trench that, in turn, has another timber house along the palisade line that apparently overlies that enclosure. The hillfort also has a period of rampart building, the digging of an internal hollow that cuts the palisade, and a stone-built circular structure that overlies the hollow and part of the rampart (Fig. 5.4.1).

More information on the site can be found in interim reports (ASUD 2001; 2002) and Oswald et al. (2006).

5.4.2 Sample specifics

A total of 19 radiocarbon results have been made available by the excavations from contexts associated with fills of ditches, gullies, occupation layers, and a post hole.

5.4.3 Model description

The chronological model for Wether Hill is not as robust as those from Fawdon Dean and Ingram South. This is because the necessary access to the site archive could not be obtained within the timeframe of this thesis. In spite of that, the model has placed all of the known radiocarbon dates from the site in a single unordered phase with the assumption that they form a single uniform phase of use.

5.4.4 Model results

The model (Fig. 5.4.2) has good agreement between the radiocarbon dates and the prior assumption that the dates represent a uniform phase of activity (A_{model}=82). Two results have been excluded from the model (AA-40756 and -40758). These two results are either intrusive or representative of a later period of reuse that is perhaps chronologically distinct from the main dated phase. AA-40758 is a result from the core matrix of a stone-built roundhouse that was constructed in a scoop that cuts the palisade trench. This presumably dates a later pre-Roman Iron Age or early Roman Iron Age use of the site. AA-40756 is from the upper fill of the palisade trench. It is of a similar date to AA-40758 and may either be intrusive or else accurately date a context that is associated with the later activity surrounding the stone-built house.

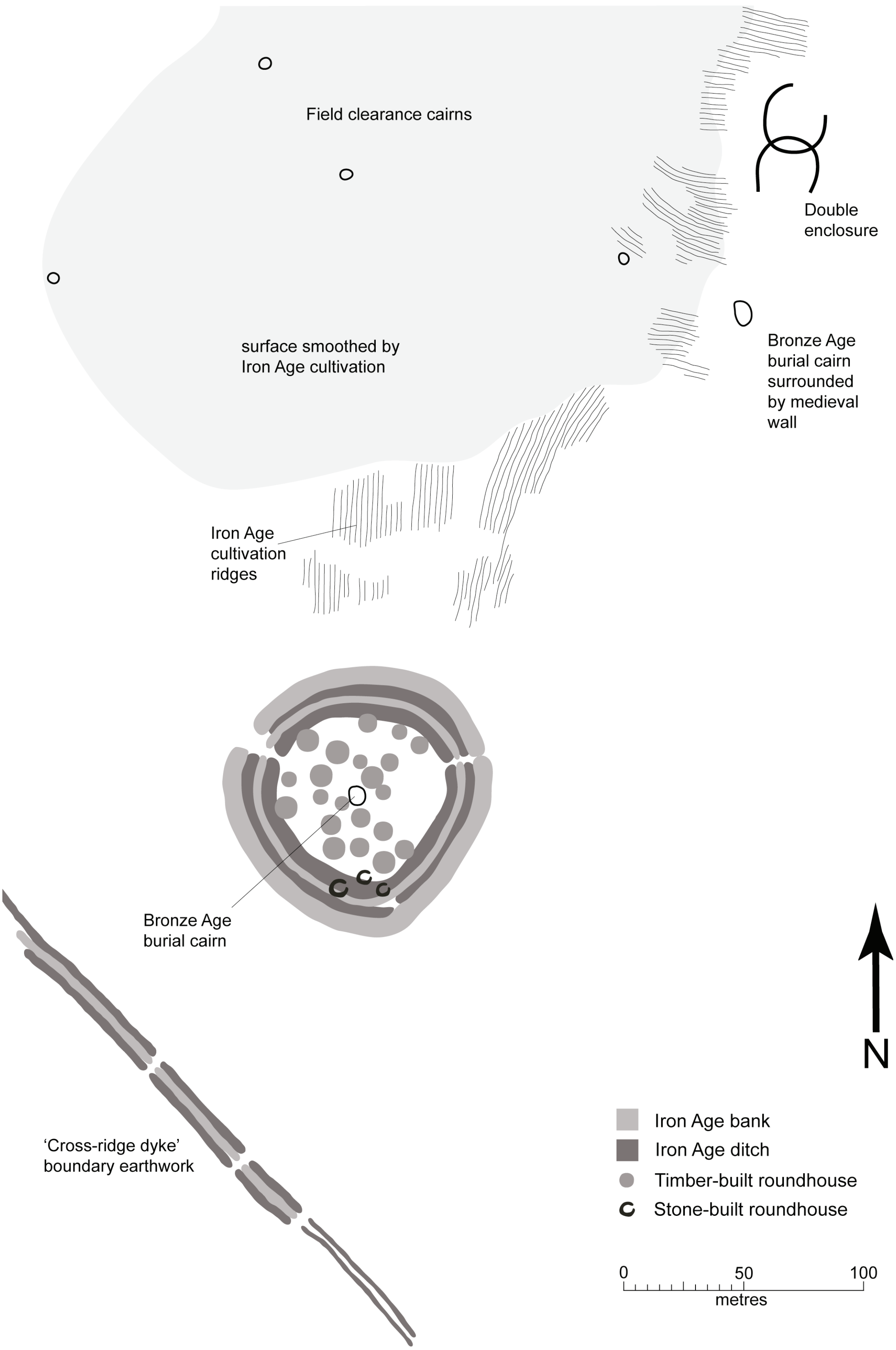

Figure 5.4.1: Plan from surface survey of Wether Hill and surrounding archaeological landscape (after Topping 2004, fig. 12.2; Oswald et al. 2006, fig. 2.32)

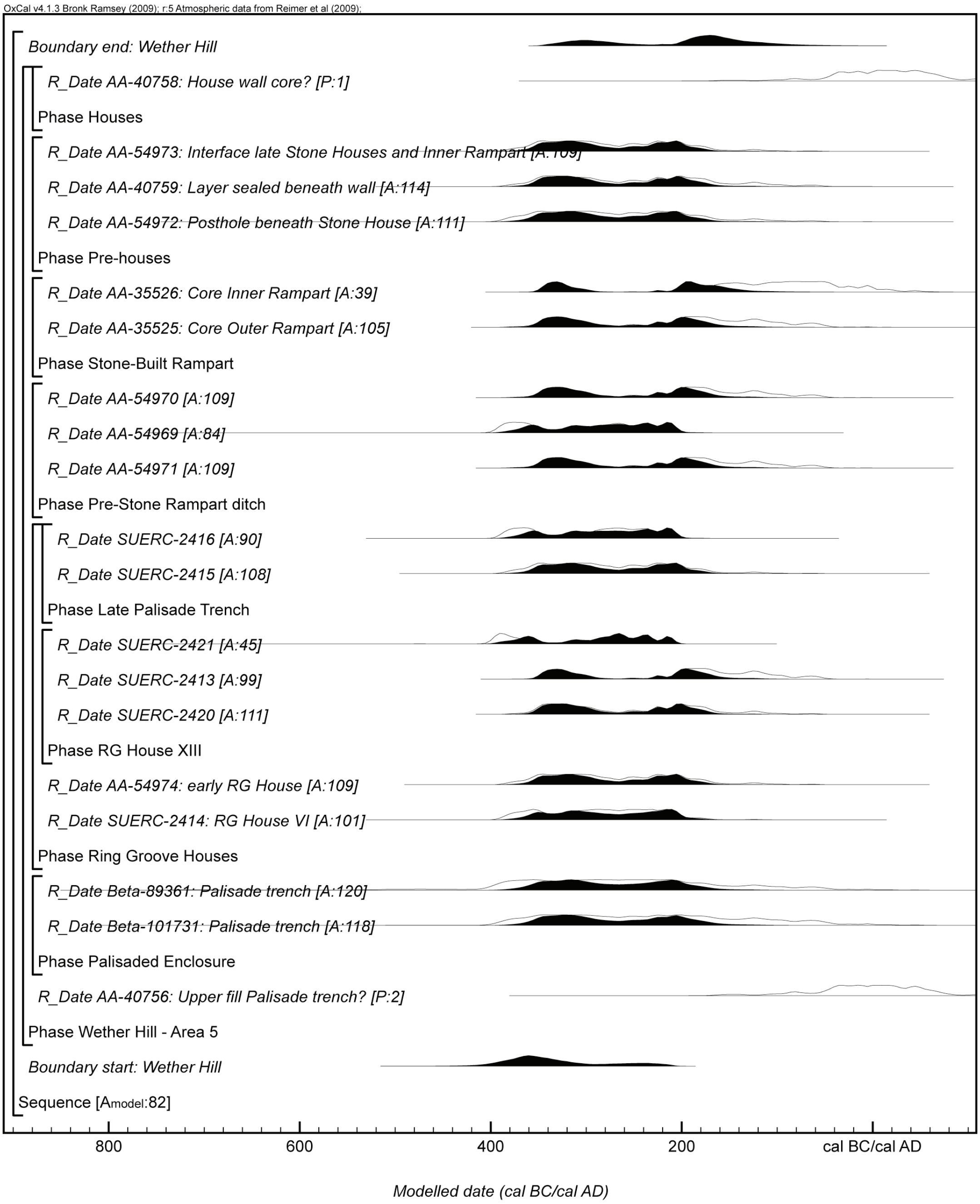

Figure 5.4.2: Chronological model for Wether Hill. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

It seems likely that the stone-built house is part of a later period of use of the hilltop, and this is archaeologically associated with the scooped hollow. If the palisade fill context that contained the sample that produced AA-40756 is near the activity area of the excavated hollow then that intrusive result may well be related to a later stone-built structure phase. The dating of a later phase would likely be sometime in the 1st century BC or 1st century AD. The remaining 17 radiocarbon dates provide a means to calculate the start and end dates for the primary activity.

The model estimates that activity on the hilltop began in *410–215 cal BC* (*95% probability*; Fig. 5.4.2; *start: Wether Hill*) and probably in *400–305 cal BC* (*68% probability*). The activity ended in *345–235 cal BC* (*32% probability*; Fig. 5.4.2; *end: Wether Hill*) or *225–80 cal BC* (*63% probability*) and probably in *325–275 cal BC* (*19% probability*) or *205–125 cal BC* (*49% probability*).

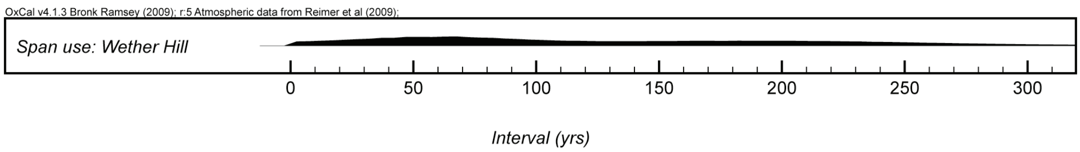

Figure 5.4.3: Probability distribution for the span of dated activity on Wether Hill as derived from the chronological model shown in Figure 5.4.2

The span of pre-Roman Iron Age activity on the hilltop was *1–290 years* (*98% probability*; Fig. 5.4.3; *use: Wether Hill*) and probably *5–125 years* (*49% probability*) or *145–215 years* (*19% probability*). While the 17 measurements included in this model do not pass a chi-square test at 95% (T'=27.9; v=16; T'(5%)=26.3), they do pass at 97% where T'(3%)=28.2 and do suggest a shorter rather than longer period of use.

5.5.1 Cheviot Hills Discussion

Fawdon Dean and Ingram South provide a unique case study whereby two later Iron Age – early Romano-British native settlements within close proximity could be radiocarbon dated and Bayesian modelled. A comparison can also be made with the hilltop settlement of Wether Hill. Although the information required to construct a robust Bayesian model for Wether Hill is not yet available, the ^{14}C results were modelled as a general uniform phase of activity in order to provide an estimate for the end of settlement activity there and then analysed against the modelled probabilities from Fawdon Dean and Ingram South (e.g. *start: Fawdon Dean, Northumberland*, *build: Enclosure 2*, *start: Ingram South, Northumberland*, etc.). From this a table was created (Fig. 5.5.1) of the probabilities that any given event occurred before any other.

The results of this study show that there is a 99% probability that activity ended on Wether Hill prior to *start: Fawdon Dean, Northumberland*, and 100% probability that it ended prior to *start: Ingram South, Northumberland*.

Furthermore, the modelling gives a 99% probability that *start: Fawdon Dean, Northumberland* occurred prior to *start: Ingram South, Northumberland*. There is, however, a 97% probability that *start: Ingram South, Northumberland* occurred prior to *build: Enclosure 2* at Fawdon Dean. There is also an 76% probability that *build: Inner Ditch, Ingram South* occurred before *build: Enclosure 2* at Fawdon Dean. There is a 82% probability that *build: Enclosure 2* at Fawdon Dean takes place prior to *end: Ingram South, Northumberland*. Finally, there is only a 12% probability that *end: Fawdon Dean, Northumberland* dates earlier than *end: Ingram South, Northumberland*.

While it is unfortunate that it was not possible as part of this project to provide a precise chronology for the excavated sequence at Wether Hill, the data strongly suggest that the main period of hillfort construction and occupation had ended prior to the construction of either settlement further down the hill slope. The chronological sequence of settlement developed for Fawdon Dean and Ingram South (Fig. 5.5.3) proves to be an interesting one, and is marked by enclosure activity oscillating up and down the hill side over the period of the final century cal BC and first two centuries cal AD.

The curvilinear enclosure at Fawdon Dean was probably settled in the second half of the 1st century cal BC, based upon the build estimates for the CS 1 and 2. This first

Probability $\tau_1 < \tau_2$	τ_2												
τ_1	**end: Wether Hill**		**start: Fawdon Dean, Northumberland**	**build: CS 1, Phase 2**	**build: CS 2, Phase 1**	**build: stone Roundhouses**	**end: CS 3**	**build: Enclosure 2**	**end: Fawdon Dean, Northumberland**		**start: Ingram South, Northumberland**	**build: Inner Ditch, Ingram South**	**end: Ingram South, Northumberland**
end: Wether Hill	0		99	100	100	100	100	100	100		100	100	100
start: Fawdon Dean, Northumberland	1		0	73	75	99	100	100	100		99	100	100
build: CS 1, Phase 2	0		27	0	52	94	100	100	100		98	100	100
build: CS 2, Phase 1	0		25	48	0	93	100	100	100		97	100	100
build: stone Roundhouses	0		1	6	7	0	97	100	100		82	100	100
end: CS 3	0		0	0	4	3	0	82	100		21	68	95
build: Enclosure 2	0		0	0	0	0	18	0	99		3	24	82
end: Fawdon Dean, Northumberland	0		0	0	0	0	0	1	0		0	0	12
start: Ingram South, Northumberland	0		1	2	3	18	79	97	100		0	95	99
build: Inner Ditch, Ingram South	0		0	0	0	0	32	76	100		5	0	95
end: Ingram South, Northumberland	0		0	0	0	0	5	18	88		1	5	0

Figure 5.5.1: Order matrix between modelled probabilities of events identified at Wether Hill, Fawdon Dean, and Ingram South. The probabilities are derived from the models presented above

period of settlement may have been marked by the construction of the timber-built phases of both CS 1 and 2. There is a 48% probability that *CS 2, Phase 1* predates *CS 1, Phase 2*. Settlement quite possibly began with CS 1 and was followed by the construction of CS 2 at the same time that CS 1 was being rebuilt in timber. Both structures appear to have been burned to the ground and rebuilt, along with the construction of CS 3, probably in *cal AD 10–45* (*68% probability*; *build: stone Roundhouses*). While the events that might have caused these structures to burn are varied (e.g. warfare, ritual, accident), given there is an 85% probability that *build: stone Roundhouses* predates the Roman invasion of Britain in AD 43 (Fig. 5.5.2) and 100% probability that it predates Roman arrival in the area *c.* AD 70, it would seem highly unlikely that the destruction and rebuilding of these structures are in anyway connected to either event.

Each phase of timber-built roundhouse appears to have been occupied for up to 2 generations, perhaps 40 years (median 39 and 41 for *span: CS 2, Phase 1* and *span: CS 1, Phase 2*, respectively; Table 5.2.2). The stone-built structural phases for CS 1 and 2 would also appear to be in use for a longer period of time (median 74 for both *span: CS 1, Phase 3* and *span: CS 2, Phase 2*). However, these spans should be considered the maximum amount of time the structures could have been used since it is the dating of the Enclosure 2 ditch that is used for the upper constraint. If we assume that all three stone-built roundhouses were abandoned at the same time, then we can use the probability *end: CS 3* to estimate when that phase of settlement associated with Enclosure 1 at Fawdon Dean ended, in *cal AD 30–120* (*95% probability*; *end: CS 3*), and probably in *cal AD 20–85* (*68% probability*). This would produce a median probability span for the stone-built structures of 46 years.

The picture arising is one of people moving in the landscape and refocussing their homes and place of livelihood. While there is not enough information available to suggest why people were living on top of Wether Hill, or what they were doing in terms of economic livelihood, it is clear that by the 1st century BC they had left the area. The 99% probability that *end: Wether Hill* is before *start: Fawdon Dean, Northumberland* suggests to me that the inhabitants of Wether Hill did not move simply down the slope to found a new settlement. Given the relatively large size of the settlement on Wether Hill, I would suggest here that perhaps what we are seeing here is the fragmentation of a nucleated Cheviot society in the 1st century BC. While more dating of nearby settlements is needed, what we may be seeing here is the shift to a more dispersed community of networked extended families in homesteads. The settlement at Fawdon Dean is ideally sited to take advantage of both the upland and lowland environments, and would be most suited to self-sufficient family groups practicing mixed agriculture.

Although the data for Wether Hill are limited, it would seem reasonable to suggest that the stone-built roundhouse on the hilltop is associated with the later stone-built structure phase at Fawdon Dean or perhaps even slightly later. The calibrated radiocarbon date for that later house, 100 cal BC–cal AD 130 (AA-40758: 1985 ±45BP), does accord with the stone-built phase at Fawdon Dean beginning in *10 cal BC–cal AD 60* (*95% probability*; *build: stone Roundhouses*) and probably in *cal AD 10–45* (*68% probability*). More settlement data is necessary to investigate this idea further.

Next, or at about the same time as Fawdon Dean was abandoned, the rectilinear enclosure at Ingram South is dug and settled, in *10 cal BC–cal AD 85* (*93% probability*) or *cal AD 110–115* (*2% probability*; *start: Ingram South, Northumberland*), and probably in *cal AD 30–75* (*68% probability*). The ditches are doubled and the enclosed space expanded in *cal AD 65–120* (*95% probability*; *build: Inner Ditch, Ingram South*) and probably in *cal AD 70–95* (*68% probability*). However, people do eventually return to the site of Fawdon Dean and in *cal AD 65–135* (*95% probability*; *build: Enclosure 2, Fawdon Dean*) they dig the later rectilinear enclosure, and probably in *cal AD 85–125* (*68% probability*). This is almost certainly post-Roman contact in the area (91% *probability build: Enclosure 2* is after AD 79).

Probability $\tau_1 < \tau_2$	**τ_2**			
τ_1	**AD 43**	**AD 70**	**AD 79**	**AD 122**
start: Fawdon Dean, Northumberland	100	100	100	100
build: stone Roundhouses	85	100	100	100
end: CS 3	6	44	59	99
build: Enclosure 2	0	2	9	87
end: Fawdon Dean, Northumberland	0	0	0	0
start: Ingram South, Northumberland	33	87	94	100
build: Inner Ditch, Ingram South	0	6	26	99
end: Ingram South, Northumberland	0	0	0	39

Figure 5.5.2: Order matrix between modelled probabilities of events identified at Fawdon Dean and Ingram South and various historically significant dates. The probabilities are derived from the models presented above

Furthermore, there is an 88% probability that activity ended at Ingram South (*end: Ingram South, Northumberland*) prior to Fawdon Dean (*end: Fawdon Dean, Northumberland*). Ingram South was probably abandoned in *cal AD 95–150* (*68% probability*; *end: Ingram South, Northumberland*) with Fawdon Dean following in *cal AD 135–180* (*68% probability*; *end: Fawdon Dean, Northumberland*).

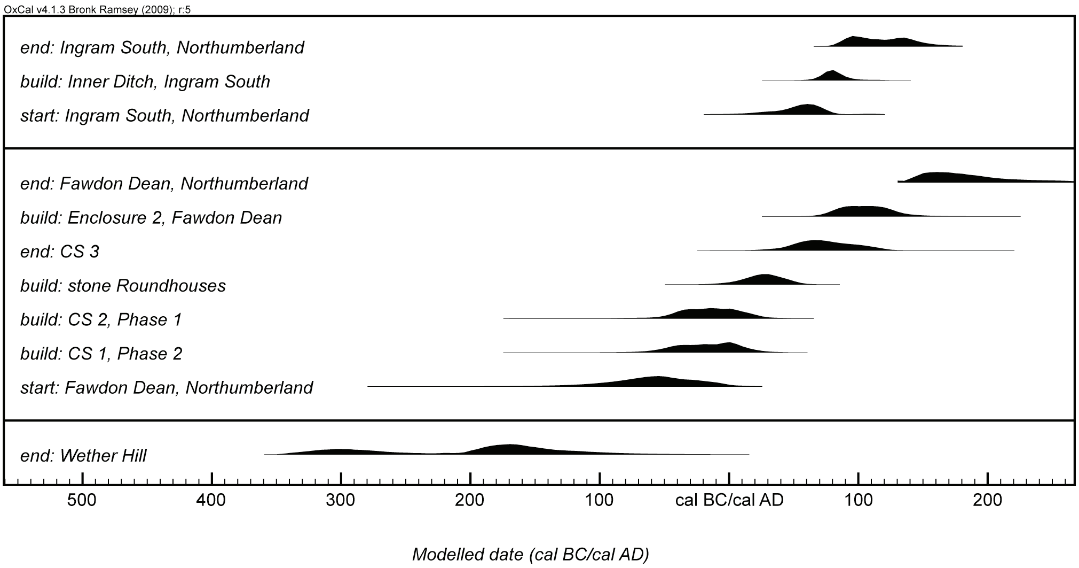

Figure 5.5.3: Probability distributions from the three modelled sites in the Cheviots discussed in this section. The probabilities are extracted from the associated site models described above

Given that Enclosure 2 was constructed while the Ingram South enclosure was still in use perhaps hints to population growth but may also suggest a re-intensification of the more upland environments or a re-diversification in land-use practice. This may be the result of supplying the newly arrived Roman army given there is an 85% probability that the construction occurred AD 70–122.

Enclosures: pre- and post-Roman invasion and contact

While the overall chronological sequence moving up and down the hill slope is particularly interesting, also of special interest is the dating of the enclosure types. The initial enclosure at Fawdon Dean is curvilinear and likely would be expected archaeologically to predate rectilinear enclosures in this part of Northumberland, as the latter, of the morphology seen here, are usually ascribed to the time period around Roman contact.

The probability that selected modelled events occurred prior to specific calendar dates are presented in the matrix given in Figure 5.5.2. The dates include the initial Roman invasion (AD 43) of Claudius, the approximate time of the Roman arrival in North Yorkshire (AD 70), The arrival of the military in southern Scotland (AD 79), and the beginning of construction of Hadrian's Wall (AD 122).

The earliest curvilinear enclosure and timber-built roundhouse phases of Fawdon Dean predate the Claudian invasion (100% probability *start: Fawdon Dean, Northumberland* predates all four calendar dates). There is also an 85% probability that the stone-built roundhouses pre-date the invasion. There is a 59% probability that the inhabitants of the stone houses at Fawdon Dean had left by the time the army moved through and into Scotland.

The initial rectilinear enclosure at Ingram South was probably dug prior to the Roman advance into North Yorkshire (87% probability), and was almost certainly in existence before the Roman advance into Scotland (94% probability). There is a 61% probability that *start: Ingram South, Northumberland* occurred in the period between AD 43 and 79. This lends support to the idea that the rectilinear enclosure form is an influence of the Roman arrival, but the data suggest that influence might be indirect as it seems unlikely the Roman army had arrived in the area prior to the construction of this particular enclosure.

The activity associated with the expansion of the Ingram South enclosures almost certainly occurred prior to the construction of Hadrian's Wall (99% probability) but probably not before the army had come through the area into Scotland (26% probability). The digging of the Enclosure 2 ditch at Fawdon Dean is similar in that it probably took place before the construction of Hadrian's Wall (87% probability) but not before the advance to Scotland (9% probability).

5.5.2 Conclusion

The results of the dating and modelling of these three sites on Wether Hill, in the Cheviots, and near Ingram bring to light the dynamism of settlement morphology (Fig. 5.5.3). Over the course of the two or three centuries that people were inhabiting the area, they were moving up and down the hill slope along with the focus of the settlements. In that time, as well, there is a shift in the fundamental construction material of the houses and then in the shape of the ditches that are dug. The modelling reinforces to some degree the long held belief that, at least in this area, curvilinear enclosures are more closely associated with the pre-Roman Iron Age while rectilinear enclosures develop at or just before direct Roman contact. The curvilinear enclosure at Fawdon Dean was dug prior to the Roman invasion, yet the rectilinear enclosure at Ingram South was most likely constructed at a time when the Roman army or emissaries for Rome were in Northumberland. This new tradition of digging rectilinear enclosures continued when Enclosure 2 was dug at Fawdon Dean.

Although there are examples of single and multiple stone-built roundhouses in the Cheviots dating to the Bronze Age (i.e. Houseledge), often when associated with putative Iron Age enclosure activity they are classified as 'Votadinian' houses and ascribed to the Roman Iron Age. This ascription is perhaps because these houses were first noticed and described as overlying the 'defences' of palisaded and ramparted enclosures (i.e. Dryburn Bridge) and so thought to date to a *Pax Romana*. At Fawdon Dean the stone-built phases of these houses probably pre-date the arrival of Claudius in the South (85% probability), and certainly pre-date any Roman advance into North Yorkshire.

CHAPTER 6: NORTHUMBERLAND COASTAL PLAIN (SITE RESULTS)

6.1.1 Geography

The Northumberland coastal plain is a narrow band of low-lying land that stretches from the Lammermuir Hills of Scotland south to the Durham plateau. To the west it is bounded by the Cheviot Hills and the Pennines. The plain is approximately 20km wide nearer the north, but is up to 40km wide in the south. Most of the coastal strip lies below 200m OD, with some hills rising to as much as 500m OD.

The Northumberland coastal plain is cut through east-west by six primary rivers that come down from the Pennines and Cheviots. They are, from south to north: Wear, Tyne, Blyth, Wansbeck, Coquet, and Tweed. Much of the underlying geology is Carboniferous Age limestone and sandstone. The overlying drift deposits in many areas are composed of glacial till, but also laminated clay, sand, and gravel. The soils in the area of the selected sites are heavy and clayey, so that not only is percolation impeded but they are often waterlogged throughout much of the winter.

6.1.2 History of research and Iron Age settlement in the region

The lowland coastal plain of Northumberland, and Co. Durham for that matter, historically has not been a particular hot-spot of research activity. Although the Northumberland coastal plain lies firmly within the Tyne-Forth province that George Jobey spent much time surveying and writing on, due to the urban nature of much of the coastal plain he actually excavated only a few sites in the area, including Hartburn and Burradon (Jobey 1970; 1973). Instead he spent much more of his time in the Cheviot Hills and neighbouring uplands near and across the Anglo-Scottish border. Unlike upland sites that can survive with remnants of earthworks and stone walls visible on the surface, much of the archaeology across the lowland region only survives as cropmarks and so it is with the aerial photography campaigns in the 1980s that many of the enclosed sites were first identified.

Probably as a direct result of aerial photography, the traditional view of settlement in the area has been dominated by rectilinear enclosures, usually with a main central roundhouse, though a few ancillary structures and division screens exist as well. In the southern portion of the lowlands Jobey excavated just such a site at West Brandon (1962b), while Haselgrove and Allon (1982) published a similar type of site at Coxhoe. Moving north of Newcastle, sites such as Chester House (Holbrook 1988) on the

Coquet and Doubstead (Jobey 1982) just south of the Tweed fall into the same category of enclosed homestead.

These small enclosed homesteads of the Northumbrian coast often stand in counterposition to the more extensive settlements of the Tees valley. Although Thorpe Thewles began life as a similar type of rectilinear enclosed homestead, if larger, there the settlement eventually either outgrew the enclosure ditches or simply had no need for them and became much more extensive.

The most recent research, undertaken in advance of development projects along the coast, has brought to light the complexity of later prehistoric settlement across east-central Britain in general and along the coastal plain more specifically. Pegswood Moor, near Morpeth, is an extensive settlement that develops an increasingly complex array of enclosures through time. South of Pegswood Moor, the two sites of East and West Brunton each begin as extensive settlements but appear in their final form as small rectilinear enclosed homesteads, with West Brunton being a unique find in that it has two rectilinear enclosures only 25m apart.

6.1.3 Site selection

East and West Brunton and Pegswood Moor were selected for further radiocarbon dating and Bayesian modelling (Fig. 6.1). All three sites were excavated in recent years using modern sampling techniques and were known to have an ample amount of material available. Furthermore, preliminary dating had been undertaken from which simulation models could be made, informing the sample selection process.

While Pegswood Moor is a settlement that grows increasingly complex and extensive, East and West Brunton appear to almost contract, transforming from extensive open or palisaded settlements to ‘simple’ rectilinear enclosed homesteads. Furthermore, the two rectilinear enclosures in such proximity at West Brunton are unique as these types of site have always been found in relative isolation.

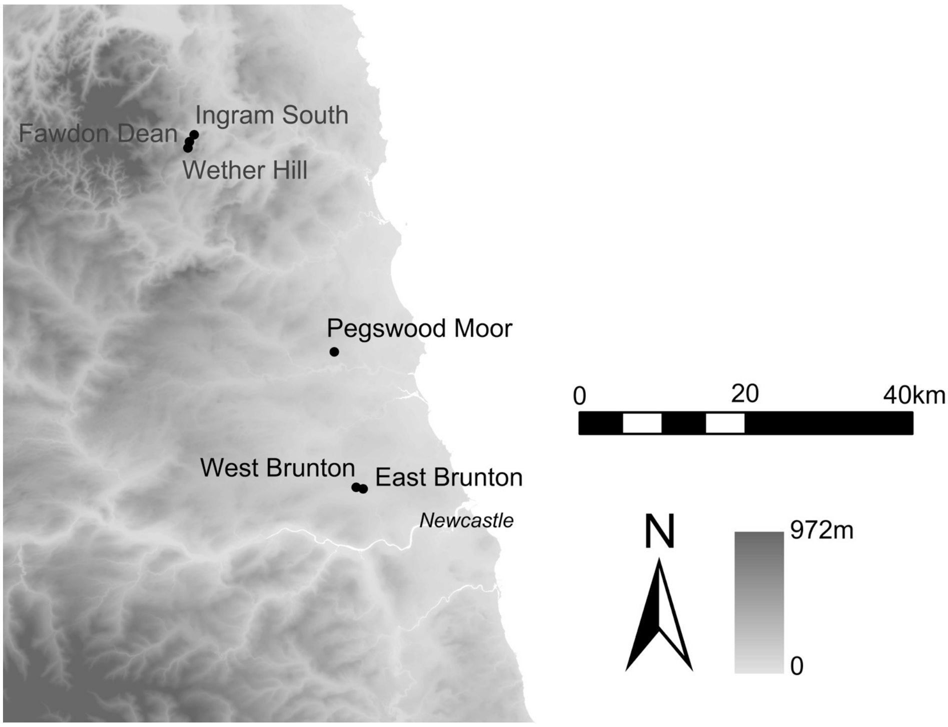

Figure 6.1: Shaded relief map of a section of the Northumberland coastal plain showing the location of the three selected sites along with the locations of the three Cheviot Hills sites, labelled in grey

6.2 East Brunton Farm

6.2.1 Site description

East Brunton (NZ 235 705) is an Iron Age settlement (Fig. 6.2.1) situated on the Northumberland coastal plain immediately NW of Newcastle upon Tyne (6km N of Hadrian's Wall). The site was completely revealed in open area excavation in advance of development in 2002.

Excavation revealed the following structural sequence: Phase 1) a palisaded enclosure; Phase 2) an unenclosed settlement of round houses; and Phase 3) two rectilinear enclosures, immediately adjacent to each other, with large ditches (up to 5m wide and 1.5m deep) and, originally, interior banks. The western enclosure contained a very large (16m diameter) central house encircled by a substantial circular ditch.

Many of the 40 or so round houses recognized at East Brunton cannot be confidently placed into one of the principal phases because they have no stratigraphical relationship tying them unequivocally to one of the three main phases of development. The excavation will be published in Hodgson (forthcoming).

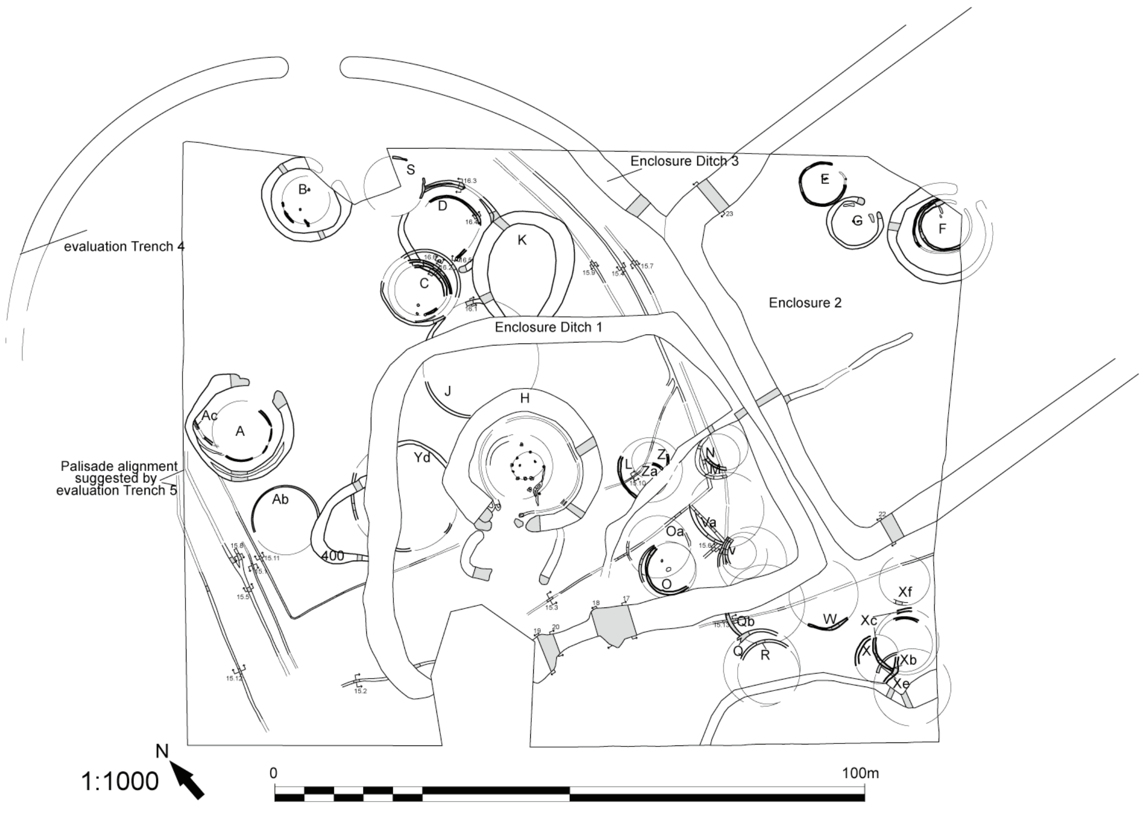

Figure 6.2.1: Site plan of all excavated features at East Brunton Farm (provided by Tyne & Wear Museum Service)

6.2.2 Sample specifics

A total of 12 samples of charcoal and two samples of charred grain were submitted from layers in ditches and fills in pits and postholes. One charcoal sample (NGP03 121) was unidentified and a second (NGP02 131/56) was identified solely as *Quercus* sp. with no further indication of whether the sample consisted of roundwood, sapwood, or heartwood.

6.2.3 Model description

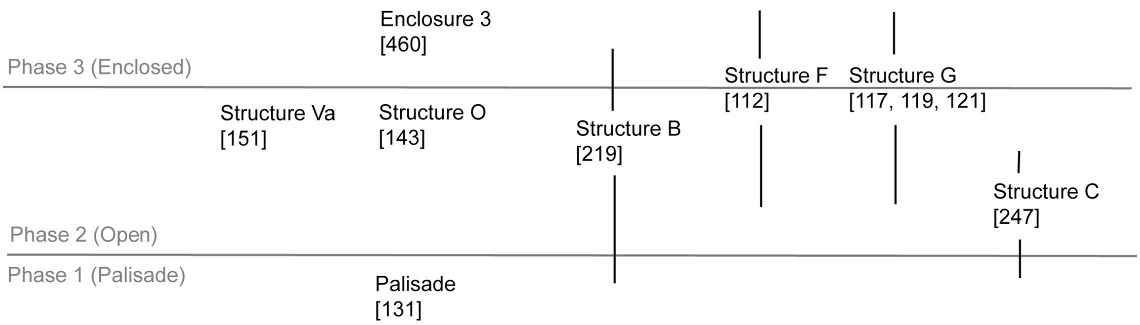

Figure 6.2.2: Matrix of all dated and modelled contexts and features at East Brunton Farm

The model sequence (Fig. 6.2.2) begins with the earliest dated context on the site, the fill [131] of the palisade trench (UBA-7820). The material submitted was identified as *Quercus* sp. with no further indication whether the sample was roundwood, sapwood, or heartwood. Without a means to determine the approximate age at death, especially given oak is a long-lived species of tree, the sample could exhibit an old wood effect. It has therefore been included in the model as providing a *terminus post quem* for the construction of the palisade. No further suitable material was available from this palisade trench or any other Phase 1 features.

Three houses were placed within the open phase of the settlement (House C, O, and Va) and a fourth (Structure B) was thought to date from the open phase, but without any stratigraphic link to other features could have also dated from the palisaded phase or the enclosed phase as it lies within the bounds of both the palisade and Enclosure 2. There is no stratigraphic relationship between the four houses but Houses O and Va are both stratigraphically later than the palisade trench.

A charred barley grain was submitted from upper fill [143] of pit 144 in House O (UBA-7818). A charred tuber was submitted from fill [151] of the wall slot 152 in House Va (OxA-22490). This result is 200–400 years later than expected and probably entered this context during subsequent activity associated with the enclosures. As such, it has been excluded from further modelling.

A sample of alder/hazel charcoal was submitted from fill [219] of a posthole 220 in the internal post ring of House B (OxA-22491). Three samples of short-lived charcoal of different wood species were submitted from fill [247] of a posthole 248 in House C (OxA-22492/3 and -22628). The three measurements are not statistically consistent (T'=15.5; v=2; T'(5%)=6.0), which suggests that the material is of different ages. OxA-22628 is probably residual in this context and has been excluded from the modelling.

Whether the settlement was continuous or simply sequential with a break in habitation is unclear. The model has been constructed so that the enclosed phase is later than the open phase of use, but not necessarily contiguous so that a hiatus in use is possible.

Two houses in Enclosure 2 and its ditch were dated. Two results are available (OxA-22485/6) on short-lived charcoal of different species from fill [112] of the wall slot in House F. The two results are statistically consistent (T'=1.5; v=1; T'(5%)=3.8) and so the samples could be the same actual age. Two results are also available (OxA-22487/8) on short-lived charcoal of different species from fill [117] of gully 118 surrounding House G. These two are also statistically consistent (T'=0.0; v=1; T'(5%) =3.8). A further two results (OxA-22489 and SUERC-1398) are available from House G, from postholes to the north (120) and south (122) of the entrance. The charcoal in fill [121] of posthole 122 was unidentified and so is included in the model as a *terminus post quem* for the context as it is not possible to exclude the possibility of old wood in the sample. Two charred wheat grains had been submitted as well from a fill [460] in the third recut of Enclosure 2 (UBA-7819).

6.2.4 Model results

The model (Fig. 6.2.3) shows good agreement between the radiocarbon dates and the archaeological information (A_{model}=73).

Because the sample from the palisade trench was included as a *terminus post quem* date for the context it is only possible to say that activity on the site began after *760–*

410 cal BC (*95% probability*; Fig. 6.2.4; *start: East Brunton*). However, the activity associated with the post-palisade, open settlement began in *435–380 cal BC* (*95% probability*; Fig. 6.2.4; *start: East Brunton open*), and probably in *405–385 cal BC* (*68% probability*). That activity lasted for *1–50 years* (*95% probability*; Fig. 6.2.5; *span: East Brunton open*), but probably *1–20 years* (*68% probability*), and ended in *405–345 cal BC* (*95% probability*; Fig. 6.2.4; *end: East Brunton open*) and probably in *400–375 cal BC* (*68% probability*).

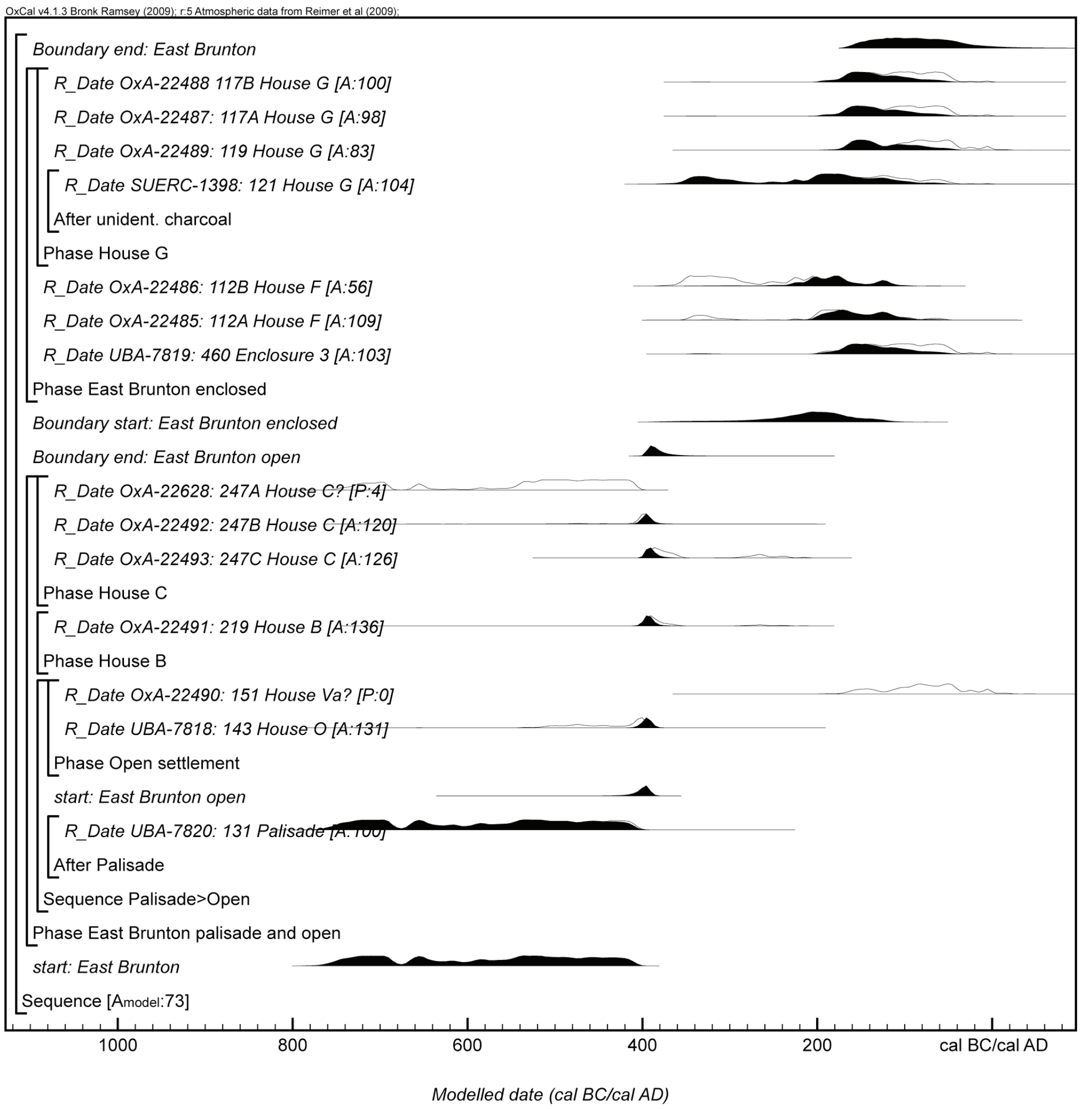

Figure 6.2.3: Chronological model for East Brunton Farm. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

The model suggests that there was, in fact, a hiatus between the dated activity in the open settlement and the later enclosed settlement activity. The hiatus was *45–270* *years* (*95% probability*; Fig. 6.2.5; *?Hiatus*), but probably *130–230 years* (*68% probability*).

The enclosed phase of activity as dated at Enclosure 2 began in *335–115 cal BC* (*95% probability*; Fig. 6.2.4; *start: East Brunton enclosed*) and probably in *250–155 cal BC* (*68% probability*). That activity lasted for *1–190 years* (*95% probability*; Fig. 6.2.5; *span: East Brunton enclosed*) and probably for *10–125 years* (*68% probability*). Dated activity at the site ended in *170 cal BC–cal AD 5* (*95% probability*; Fig. 6.2.4; *end: East Brunton*) and probably in *145–50 cal BC* (*68% probability*).

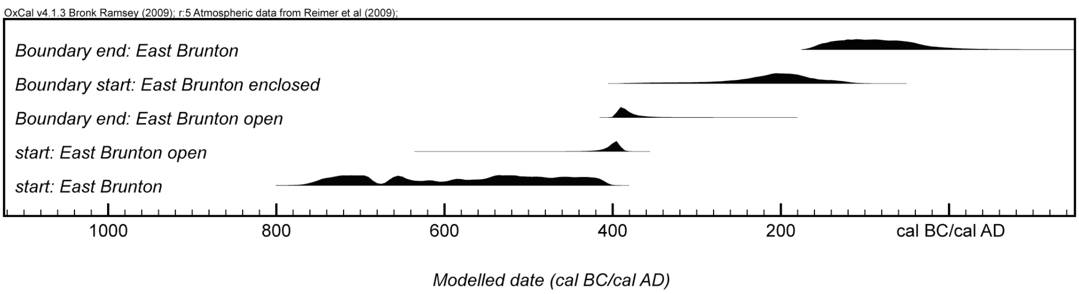

Figure 6.2.4: Probability distributions for the overall site start and end dates of the various identified phases ay East Brunton Farm. The probabilities have been isolated from the alternative chronological model shown in Figure 6.2.3

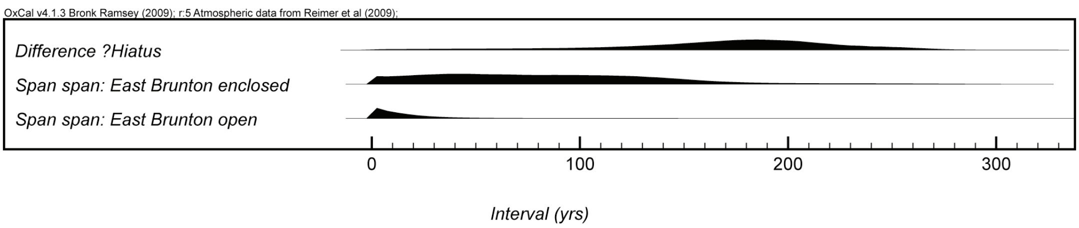

Figure 6.2.5: Probability distributions for the span of the two phases of occupation at East Brunton Farm and the hiatus in activity which calculated as the difference between *end: East Brunton open* and *start: east Brunton enclosed*. The probabilities are derived from the modelling in Figure 6.2.3

6.3 West Brunton Farm

6.3.1 Site description

West Brunton (NZ 233 711) is situated on the coastal plain northwest of Newcastle upon Tyne within 1.5km of East Brunton. Open area excavation (Fig. 6.3.1) in 2004 revealed the following structural sequence:

Phase 1/2 - Unenclosed settlement, which at some stage had Structure 1 enclosed within a small rectilinear palisaded enclosure;

Phase 3 - construction of two rectilinear enclosures, 25m apart, with a series of subsidiary ditches dividing the area between and around them into a number of discrete areas of activity. The principal enclosure ditches were very large (up to 5m wide and 1.5m deep) and originally accompanied by internal banks. Both enclosures

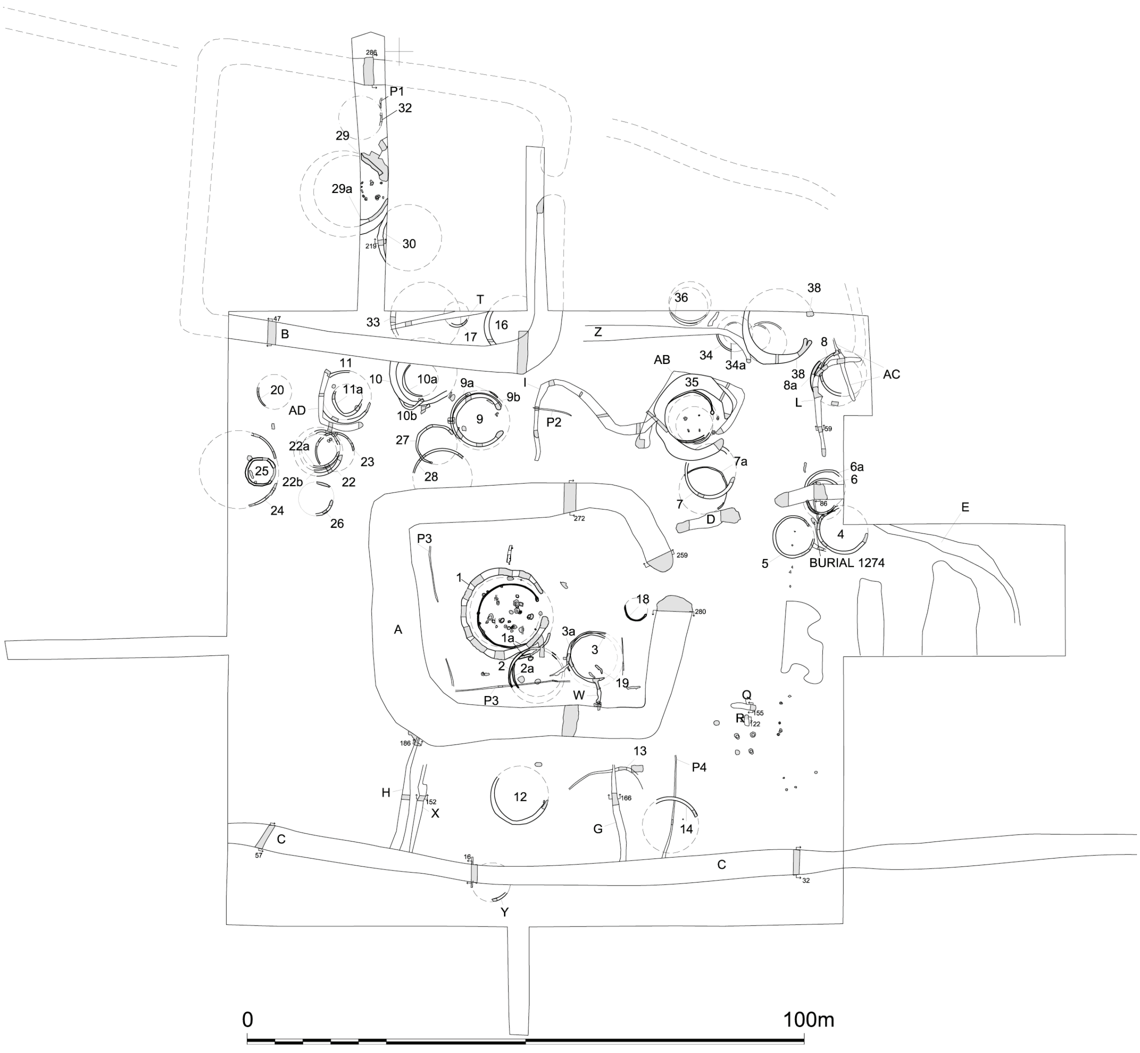

Figure 6.3.1: Site plan of all excavated features at West Brunton Farm (provided by Tyne & Wear Museum Service)

contained a large central house, larger than most of some 40 houses detected in the previous settlement phases.

Structure 1

Although Structure 1 has two identifiable phases, the area of the structure and the palisade and enclosure has three identified phases. The archaeology suggests a sequence whereby Structure 1A is sited within a palisaded enclosure. This structure has been viewed as being exceptionally different from the other structures in the open phase in that it was 1) architecturally more elaborate, and 2) within a small enclosed area.

The palisade is later cut by the gully to Structure 2. Structure 1B is thought to have been constructed at some time while Structure 2 was standing as its drip gully is slightly distorted, apparently respecting that of Structure 2. The excavator believes that perhaps the earlier palisade was enlarged at this time to encompass these buildings, but that evidence could have been removed with the construction of the large Enclosure A ditch. Structure 2 would most likely have been out of use when the Enclosure A ditch was dug as it is in such close proximity to the edge of the ditch and would have been impacted by any internal bank.

The archaeology would appear to suggest a continuous sequence of activity on the site in this area covering Phases 2 and 3.

The excavation report is in preparation (Hodgson forthcoming).

6.3.2 Sample specifics

A total of 27 samples of charcoal, charred grain, and calcined animal bone were submitted from 19 contexts from pits, ditches, and postholes.

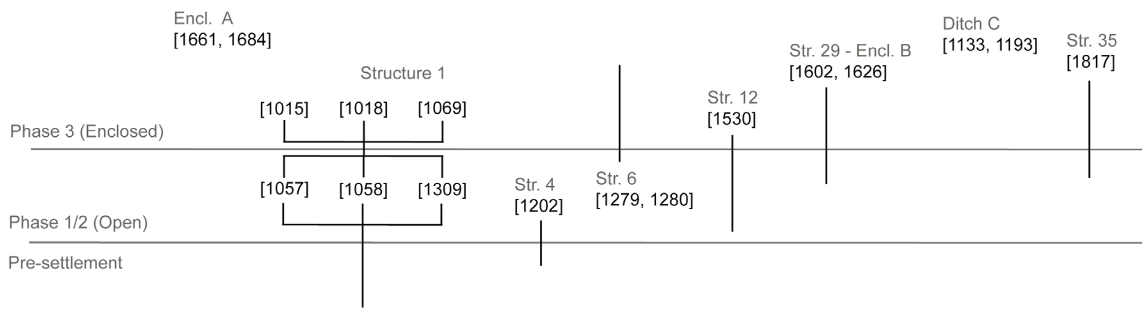

Figure 6.3.2: Site matrix for all dated and modelled contexts and features at West Brunton Farm

6.3.3 Model description

The site matrix for dated and modelled contexts is given in Figure 6.3.2. Based on the archaeology and phasing, the model has been constructed so that the open and enclosed phases are contiguous and form a single phase of activity. There was no material available to date from the pre-settlement activity. Two structures (4 and 6) are firmly placed within the open phase of settlement, with Structure 1A also placed in this period. A result (UBA-7809) on calcined sheep bone is available from fill [1202] of the gully surrounding Structure 4. Given the bone is not in a primary deposit and could have been reworked it is included as a *terminus post quem* date for the context. Two results (UBA-7807 and -7808) are available on a charred wheat and a charred barley grain from two unrelated fills ([1279] and [1280]) in the gully surrounding Structure 6. UBA-7807 is too recent for its stratigraphic position and has been excluded from the model.

There are two dated phases to Structure 1. Structure 1A is dated by five samples from three contexts. The first is slot [1309] from which two results (UBA-7806 and OxA-22354) are available on hazel charcoal. The charcoal and ash-rich fill [1058] of scoop [1061] was dated by a charred grain of barley (UBA-7811). Two results (OxA-22397 and -22847) are available on short-lived charcoal (*Corylus* sp. and *Sorbus* sp.) from fill [1057] of hearth/pit [1060].

Unfortunately no suitable samples were available from contexts associated with open settlement features. There are radiocarbon dates available from five structures and two enclosure ditches associated with the enclosed Phase 3 of the site.

Firstly, at some point, Structure 1A went out of use and Structure 2, from which there are no samples, was constructed over the disused palisade. Eventually, Structure 1B was constructed, along with the Enclosure A ditch, when Structure 2 was no longer in use. There is one result (UBA-7810) on a grain of charred wheat from fill [1018] of the gully of Structure 1B. Another result (OxA-22846) is available on a fragment of *Prunus* sp. charcoal in the infilling [1015] of the last recut of the gully. A final result (OxA-22780) is available on Rowan type charcoal from fill [1069] in posthole 1068. This result is too early given its stratigraphic position and is likely to be residual, and so has been excluded from the modelling.

There are two results (UBA-7812 and -7813) on hazel and cherry wood, respectively, recovered from fill [1661] in the terminal of the Enclosure A ditch. A third result (OxA-23067) is available from a single fragment of *Acer* ap. roundwood charcoal from the lowest fill [1664] of ditch [1665] of Enclosure A.

Three results (OxA-22849/-22850 and SUERC-28598) are available from two samples of short-lived charcoal (*Sorbus* sp. and *Alnus/Corylus* sp.) from fill [1530] of gully segment 1533 surrounding Structure 12. OxA-22849 and -22850 are laboratory replicates on the same sample and should be expected to be the same age. The two results, however, do not pass a chi-square test (T'=9.5; v=1; T'(5%)=3.8). Not only does the third result from this context (SUERC-28598) pass a chi-square test with OxA-22850 (T'=0.0; v=1; T'(5%)=3.8), but OxA-22849 appears to be too old when compared to other results, and so it has been excluded from the modelling. There was no recorded problem with these samples and it would appear that OxA-22849 is a statistical outlier (Higham pers. comm.)

Two contexts associated with Structure 29, the central structure in Enclosure B, were dated. One result (UBA-7814) is available on non-oak charcoal from fill [1602] of the surrounding gully. The $\delta^{13}C$ value for this sample (-10.4‰) is low and though a product of fractionation in the AMS and accounted for in the age calculation may indicate a problem with the sample. Even if the measurement is accurate, the result (2404 ±37BP) is approximately 400 ^{14}C years older than the others from that feature group. It is likely either inaccurate or residual and as such has been excluded from the modelling. A second result is also available from this context on a fragment of hazel roundwood. The result had a very low combustion yield, less than 20% or a third of what would be expected (Higham pers. comm.), which can be indicative of poorly preserved or degraded material, but also of the inclusion of inorganic matter in the sample, though there was no evidence this was the case. Although it has been given a health warning by the Oxford lab – as designated by the OxA-X- prefix – it could very well be accurate. It does appear to be too early given its placement within the model, and it furthermore does not pass a chi-square with the previously discussed UBA-7814 (T'=7.4; v=1; T'(5%0=3.8). It is likely to be either erroneous or residual and as such has also been excluded from the model. Two further results (OxA-22398 and -22851) are available on short-lived charcoal (*Corylus* sp. and *Acer* sp. roundwood) from fill [1626] of entrance posthole 1627 in the structure.

A single result (OxA-22789) is available on roundwood hazel charcoal from fill [1817] of the gully surrounding Structure 35.

Four results are available from two contexts in the Enclosure C ditch. UBA-7815 and -7816 are from single charred grains of wheat in upper fill [1133] of the ditch while OxA-22848 (*Acer* sp.) and SUERC-28599 (*Populus/Salix* sp.) are from short-lived charcoal in basal fill [1193], which is known to be from the last recut of the ditch. The two contexts are from unrelated segments and it is not possible to be certain if [1133] might be earlier than [1193], as such the two contexts are modelled as unrelated through stratigraphy.

6.3.4 Model results

The model (Fig. 6.3.3) shows good agreement between the radiocarbon dates and the archaeological information (A_{model}=78).

The model estimates that the open settlement began in *525–390 cal BC* (*95% probability*; Fig. 6.3.4; *start: West Brunton open*) and probably in *455–400 cal BC* (*68% probability*). After being an open settlement for *95–320 years* (*95% probability*; Fig. 6.3.5; *span: West Brunton open*) and probably *155–260 years* (*68% probability*), West Brunton Farm began to be enclosed. The initial enclosure took place in *320–170 cal BC* (*95% probability*; Fig. 6.3.4; *transition: West Brunton enclosed*) and probably in *260–190 cal BC* (*68% probability*). The site remained enclosed for *285–500 years* (*95% probability*; Fig. 6.3.5; *span: West Brunton enclosed*) and probably for *320–425 years* (*68% probability*).

The settlement went out of use in *cal AD 85–240* (*95% probability*; Fig. 6.3.4; *end: West Brunton enclosed*) and probably in *cal AD 100–175* (*68% probability*).

From the evidence, I see no reason why the sequence of structures in Enclosure A (1A>2>1B) are not continuous. However, given that there are three identifiable phases of construction, and even taking into account the possibility of posts being reset in some of the phases, the evidence at other settlements for timber roundhouses strongly suggests that the overall span in the model presented here is much too long.

It is not possible with the current dating and modelling to determine with better precision when the structures went out of use and compare that to when the ditches themselves had been completely filled. Some of the ditches were possibly used after the structures had been abandoned, with the later structures in the settlement having not been dated.

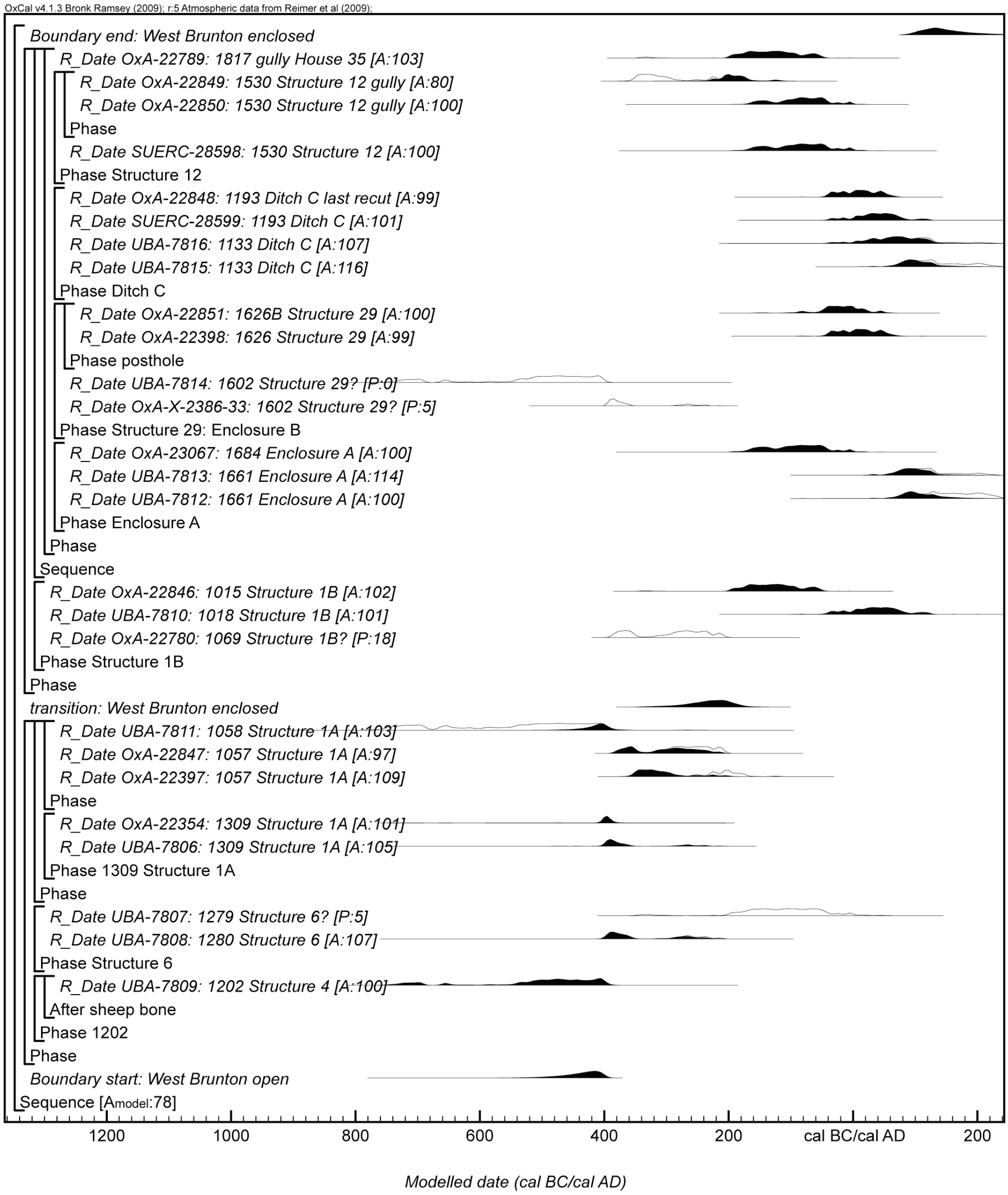

Figure 6.3.3: Chronological model for West Brunton Farm. The model structure is defined by the brackets and the keywords. The format is as described in Figure 4.2.3

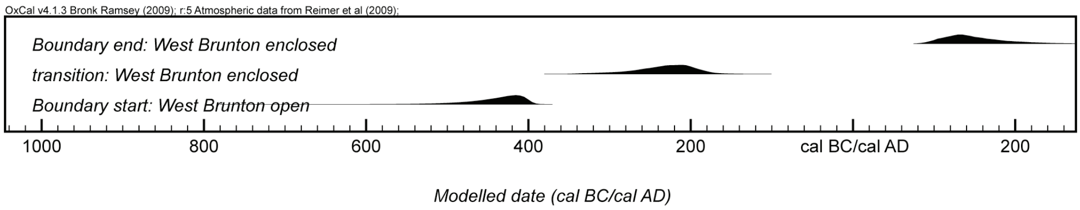

Figure 6.3.4: Probability distributions for the overall site start and end dates of the site phases at West Brunton Farm. The probabilities have been isolated from the chronological model shown in Figure 6.3.3

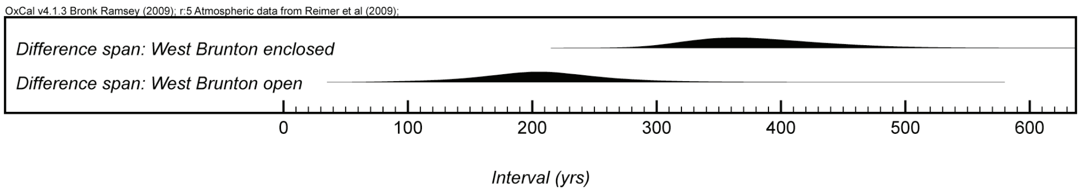

Figure 6.3.5: Probability distributions for span of the open and enclosed phases at West Brunton Farm. The spans are derived from the chronological model shown in Figure 6.3.3. [*span: West Brunton open* = *transition: West Brunton enclosed* – *start: West Brunton open*; *span: West Brunton enclosed* = *end: West Brunton enclosed* – *transition: West Brunton enclosed*]

6.4 Pegswood Moor

6.4.1 Site description

The excavation at Pegswood Moor (NZ 201 882) covered *c.* 4.25 hectares (Proctor 2009). The earliest human presence is of Mesolithic/Neolithic date (Phases 1–2), but the main components of the site comprise late Pre-Roman Iron Age unenclosed and then enclosed habitation phases that culminated in a Romano-British phase of stock enclosure (Fig. 6.4.1). The Iron Age settlement activity extended beyond the limits of excavation so its overall size is uncertain, but it is clear that during its Iron Age phases, the settlement evolved into an extensive and highly organized community.

Phase 3 comprises the first Iron Age settlement. This phase is unenclosed and characterized by four round houses. Structures 1–3 are not all contemporary, as their stratigraphy overlaps, and Structure 4 lies *c.* 50m to the southwest of the group.

Phase 4 is the enclosed settlement from which most of the dating is derived. It is characterized by multiple enclosure ditches, as many as 11 structures, an area of hearth activity, and droveways/fencelines/slighter boundary gullies.

Phase 5 takes the settlement into the Romano-British period where the enclosure ditches of the previous phase are replaced, backfilled in areas, with stock enclosure.

Phase 4 is particularly important as dating the features will help gain a better understanding of the rate of change within an enclosed settlement. The site is complex with a great deal of stratigraphy. For dating, this has been simplified, and in most cases uses the stratigraphic relations between feature groups (as inferred from direct relationship between one or more individual components) to place the suitable samples in stratigraphic order.

6.4.2 Sample specifics

A total of 24 samples of charcoal, carbonized grains, and carbonized residues on pottery were submitted from the fills of pits, hearths, and ditches across the site.

6.4.3 Model description

The dated and modelled contexts are given in the site matrix (Fig. 6.4.2). One sample was available from the Phase 3 Unenclosed settlement. There was no suitable material available from Structures 1–3. The one result (Beta-230302) is from a carbonized residue on Iron Age pottery from fill [1108] of pit 1111 in Structure 4.

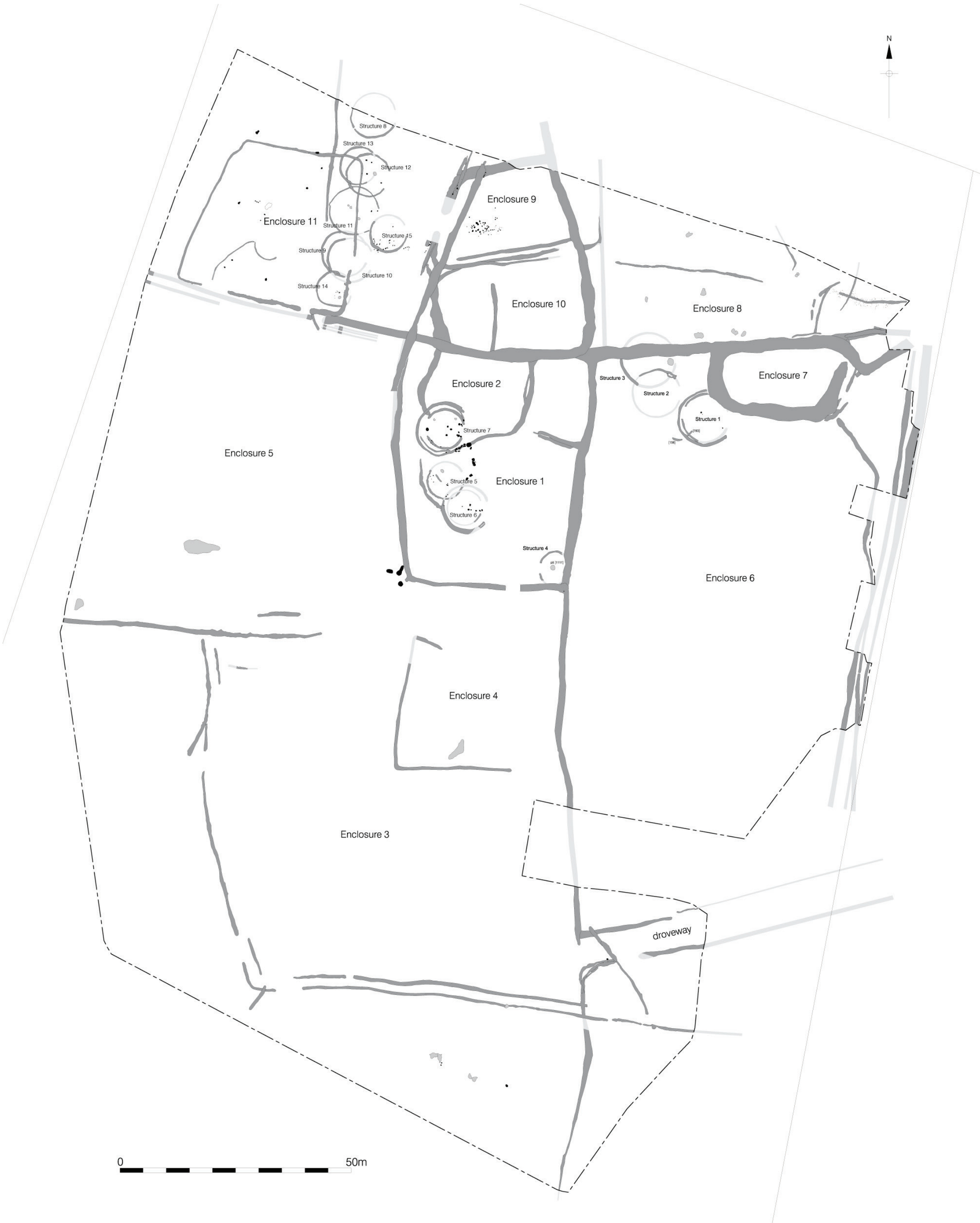

Figure 6.4.1: Site plan of all excavated features at Pegswood Moor (provided by PCA North)

Structure 4 is cut by Enclosure 1 from which a sample of carbonized residue on a pottery sherd was submitted from fill 636 of ditch 1102. As of 5 November 2010, the sample is awaiting to be assigned a wheel for measurement. The sample produced a very low yield of carbon and as such the graphite target is extremely small and the

Oxford Radiocarbon Accelerator Unit has noted that they do not have much confidence that it will produce a reliable measurement (T. Higham pers. comm.).

There is one result (OxA-22833) from a carbonized residue on a sherd of Iron Age pottery that was recovered from fill [1060] of a posthole in ditch 1205 of Enclosure 2. Two results (OxA-22396 and -22895) are available from single fragments of *Sorbus* sp. and hazel charcoal in fill [1224] of hearth 1225, which is associated with Structure 5. Enclosure 2 is cut by Structure 7 from which there is a result (OxA-23068) on a single fragment of *Sorbus* sp. charcoal from fill [821] in pit 822.

Enclosures 1 and 2 are both cut by Enclosure 10 from which a result (OxA-22853) is available from a carbonized barley grain in the primary fill [173] of ditch 174.

A single result (OxA-22894) is available from a single fragment of Rowan type charcoal recovered from fill [1011] in gully 1012 that bounds Structures 8–15. This feature and Enclosure 10 are cut by ditch 614. The deliberate infill [582] of this ditch included a fragment of Iron Age pottery from which one result (Beta-230299) is available from the carbonized residue adhering to the internal surface.

A single result (OxA-22781) is available from a carbonized residue on a pottery sherd recovered from fill [612] of ditch 613 in Enclosure 9. The result is nearly 7000 years older than expected and likely to have been contaminated by exogenous carbon in the body matrix of the sherd at the time of sampling. The result has been excluded from further modelling. Enclosure 9 is cut by a series of ditch/fences to the east of Enclosure 11 that form part of the Romano-British enclosure. Two results (OxA-22891 and SUERC-28605) are available from single fragments of charcoal (*Acer* sp. and

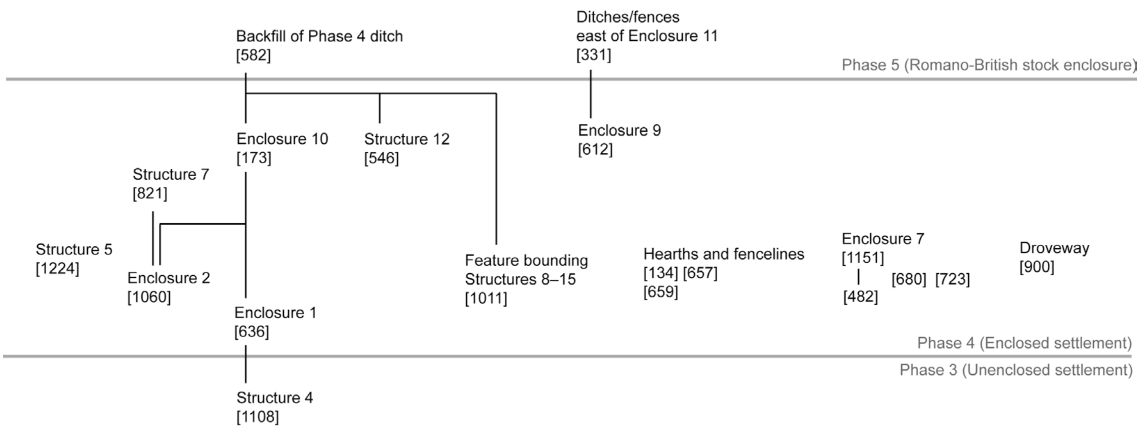

Figure 6.4.2: Site matrix for all dated and modelled contexts and features at Pegswood Moor

purging blackthorn) from fill [331] of ditch 334. Both results are post-medieval in date and likely to be intrusive. As such they have been excluded from the subsequent modelling.

Two results (OxA-22893 and SUERC-28600) are available on single fragments of *Prunus* sp. and purging buckthorn charcoal from fill [900] of ditch 923, which makes up a section of the Droveway. Both results are post-medieval in date and likely to be intrusive. As such they have been excluded from the subsequent modelling. The four post-medieval dates are revisited in the discussion.

Four radiocarbon dates are available from activity adjacent to an area identified as a pottery production locus. One result (OxA-22852) is available from a fragment of *Sorbus* sp. charcoal from fill [134] in pit 135. A carbonized residue on a sherd of pottery recovered from fill [657] of fence 658 gave a result (OxA-22782) that is nearly 2000 years older than expected and is also likely to have been contaminated by exogenous carbon in the body matrix of the sherd at the time of sampling. It has been excluded from further modelling. Two results (Beta-230300 and SUERC-28601) are available from another carbonized residue on a pottery sherd and a single grain of carbonized grain (cf. *Hordeum* sp.), respectively, from fill [659] of ditch 660.

Four radiocarbon results from samples were recovered from as many contexts in the Enclosure 7 ditch. One result (Beta-230298) is from a carbonized residue on a pottery sherd in fill [482] of ditch 182. Stratigraphically later than this there is a result (AA-43432) on a fragment of *Betulaceae* (cf. *Corylus*) charcoal from the uppermost fill [1151] of ditch [182]. Another carbonized residue from fill [680] in ditch 681 produced Beta-230301, and a single fragment of hazel charcoal was submitted from fill [723] of ditch 724 and produced OxA-22783.

Two results (OxA-22353 and -22892) are available from single fragments of charcoal (*Acer campestre* and *Corylus avellana*) fill [546] in pit 547, which lies within Structure 12.

Carbonized residues

The initial Beta Analytic results on carbonized residues appeared, for the most part, to provide accurate dates for the settlement. These samples were taken using a scalpel and microscope in an effort to remove only the residue and none of the body matrix of the sherd. The samples submitted as part of this project utilized a scalpel but not a microscope.

A reevaluation of the dates suggests that there may be a problem with the pottery dates being older than expected. While OxA-22781 and -22782 were likely contaminated with old carbon, as they provided results of 4084 ±32BP and 8905 ±50BP respectively, all the other results appeared to be within a general later prehistoric timeframe. There is earlier activity associated with the unenclosed settlement thought to date to the 4th–2nd century cal BC, and the possibility always exists that the dated pottery is residual in the later contexts.

Laboratory ID	**Context no.**	**$\delta^{13}C$ (‰)**	**Radiocarbon age (BP)**	**Calibrated date (95% confidence)**
Beta-230298	482	-27.5	2100 ±40	350–1 cal BC
Beta-230299	582	-26.5	2140 ±40	360–50 cal BC
Beta-230300	659	-26.3	2370 ±40	710–380 cal BC
Beta-230301	680	-26.6	2210 ±40	390–170 cal BC
Beta-230302	1108	-24.7	2200 ±40	390–160 cal BC
OxA-22781	657	-26.7	4084 ±32	8250–7830 cal BC
OxA-22782	612	-25.8	8905 ±50	2860–2490 cal BC
OxA-22833	1060	-23.4	1956 ±24	20 cal BC–cal AD 120

Table 6.4.1: Table of radiocarbon dates for carbonized residues from Pegswood Moor

Of all these results only one (Beta-230300) comes from a context (fill 659 of hearth 660) where a replicate measurement (SUERC-28601: 1965 ±30BP) was made on a single carbonized grain of barley. The two measurements are not statistically consistent (T'=66.5; v=1; T'(5%)=3.8). While no other contexts with dates on carbonized residues had replicate measurements made, four other contexts on the site did have replicates on charred material of different species dated.

Contexts 331 and 900 produced post-medieval results on the charred material, but the chi-square results suggest that the contexts across the site are not overly disturbed. The excavator acknowledges that the features could be post-medieval, but does not think that such a late date really fits in with the known use of the site, as it was moorland up to the late post-medieval period. Furthermore, the features do not fit with the alignment of the post-medieval field system established on the site, but they do fit in with the prehistoric and Roman field systems (Proctor pers. comm.).

Context	Chi-square result
331: fill in ditch 334 east of Enclosure 11	T'=0.1; v=1; T'(5%)=3.8
546: fill of pit 547 in Structure 12	T'=1.7; v=1; T'(5%)=3.8
900: in ditch 923 of the Droveway	T'=2.5; v=1; T'(5%)=3.8
1224:fill of hearth 1225 in Structure 5	T'=0.4; v=1; T'(5%)=3.8

Table 6.4.2: Table of chi-square results for pairs of radiocarbon measurements from the same context at Pegswood Moor

There is not enough data available further to evaluate the date of these two features. It is possible that both features contain intrusive post-medieval charred material that was incorporated during episodes of later ploughing that truncated many of the site features and from which two samples were unfortunately selected. But it is also possible that dated contexts were formed in the post-medieval period and, given the truncation of the site, the relationship was not fully realized on site. At the very least the individual contexts do appear consistent. Furthermore, all four of the paired measurements from macrofossil dates in the same context pass a chi-square test, suggesting little residuality.

However, two of the eight carbonized residue dates are undoubtably too old, with a third apparently too old when compared to its replicate, which raises a question as to the accuracy of the dating of the carbonized residues across the site. Bayesian outlier analysis was attempted to help resolve the issue, but the model had difficulty in running to a resolution, which was likely the result of needing to indicate that the earliest and latest stratigraphic contexts had possible outlier results.

In the end, manual outlier detection was undertaken with results with low indexes of agreement being excluded one-by-one. As each result was excluded, however, another would run of the model would produce another result that was apparently too early. In the end, all but one carbonized residue date (OxA-22833) had been excluded from the model. Manual outlier detection is not well-suited to the data in this model. Ideally, further samples from charred material would have been submitted from the same contexts as some of the other carbonized residue dates to provide data for comparison. Given that pottery sherds are fairly robust there is always the potential for their being reworked in the deposits. At Pegswood, the residues were quite thick and suggested the sherds were deposited fresh. While, under normal circumstances this potential discrepancy in the residue dating would be investigated further, it was identified late in this project and further dating will have to be considered as part of any further research with this material after completion of the PhD project. The residues dated are being incorporated into the PhD research on chemistry of carbonized residues on archaeological ceramics by George Kirke, University of Bristol.

It was decided to remove all dates on carbonized residues from the model as there is clearly a problem with them and no reliable way to evaluate them at the moment. After the exclusion of the carbonized residue results from the model, a sample of Rowan type charcoal from a fill (1011) in the ditch bounding structures 8–15 provided a result that appeared too old (OxA-22894) and so has also been excluded from the model.

6.4.4 Model results

The model (Fig. 6.4.3) has good agreement between the radiocarbon dates and the prior information (A_{model}=75).

Because the only date on a pre-enclosure feature was a carbonized residue, the model cannot be used to estimate when all settlement activity began. However, there is enough data available to estimate the date of the enclosed phase of activity (Phase 4).

Enclosed activity began on the site in *25 cal BC–cal AD 55* (*95% probability*; Fig. 6.4.4; *start: Pegswood enclosed*), and probably *AD 10–50* (*68% probability*). This lasted for *1–85 years* (*95% probability*; Fig. 6.4.5; *span: Phase 4 enclosed*), and probably *1–30 years* (*68% probability*). Enclosed activity ended in *cal AD 10–75* (*95% probability*; Fig. 6.4.4; *end: Pegswood enclosed*), and probably in *cal AD 25–60* (*68% probability*).

Structure 5 was constructed in *cal AD 1–60* (*95% probability*; Fig. 6.4.4; *build: Structure 5*), and probably in *cal AD 15–50* (*68% probability*). Structure 7 was constructed in *5 cal BC–cal AD 60* (*95% probability*; Fig. 6.4.4; *start: Structure 7*), and probably in *cal AD 15–50* (*68% probability*).

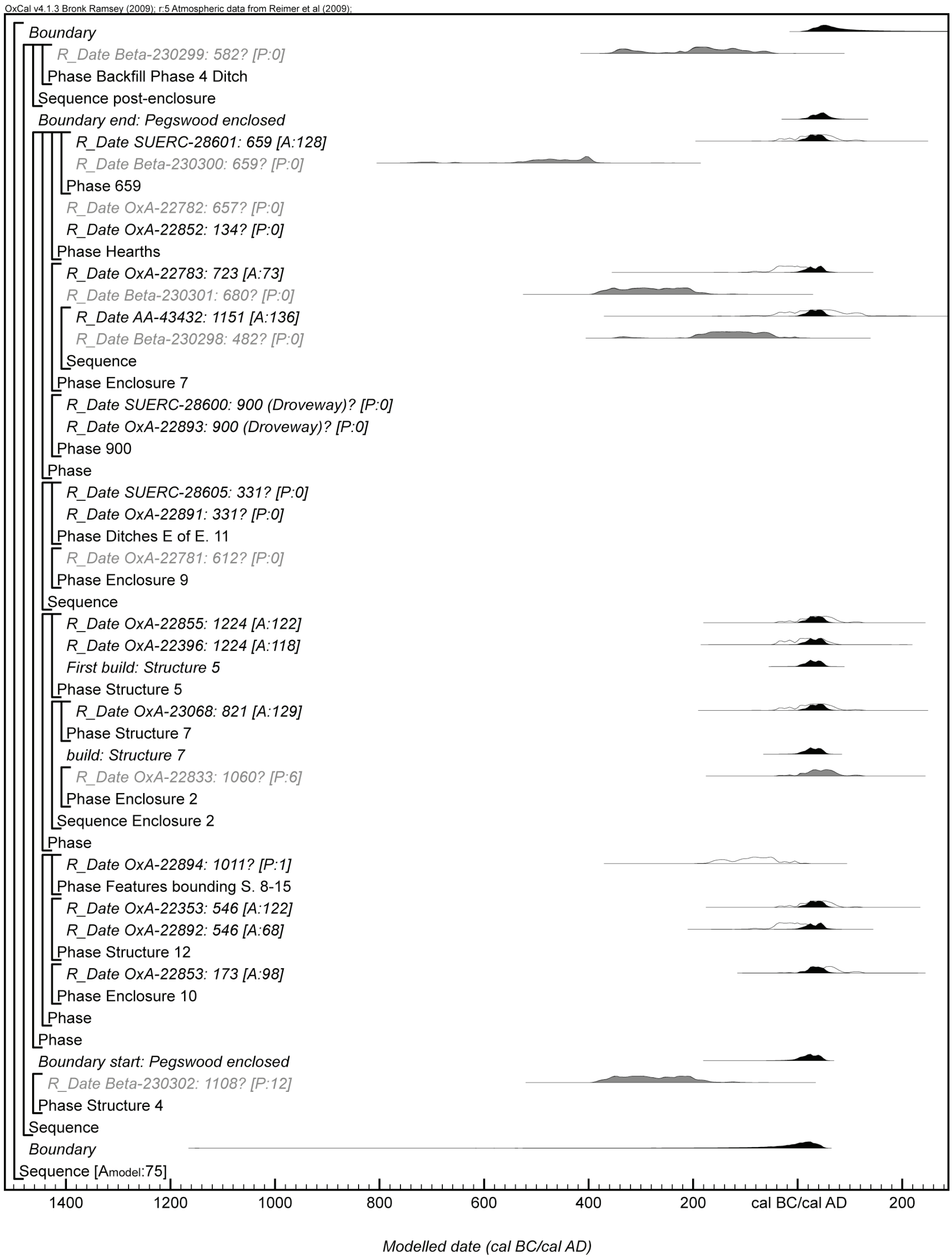

Figure 6.4.3: Chronological model for Pegswood Moor Farm with excluded carbonized residue dates shown in grey. The model structure is defined by the brackets and the keywords. The format is as described in Figure 4.2.3

Furthermore, the spans of Structures 5 and 7 were calculated by finding the difference between their respective start date and *end: Pegswood enclosed*. The model calculates that Structure 5 was in use for *1–60 years* (*95% probability*; Fig. 6.4.5; *span:*

Structure 5) and probably for *1–20 years* (*68% probability*). Structure 7 was in use for *1–60 years* (*95% probability*; Fig. 6.4.5; *span: Structure 7*), and probably for *1–20*

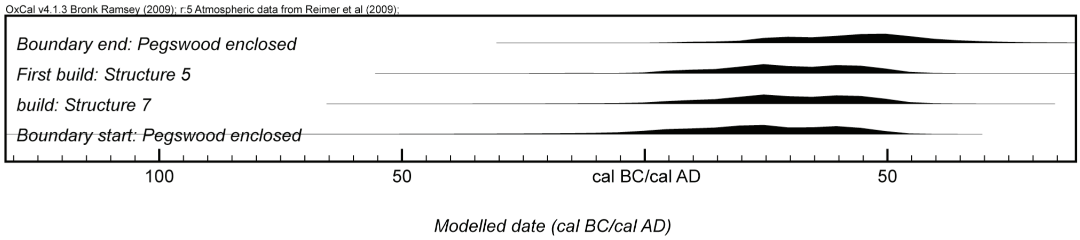

Figure 6.4.4: Probability distributions for the overall site start and end dates of the site phases and the two dated structures at Pegswood Moor Farm. The probabilities have been isolated from the chronological model shown in Figure 6.4.3

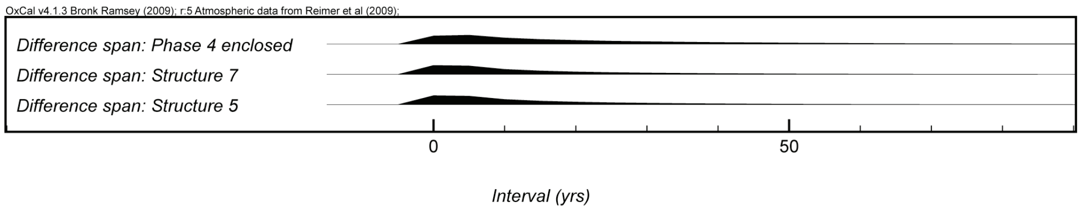

Figure 6.4.5: Probability distributions for span of the enclosed phase at Pegswood Moor Farm and the span of use for Structure 5 and 7. The spans are derived from the chronological model shown in Figure 6.4.3

years (*68% probability*).

It could be argued that by excluding all of the carbonized residue dates from Pegswood Moor that the modelling is less robust. If only a few carbonized residue dates are incorrect, it is possible that the site was enclosed at some time around 3rd century cal BC. Whereas with those dates excluded, the enclosure activity on the site would date to the very end of the Iron Age and into the early Roman period. Furthermore, the enclosed activity would appear to be very short-lived.

However, the current data do suggest strongly that there are issues with the dates on the carbonized residues. Furthermore, I would argue that the very coherence of dating from the plant macrofossils from across the site would suggest that the enclosed phase of activity at Pegswood Moor was, in fact, reliably dated with the model derived from these dates providing accurate date estimates of this phase. What is less clear is the chronological relationship of the open settlement to the enclosed.

6.5 Northumberland Coastal Plain Discussion

The dating of the sites along the Northumberland coastal plain has perhaps been the most problematic of the three sub-regions in the PhD where new material was submitted for dating. Firstly, these sites were the last group to be selected, midway through the first year. Secondly, the settlements at East and West Brunton were undergoing post-excavation assessment and analysis at that time which slightly delayed sample selection. Thirdly, much of the dating was funded through the NERC Radiocarbon Facility fund (NRCF) as the result of two separate applications. These were made back-to-back with six months' gap. When it became apparent that the number of dates provided by the NRCF would not be adequate to properly model the sites, English Heritage kindly agreed to fund the extra dates indicated as being needed through the simulation modelling. What is unfortunate is that the NRCF dates take quite some time to process and there is still one date awaited from material submitted 9 months prior to the completion of the project. Knowing this would likely be the case, the English Heritage funded dates were selected and submitted at the same time as the NRCF dates. Given all the sites had some initial dating available when the simulations were produced this was not seen as overly problematic, but late in the project it became clear that there were unforeseen complexities and problems with the sites.

The potential problem with the dates on the carbonized residues at Pegswood is perhaps the most apparent and would require a third or even fourth round of

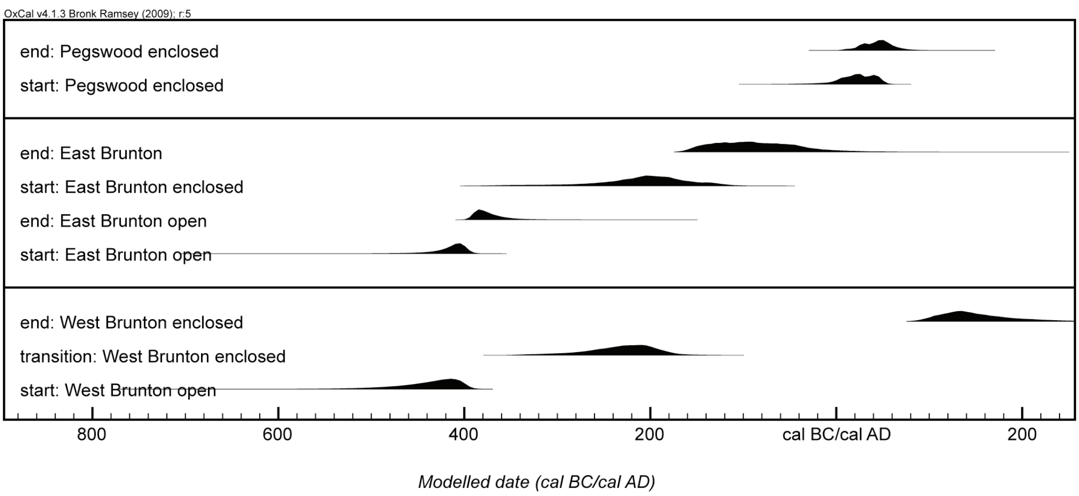

Figure 6.5: Probability distributions for the beginning and end of dated activity at the three sites on the Northumberland coastal plain. the probabilities are derived from the modelling presented in the earlier sections of this chapter

radiocarbon dating to resolve. At both East and West Brunton the issues are not so much related to problems with the dating but rather underestimating the complexity of the sites, so that the dating should be expanded to produce more robust site-specific models.

Despite these problems with the dating, confidence can be placed in the results of the models. The modelled activity at both East and West Brunton and the timing of the transition from open to enclosed settlement (Fig. 6.5) is likely accurate. The data from both settlements suggest that the open settlements began in the l*ate 5th century cal BC* and that the farmstead/homestead style enclosures were constructed at the end of the *3rd century cal BC*, but perhaps as late as the beginning of the *2nd century cal BC*.

At East Brunton, the end of activity is dated with confidence, but it is rather imprecise. Given the data that has been accumulated in this project on the longevity of timber structures, I would argue that the end date for West Brunton, as a reflection of the archaeology associated within Enclosures A and B is not reliable. The span of time for the enclosed activity is far too long in my mind given there is only evidence for resetting posts in the central buildings in these two enclosures and not multiple complete rebuilds. Given the similarities between and proximity of East and West Brunton, I would suggest that both may well have similar chronologies for the habitation, but acknowledge that more dating would need to be undertaken to resolve the matter.

In spite of the technical issues associated with dating the carbonized pottery residues at Pegswood Moor, it is not only likely that the enclosed phase is accurately dated, but precisely dated as well. The dating suggests a settlement that was probably enclosed prior to the Roman invasion in AD 43 (*87% probability*) but also probably abandoned prior to the Roman push into Scotland in AD 79 (*98% probability*).

CHAPTER 7: TWEED-FORTH (SITE RESULTS)

7.1.1 Geography

The geography of south-east Scotland is highly varied from the flat expanses along the North Sea and Firth of Forth coastlines to the hills of the Southern Uplands and the valleys of the Tweed and Teviot rivers. The underlying geology of the uplands is primarily shale and greywackes, while the surrounding areas are underlain by sedimentary rocks with a few areas of Carboniferous or Devonian age lava outcrops (Ballantyne and Dawson 1997, fig. 3.1). Today, the soils along the coast, the Forth, and within the river valleys are well-suited to arable cropping, while those in the upland areas are more suited for rough grazing (Davidson and Carter 1997, fig. 4.2) and this not likely to have been very different in the Iron Age.

7.1.2 History of research and Iron Age settlement in the region

Of the four sub-regions presented in this thesis, south-east Scotland is the largest and most varied. While the towering remains of brochs have captivated the imagination of researchers in Atlantic Scotland and the remains of crannogs hold great interest to those working in and around the Highland lochs, south-east Scotland has a rich history of archaeological research that begins with hillforts but has found increasing focus on lowland settlements.

Some of the earliest hillfort surveys were undertaken in the area between the Tyne and Forth in the late 19th century by Christison (1894; 1895; 1898). Although there are a large number of hillforts in the Lammermuir Hills, one hillfort north of the Anglo-Scottish border has stood out and dominated much of the subsequent research and interpretations in the area. The site is Traprain Law, a large hillfort constructed atop a volcanic plug that rises from the East Lothian coastal plain. The site was subject to excavation in 1914–23 (Cree 1923) with the discovery of a late Roman silver hoard piquing much interest (Curle 1920; 1923). George Jobey, known more for his work in Northumberland, even wrote on Traprain Law (1976). Recently the site has been under reinvestigation by members of the Traprain Law Summit Project (Armit et al. forthcoming) and sites in the landscape around the site have been surveyed, with some sites undergoing excavation, as part of the Traprain Law Environs Project (Haselgrove 2009).

A second well-known hilltop settlement in this region, and one that in many ways was the impetus behind this project, is the site of Hownam Rings, excavated in 1948 by C. M. Piggott (1950) and from which has come the 'Hownam Sequence'. Mrs. Piggott excavated other hilltop settlements in southern Scotland, including Hayhope Knowe (1949), to find corroboration of the identified sequence.

Work in the last quarter of the 20th century and to the present has focused on the settlements of the coastal lowlands, both open and enclosed, though usually only identified through the cropmarks that trace the enclosed phases. Work at Dryburn Bridge (Triscott 1982) and Broxmouth Hillfort (Hill 1979; 1982a) provided clear evidence over 20 years ago that contradicted a 'Hownam Sequence'. While the final report on Dryburn Bridge has been recently published (Dunwell 2007), a reinvestigation and interpretation of the archaeological evidence collected from the excavations at Broxmouth in the 1970s is currently underway at Bradford University.

A number of Iron Age cropmark enclosure settlements have been excavated in the past decade or so, with perhaps the earliest being at St. Germains (Alexander and Watkins 1998). This was followed by two separate excavations in Port Seton, reported together, at Fishers Road East and West (Haselgrove and McCullagh 2000). A number of prehistoric sites, dating from the Neolithic onward, were excavated along the A1 corridor with the Iron Age settlement at Phantassie Farm providing a unique glimpse into life on a Lothian farmstead (Lelong and MacGregor 2008). A number of the enclosed settlements excavated or evaluated as part of the Traprain Law Environs Project were Iron Age in date as well, but also covered the Bronze Age and even into the middle 1st millennium AD (Haselgrove 2009).

7.1.3 Site selection

Eight sites have been included from this region in this PhD research (Fig. 7.1). The sites include the two hilltop settlements on The Dunion and Eildon Hill North; the cropmark enclosure sites of Dryburn Bridge, Fishers Road East and West, Knowes Farm, and Standingstone; and the unenclosed settlement at Phantassie Farm. Unlike the sites on the English side of the Border, none of these sites has been subjected to additional radiocarbon sample selection or dating. The dates presented and modelled in the following sections are in a sense wholly 'inherited'. The sites were excavated at different times and with different prerogatives and techniques over the past three decades. Furthermore, the radiocarbon dating that was undertaken was, in some cases, carried out without following the same exacting and rigorous criteria that are applied today. The result is that the modelling of the sites has met with varied levels of success for interpretation.

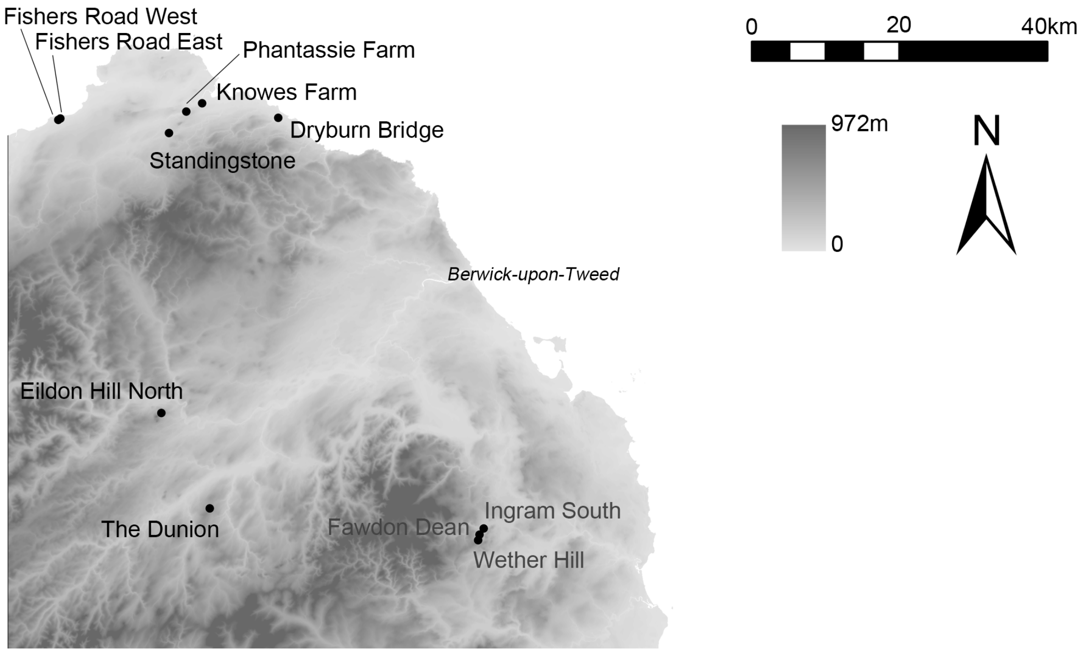

Figure 7.1: Shaded relief map showing the location of the settlements modelled from south-east Scotland and discussed in the text. The three sites from the Cheviot Hills sub-region appear with their names in grey text

7.2 Dryburn Bridge

7.2.1 Site description

Dryburn Bridge (NT 724 755) is the site of a cropmark enclosure that lies approximately 5.5km south-east of Dunbar and 1km in from the North Sea coast. It was excavated in 1978 and 1979 by Jon Triscott and David Pollock with funding from the then Ancient Monuments Branch, Scottish Development Department (Historic Scotland) (Fig. 7.2.1). The excavations revealed activity at the site spanning the Mesolithic to the Roman Iron Age. Although an interim report was published by the excavators shortly following the excavation (Triscott 1982), the site was only fully reported on by Dunwell (2007).

The pre-Iron Age activity includes a Mesolithic chipped stone assemblage, a pit with Impressed Ware, and two Bronze Age Cist burials. It is suggested that the site was settled by the middle of the 1st millennium cal BC. This occupation consisted of at least three discernible phases, of which two are most certainly continuous. It remains unclear if there was a break between the second and third phases.

The first two phases of settlement are characterized by timber roundhouses, rectangular post structures, and a cemetery all within a palisaded enclosure. Phase 1 has the large outer palisade and at least two, but probably three, post-built structures (Houses 1, 6, and 10). In Phase 2, the northern house was removed and replaced by a secondary internal enclosure. Two more structures were built (Houses 2 and 9).

The third phase of activity stretches into the Roman Iron Age and sees the site becoming unenclosed. House 2 from Phase 2 may have been expanded at this time (although if there is a gap in settlement House 2 may have been expanded during Phase 2). The ring-ditch structures (Houses 3, 7, and 8) were constructed at this time with Houses 3 and 8 clearly overlying the earlier enclosure ditch.

Of the material culture from the site, the pottery is primarily of a mid-second and mid-first millennia BC type of coarseware, while an iron sickle that was discovered on the site is of a type that first appears in the late pre-Roman Iron Age, although is more commonly found in Roman contexts. A single rim-sherd of blue-green bottle glass of Roman origin is thought to date to AD 70–200.

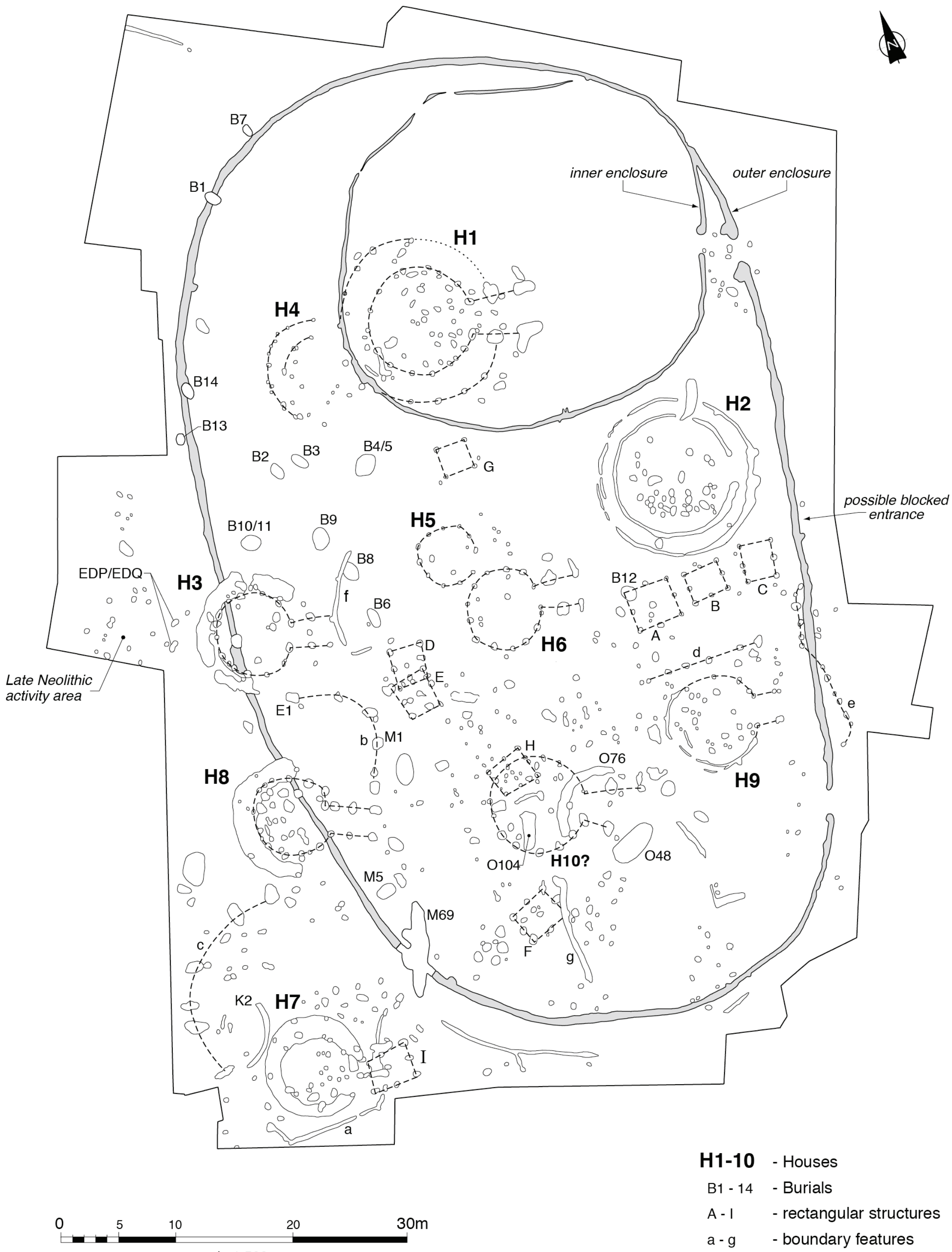

Figure 7.2.1: Site plan for Dryburn Bridge (Dunwell 2007, illus. 3)

7.2.2 Sample specifics

A total of 50 radiocarbon dates has been accumulated over the years. The earliest samples were submitted in 1979, while the most recent results are from 2005. These 50 samples come from 20 discrete contexts, 14 of which are human burials.

7.2.3 Discussion of Dates

Although Dryburn Bridge is well-known in the literature for the Iron Age settlement, it is the inhumations in the north-west quadrant of the site that have received the bulk of the attention when the site was radiocarbon dated. Individual burials have been measured up to four times across three tranches of sample submissions between 1979 and 2005. Ten of the burials have three or more associated results. It is perhaps necessary here to recap Dunwell (2007) to better understand the reasons why the same burials were dated on multiple occasions.

The earliest measurements (GU-), made in 1980, were deemed too imprecise. While the original errors associated with these measurements range from ±70 to ±180 radiocarbon years, all of these early results had the errors adjusted as per Ashmore et al. (2000) and effectively doubled. The apparent imprecision led to a second tranche of radiocarbon measurements. This tranche was pretreated and processed to graphite targets at SUERC and measured by the AMS facility at the University of Arizona. Unfortunately, a few of these results were not only in disagreement with the earlier results from the same material, but also in some cases much younger than would be expected (Dunwell 2007, 5). The fact that some of these samples had low “collagen” yields is cited as a possible reason for the discrepancy in these dates. A third tranche was submitted and this second tranche was summarily excluded from the final report in favour of the first and third set of results.

The relationship between “collagen” yield – the amount of extracted prehistoric collagen per sample mass and given as a percentage – and the reliability of the radiocarbon result is not straightforward. There are many factors that can, and do, affect the quality of the final radiocarbon result on bone samples many of which are detailed in Van Klinken (1999). The indicators that should be investigated include “collagen” yield, % carbon, C:N, $\delta^{13}C$, and amino acid profiles. Van Klinken (1999) provides a threshold “collagen” yield of 0.5% below which the bone “collagen” is deemed ‘poor/low’, while in the range 0.5–1.0% is considered marginal.

Sample	Laboratory ID	Radiocarbon Age (BP)	$\delta^{13}C$ (‰)	% "collagen" yield	% Carbon
Burial 1	GU-1149	2210 ±70	-21.5	19.4	9.5
	AA-53706	2280 ±50	-20.6	4.3	11.8
	SUERC-4068	2485 ±35	-20.4	---	31.8
Burial 2	GU-1404	2400 ±100	-21.8	---	18.2
	AA-53707	2265 ±50	-21.2	2.3	9.9
	SUERC-4069	2435 ±35	-21.1	---	12.7
Burial 3	GU-1405	2665 ±165	-20.4	---	6.6
	AA-53708	2325 ±50	-21.1	4.2	13.1
	SUERC-4070	2455 ±35	-20.6	---	30.4
Burial 4	GU-1406	3850 ±160	-21.4	---	8.6
	AA-53709	3755 ±55	-20.7	2.1	28.6
	SUERC-4071	3765 ±35	-20.4	---	28.5
	SUERC-4082	3760 ±40	-20.1	---	17.8
Burial 5	AA-53710	3340 ±75	-20.4	2.5	7.5
	SUERC-4072	3615 ±40	-21.8	---	7.1
	SUERC-4083	3725 ±35	-21.0	---	26.2
Burial 6	GU-1410	2415 ±80	-20.9	---	24.5
	AA-53711	1880 ±45	-23.0	2.5	2.6
	SUERC-4073	2380 ±35	-21.7	---	9.7
	SUERC-4084	2400 ±35	-21.2	---	14.7
Burial 8	AA-53713	1685 ±50	-22.4	4.8	8.5
	SUERC-4412	1705 ±40	-23.6	---	3.4
Burial 9	GU-1412	2300 ±125	-21.6	---	15.7
	AA-53714	2040 ±70	-20.8	7.7	24.7
	SUERC-4074	2435 ±35	-21.0	---	11.2
Burial 10	GU-1408	3620 ±85	-20.6	---	33.9
	AA-53715	3660 ±55	-20.8	2.7	24.8
	SUERC-4078	3755 ±35	-21.2	---	22.5
Burial 11	GU-1409	3550 ±80	-23.1	---	14.5
	AA-53716	3765 ±60	-21.0	3.0	24.5
	SUERC-4079	3720 ±35	-21.7	---	15.0
Burial 13	GU-1414	2040 ±180	-20.8	---	23.7
	AA-53718	2300 ±45	-20.7	6.7	8.1
	SUERC-4088	2450 ±35	-20.8	---	37.4
Antler	AA-53720	2290 ±55	-22.2	0.9	10.2
	SUERC-4938	2320 ±40	---	3.3	23.5
Dog	AA-53721	1830 ±45	-21.3	14.4	11.4
	SUERC-4939	1830 ±40	---	4.4	21.5

Table 7.2.1: ^{14}C dates on bone samples from Dryburn Bridge with extra laboratory information ($\delta^{13}C$, % "collagen" yield, and % Carbon) used for evaluating the reliability of the result

This is substantially lower than Ambrose (1990) who sets a range of 1.2–1.8% for the transition from well-preserved to poorly-preserved prehistoric human bone. The data for both researchers derives from differing geographical areas, with Van Klinken's data coming from temperate Europe and Ambrose's from East Africa where collagen loss is known to be much more rapid. Since the Dryburn Bridge samples are from northwestern Europe, one might expect Van Klinken's thresholds to be more relevant, at which point only one sample is marginal (AA-53720) and none are poor with regards to % "collagen" yield. If the threshold is raised to match Ambrose's 1.8% there is still just the one sample below the limit. To further complicate the matter of "collagen" yields for the Dryburn Bridge samples, with the exception of GU-1149, SUERC-4938, and SUERC-4939, only the second tranche of samples had % "collagen" yield reported and logged. It is, therefore, impossible to compare these data with earlier and later samples to determine if any of these samples is unusually low with respect to their replicates.

A second measure is % carbon, and Van Klinken (1999, 691) suggests a 2-sigma range of 17–53% (34.8 ±8.8%) as acceptable for prehistoric human bones samples. Using this measure 5 of the 14 (36%) second tranche human bone results are within the acceptable limits, but then 7 of the 17 (41%) human bone results from the first and third tranches are within these same limits, so that there is no real difference between the sets.

A third useful indicator for examining the reliability of a radiocarbon result on bone is the ratio of carbon to nitrogen (C:N). The work of DeNiro (1985) has shown that acceptable results are usually found in the range of 2.9–3.6, though it should always be kept in mind that results outside of these limits do not necessarily mean the dated material was poor, but rather that it should be more closely scrutinized. Although standard practice today at the SUERC laboratory, at the time all of the Dryburn Bridge samples were run the measuring of the nitrogen value and reporting of C:N values for human bone samples were an additional step in the process that was rarely undertaken (Cook pers. comm.).

A fourth indicator is the $\delta^{13}C$ value that is measured as part of the dating process. Hedges and Van Klinken (1992, 283) define the normal limits as -19 to -22‰, and also state that during gelatin extraction associated with the pretreatment of bone it is not uncommon for those values to deviate greater than 2‰. This means that radiocarbon results on bones with more depleted $\delta^{13}C$ values could possibly be giving a ^{14}C age that is too young, while enhanced values could be too old. The $\delta^{13}C$ value is the only one that is available for all of the bone results. A number of the human bone samples have $\delta^{13}C$ values that fall outside of the normal limits but within the limits of common deviation: AA-53711 (Burial 6); AA-53712 (Burial 7); AA-53713 (Burial 8); SUERC-4412 (Burial 8); GU-1409 (Burial 11); and AA-53717 (Burial 12). The possibly problematic results are spread across all three tranches of dating and do not signal an isolated problem.

Burial	Chi-square	Pass/Fail	Expected Period
1	T'=18.8; ν=2; T'(5%)=6.0	Fail	Iron Age
2	T'=7.7; ν=2; T'(5%)=6.0	Fail	Iron Age
3	T'=6.8; ν=2; T'(5%)=6.0	Fail	Iron Age
4	T'=0.3; ν=3; T'(5%)=7.8	Pass	Bronze Age
5	T'=21.8; ν=2; T'(5%)=6.0	Fail	Bronze Age
6	T'=98.1; ν=3; T'(5%)=7.8	Fail	Iron Age
8	T'=0.1; ν=1; T'(5%)=3.8	Pass	Roman/post-Roman
9	T'=24.9; ν=2; T'(5%)=6.0	Fail	Iron Age
10	T'=3.5; ν=2; T'(5%)=6.0	Pass	Bronze Age
11	T'=4.8; ν=2; T'(5%)=6.0	Pass	Bronze Age
13	T'=10.5; ν=2; T'(5%)=6.0	Fail	Iron Age
dog	T'=0.0; ν=1; T'(5%)=3.8	Pass	Roman
antler	T'=0.2; ν=1; T'(5%)=3.8	Pass	Iron Age

Table 7.2.2: Results of chi-square tests on replicate ^{14}C measurements from the same bone or burials from Dryburn Bridge

Based on the data at hand, there is no scientific rationale for excluding an entire tranche of results from any discussion of the radiocarbon dating of Dryburn Bridge. Furthermore, the conclusions of Ashmore et al. (2000), resulting in the inflation of errors for GU-1500 and lower results, were made prior to the full analysis and publication of data from the Third and Fourth International Radiocarbon Intercomparison studies (TIRI and FIRI) (Scott 2003), which both suggest that the measurements and errors quoted by SUERC (then SURRC) are reliable. Therefore the 'adjusted' errors are overcautious, and should be viewed as likely erroneous.

One method for cross-checking the consistency between two or more radiocarbon measurements on the same sample is a chi-square test amongst the results from a single burial (Table 7.2.2). Where all the results pass within 2-sigma those results can be combined with a weighted mean as described by Ward and Wilson (1978). Where they do not pass the test the other available data can be examined to determine which result(s) is likely to be erroneous, but as so few of the indicators are available and some are only available for a single tranche of results even those data are probably less than satisfactory to evaluate the individual measurements.

Seven of the 13 date groups on burials fail to pass a chi-square test, and so the measurements in those groups are statistically significantly different. Perhaps striking and important to note here is that with the exception of one of the Bronze Age cist

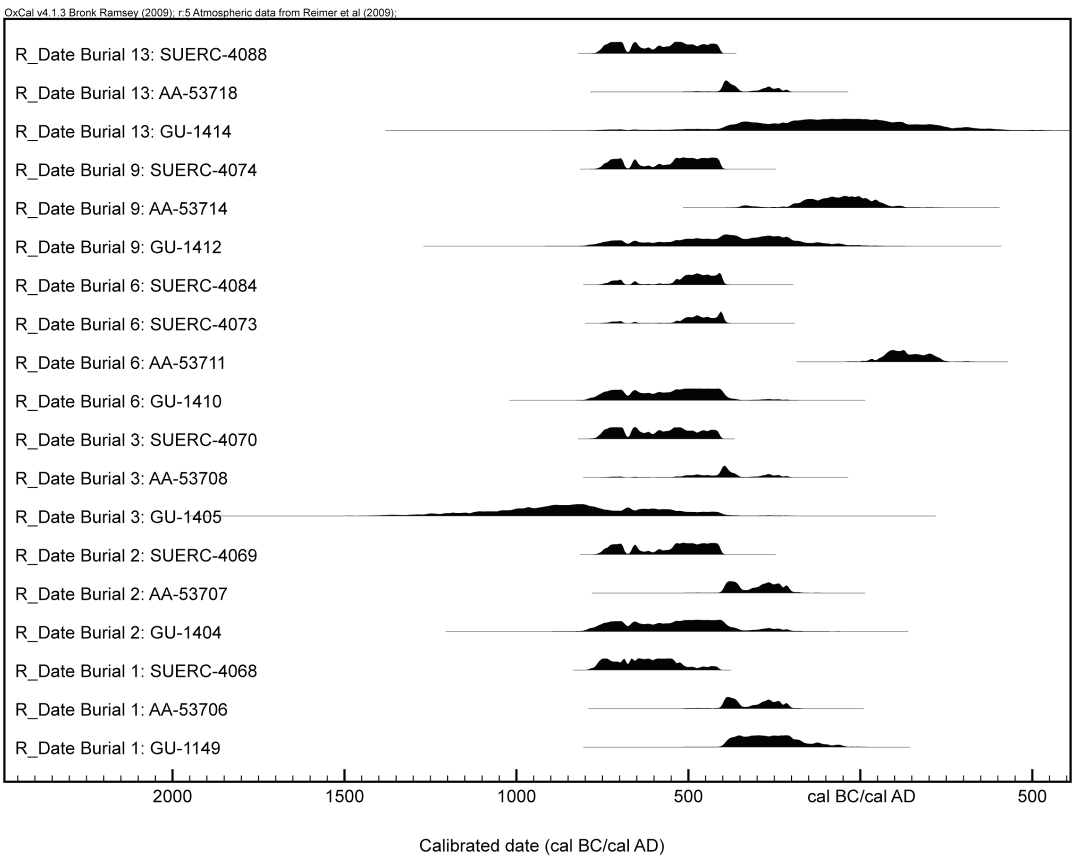

Figure 7.2.2: Probability distributions of calibrated radiocarbon results from human burials from Dryburn Bridge with replicate measurements. The figure also illustrates the effect the plateau at 800–400 BC can have on the width of the calibrated probability

burials (Burial 5), all the other burials that failed their chi-square tests were of Iron Age date. Not only were they Iron Age in date but, with the exception of AA-53711 (Burial 6), all the results cluster around 400 cal BC (Fig. 7.2.2). Burials 6, 8, and 11 were highlighted above as containing results with suspect $\delta^{13}C$ values and so possibly incorrect radiocarbon ages. Burial 6 was the only one of those three that failed its chi-square test.

Removing the obviously erroneous result from Burial 6 (AA-53711), the remaining three measurements pass a chi-square test (T'=0.3; v=2; T'(5%)=6.0) and so can be combined to form **Burial 6 mean** (2392 ±24BP). The other five Iron Age burials (Burial 1, 2, 3, 9, and 13) are not as easy to evaluate. Burials 2 and 3 just fail the chi-square

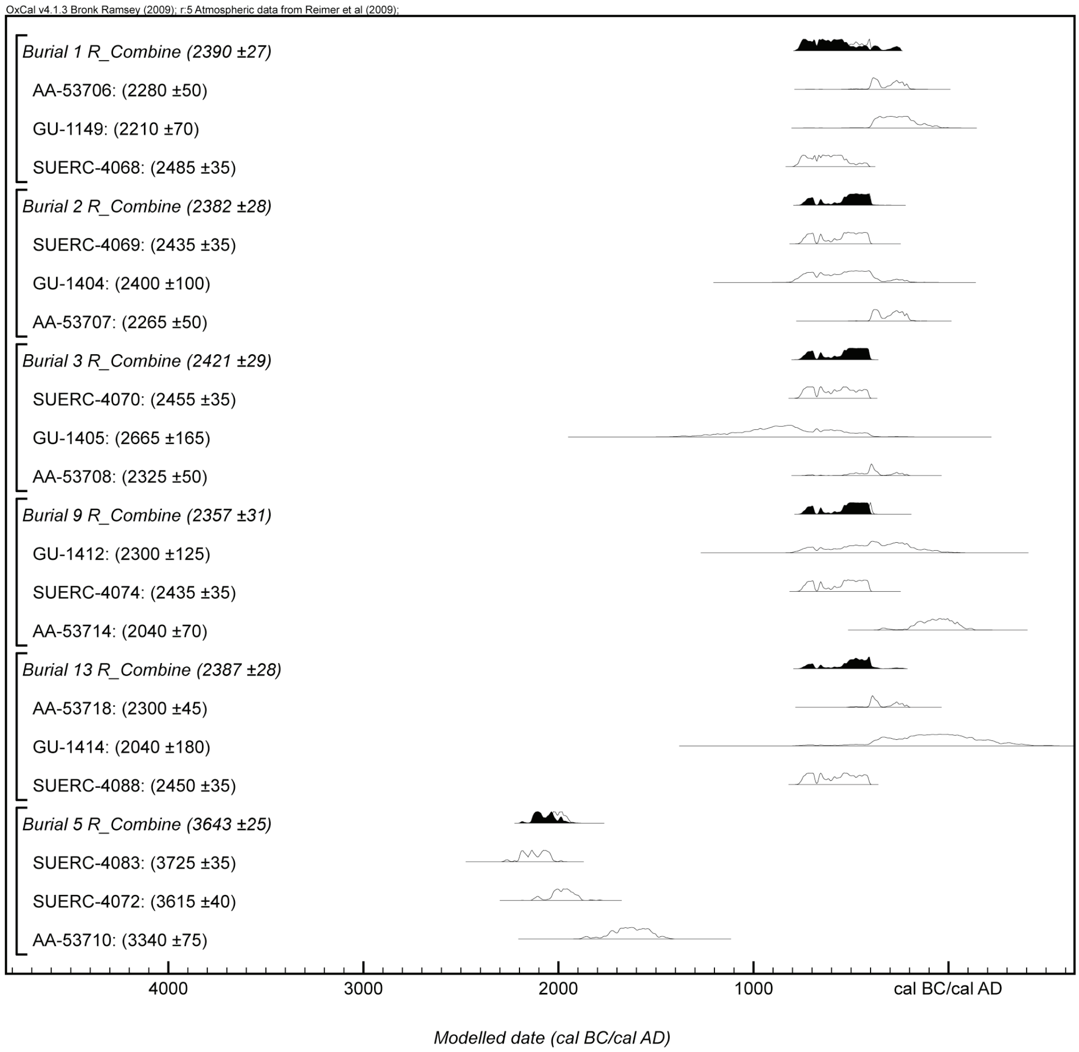

Figure 7.2.3: Probability distributions showing calibrated radiocarbon results from human burials from Dryburn Bridge in outline and the combined probabilities that are a result of the Bayesian outlier analysis

at 2-sigma, but both pass at 3-sigma. The real problem here probably has less to with measurements that are inaccurate, although we should expect that 1 in 20 will lie outside the quoted error, and has more to do with an increase in the variability between the measurements.

Referring back to the relevant section of the radiocarbon calibration curve (Fig. 3.1) we see the plateau of 800–400 cal BC descending rapidly before a deep wiggle and levelling again at about 370 cal BC. The effect here is that a period of 30 ‘real’ years is spanned by 150+ radiocarbon years. What this means is that it is quite possible in this area of the radiocarbon calibration curve to have two measurements that on their own would calibrate to encompass the calendar date with a 95% probability, but are separated enough in terms of radiocarbon years that they fail a chi-square test. To illustrate, two radiocarbon dates were simulated in OxCal with a ‘real’ calendrical date of 400 BC. The simulated radiocarbon ages (BP) were 2406 and 2285. These two dates were subjected to chi-square tests and given errors of ±30, ±40, and ±60 years. At both 30 and 40 years the chi-square test failed at 95%. Only at 60 years did the two measurements pass. With that in mind, the early GU measurements that Ashmore et al. (2000) suggested should have the errors inflated were adjusted, but still none of the chi-square tests that previously were marginal passed.

Fortunately there is a methodology that is implemented in OxCal in the form of Bayesian outlier detection that allows for the outliers to be detected within a group of results, with the effect of down-weighting the impact of the outliers on the resulting combined probability. The method was first proposed by Christen (1994) with the OxCal implementation described in Bronk Ramsey (2009b). The resulting probabilities for the Bronze Age cist burial (5) and the Iron Age burials (1, 2, 3, 9, and 13) are given in black in Figure 7.2.3, while the calibrated probabilities for the dates are given in outline. These new probabilities were then extracted and used in the model for Dryburn Bridge discussed below.

7.2.4 Model description

The site at Dryburn Bridge has had 14 human burials, one dog burial, an antler pick, and contexts from a fence line and two of the possibly 10 roundhouses dated (Fig. 7.2.4). The activity on the site is dominated by Bronze Age cist burial and Iron Age burial and settlement features. Although a Bayesian model has been produced from the radiocarbon results, the model is most robust for estimating dates for burial activity.

Many settlement features remain undated including nine rectangular structures (i.e. four-posters), various screens and fence lines, along with the two palisade trenches and the remaining eight roundhouses. If the burials took place throughout the settlement use then the results from a model dominated by burials will still produce valid estimates for the date of the settlement, but if the burials are solely from the earliest or latest use of the settlement then the extension of using their dating to date the settlement becomes invalid.

Bronze Age cists

Two Bronze Age cist graves were excavated and dated at Dryburn Bridge. Each cist contained one articulated burial (Burials 5 and 10) that had a disarticulated burial (Burials 4 and 11) above it. Although the stratigraphic order (reflected in the site matrix) places Burial 4 over 5 and Burial 11 over 10, this is not necessarily a reflection of the order in which the individuals died. Dunwell (2007, 29–30) has determined that given the osteological and archaeological evidence, it is unlikely that the two burials in each cist represent separate burial events but rather the burial of a primary body articulated and fleshed at the same time as a second body that had been defleshed and disarticulated. Since the stratigraphic relationship between the two burials within a cist cannot be used to order their interment, and since the disarticulated skeleton could have been interred at any point in time after death, the two burials within each cist have been modelled as belonging to an unordered group.

- The four results from Burial 4, from Bronze Age cist 1, are statistically consistent (T'=0.3; v=3; T'(5%)=7.8) and have been combined to form **Burial 4 mean** (3763 ±24BP);

- The three results from Burial 5 have been combined following the Bayesian outlier analysis described above;

- The three results from Burial 10, from Bronze Age cist 2, are statistically consistent (T'=3.5; v=2; T'(5%)=6.0) and have been combined to form **Burial 10 mean** (3717 ±28BP);

- The three results from Burial 11, from Bronze Age cist 2, are statistically consistent (T'=4.8; v=2; T'(5%)=6.0) and have been combined to form **Burial 11 mean** (3709 ±29BP).

Figure 7.2.4: Site matrix for dated and modelled feature groups at Dryburn Bridge

Iron Age settlement and later

Human and animal bone

There are 10 dated human burials that are not related to one another stratigraphically and when excavated were all thought to be Iron Age in date. Two human burials (Burial 1 and 14) and the dog burial cut the palisade trench. Although there was no material dated from within the palisade trench, or from any contexts that it cut, these burials can be used to calculate a *terminus ante quem* date for the disuse of the palisade.

- The results from Burials 1, 2, 3, 9, and 13 have all been combined following the Bayesian outlier analysis outlined above;

- The four results from Burial 6 are not statistically consistent (T'=98.1; v=3; T'(5%)=7.8). If AA-53711 (1880 ±45BP) is excluded the remaining three measurements are statistically consistent (T'=0.3; v=2; T'(5%)=6.0) and have been combined to form **Burial 6 mean** (2392 ±24BP) as mentioned above;

- The two results from Burial 8 are statistically consistent (T'=0.1; v=1; T'(5%)=3.8) and have been combined to form **Burial 8 mean** (1697 ±32BP);

- There is one result each on Burial 7 (AA-53712), Burial 12 (AA-53717), and Burial 14 (AA-53719);

- Furthermore an antler, from a putative pick recovered from the base of a large pit, was dated along with a dog burial;

- The two results from the antler are statistically consistent (T'=0.2; v=1; T'(5%)=3.8) and have been combined to form **antler mean** (2310 ±33BP);

- The two results from the dog burial are statistically consistent (T'=0.0; v=1; T'(5%)=3.8) and have been combined to form **dog mean** (1830 ±29BP).

Roundhouses

Two results (GU-1287 and AA-53703) are available from oak charcoal recovered from a posthole associated with the inner ring-groove of House 2, which lies within the bounds of the palisaded enclosure.

At some point the house is thought to have been expanded at which time the outer ring-groove was formed. Four results (GU-1257, -1283, -1284, and AA-53705) are available from this phase of activity from what has been identified as either oak wood or oak charcoal from an outer ring groove post. It is unclear whether or not all of these samples originated from the same timber, especially given some samples have been identified as wood and others as charcoal. They have been included in the model as representative of dating this phase of activity.

Two results (GU-1286 and AA-53704) are available from House 9, a ring-groove house similar in form to House 2, but smaller in size, and also within the palisaded enclosure boundary. The results come from oak charcoal in a pit/posthole and door post respectively and both of which have been identified as L112.

One result (GU-1285) is available from a bulk sample of alder, hazel, willow, and birch charcoal from a fence line (K5) associated with House 7, a ring-ditch house outside of the palisaded enclosure and that likely post-dates enclosure activity since the other similar houses overlie the palisade.

The results from the posts associated with Houses 2 and 9 are all on oak charcoal. These samples present a few problems in that firstly, while it does appear some samples derive from the same posthole/stump (GU-1257/AA-53705; GU-1283/4; and GU-1287/AA-53703) it is not necessarily explicit. Secondly, the descriptions vary slightly between publication with some stating the material was charcoal from the posthole and at other times a sample is said to derive from the charred post stump. Given that none of the oak samples have been identified as sapwood or heartwood presents a further complication as the ‘old wood’ effect could come into play, especially since the post-pits in House 2 were reported as being as much as 0.5m in diameter (though the dimensions of any given post is not given in the final report). As such, these dates have been included in the model as providing a *terminus post quem* for their respective contexts. On the other hand, the bulk charcoal result (GU-1285) from the fence associated with House 7 has been included as providing a reliable result for activity associated with the gully as it has all been identified as short-lived material, although some may prefer to model this as a *terminus post quem* as well.

Modelling the settlement

From the settlement, only structures associated with Phases 2 and 3 have been dated. The interpretation of the site is one that sees House 2 extending from Phase 2 into 3, or into the Roman period, either through continuous use or reuse and expansion, while House 7 is firmly placed within Phase 3. It is unfortunate that there are no radiocarbon dates on contexts/material associated with any of the Phase 1 structures. As such the model that is presented will only accurately reflect the start of the settlement if the Iron Age burials were taking place throughout the use of the settlement and not only at the end (discussed below).

Although the matrix shows the lack of stratigraphy between samples associated with the settlement, there are a few features that appear substantially to be later than the majority of activity. As mentioned above, the style of House 7 places it in a group with two other houses that overlie the palisade trench thus placing these houses firmly in a later open phase of settlement use in the Roman Iron Age. Also, Burial 8 and the dog burial that cuts the palisade trench appear to belong to this Roman Iron Age phase of activity. Furthermore, two burials (7 and 12) group together in the early medieval period. While there are archaeological grounds for placing House 7 and the dog burial later than the enclosed phase (they cut the palisade trench), the groupings of these later dates into a Roman Iron Age and early medieval phase are a construct of a subjective evaluation of the calibrated dates. The three phases have been placed in a sequential order where the model is told that the Iron Age material is earlier than the Roman material, which is in turn earlier than the early medieval material.

7.2.5 Model results

The model (Fig. 7.2.5) shows good agreement between the prior information (i.e. stratigraphy and phasing) and the radiocarbon dates (A_{model}=119).

Given that Dunwell (2007, 30) accepts that there is the possibility that reburial, or secondary deposition within a cist, took place, the model allows for that while maintaining that all the burials are chronologically unordered. This means the model allows for the different hypotheses regarding single or multiple burial events within a cist, so that not only is a gap in time between two burials in a cist possible but also between the use of each cist. While the primary hypothesis is that the activity associated with each cist is thought to represent an individual event, the activity represented by the burial in the two Bronze Age cist graves spanned a period of *1–135*

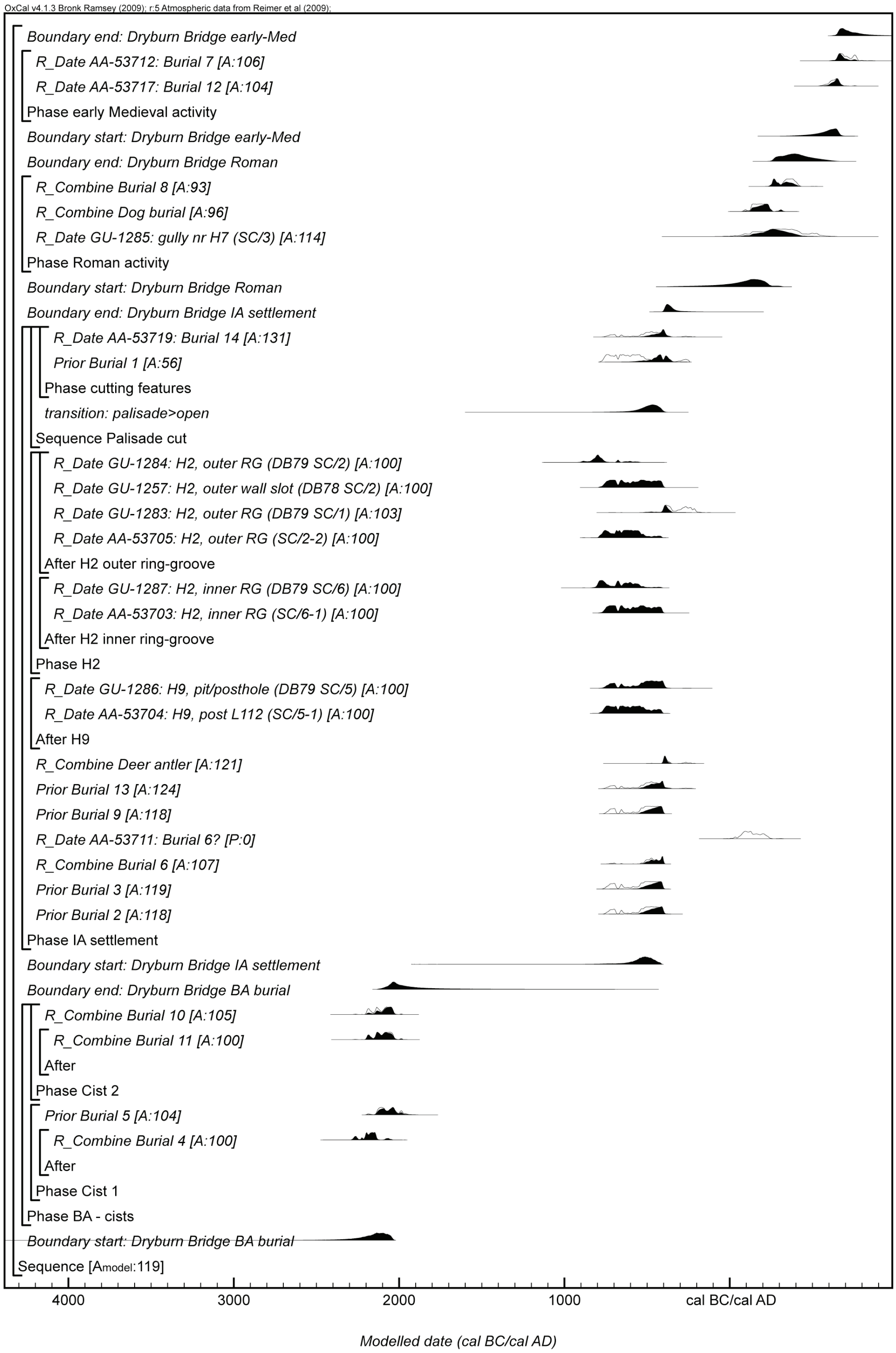

Figure 7.2.5: Chronological model for Dryburn Bridge. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

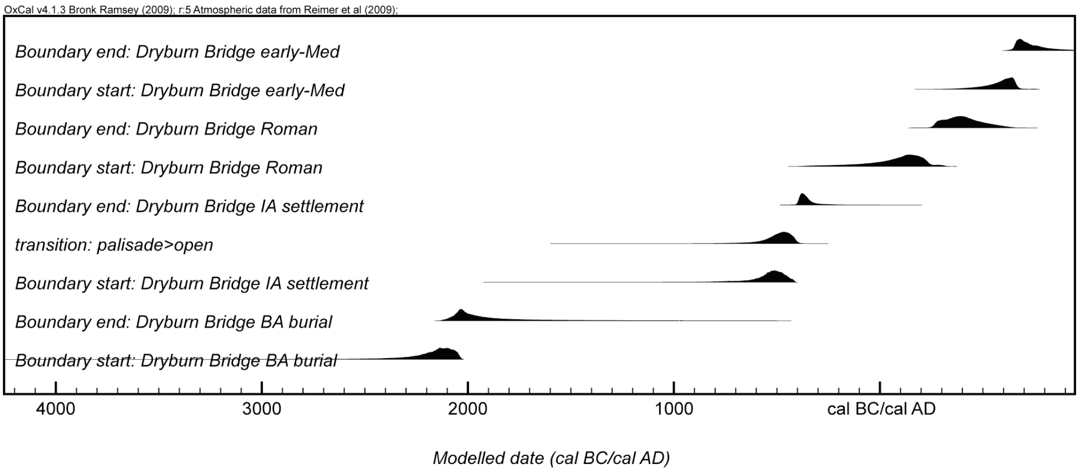

Figure 7.2.6: Probability distributions for event boundaries for the transition to an open settlement along with start and end estimates of the dated activity at Dryburn Bridge. The probabilities are extracted from the chronological model for Dryburn Bridge shown in Figure 7.2.5

years (*95% probability*; Fig. 7.2.7; *span: Dryburn Bridge BA burial*) and probably only *1–55 years* (*68% probability*). The burials began in *2525–2025 cal BC* (*95% probability*; Fig. 7.2.6; *start: Dryburn Bridge BA burial*) and probably *2220–2045 cal BC* (*68% probability*). The burials ended by *2135–1115 cal BC* (*95% probability*; Fig. 7.2.6; *end: Dryburn Bridge BA burial*) and probably by *2105–1840 cal BC* (*68% probability*).

If the measurements from all four burials in the cists, with the exception of AA-53710 that was given a 100% probability of being an outlier in the analysis above, are subjected to a chi-square test they pass (T'=19.1; v=14; T'(5%)=19.7) suggesting that they could all be the same actual age. This more likely indicates that the span of time represented by this dated activity is very short, but the four bodies could have died in the same year.

The dated Iron Age activity on the site began by *750–410 cal BC* (*95% probability*; Fig. 7.2.6; *start: Dryburn Bridge IA settlement*) and probably by *575–445 cal BC* (*68% probability*). That activity lasted for perhaps *10–280 years* (*95% probability*; Fig. 7.2.7; *span: Dryburn Bridge IA settlement*) and probably for *50–170 years* (*68% probability*). These phases of activity (Phases 1 and 2) ended in *415–220 cal BC* (*95% probability*; Fig. 7.2.6; *end: Dryburn Bridge IA settlement*) and probably in *400–340 cal BC* (*68% probability*). It should be stressed that given no direct settlement related material was dated from Phase 1, the *start* and *span* could be underestimates if the burials do not relate to the entire period of the Iron Age activity.

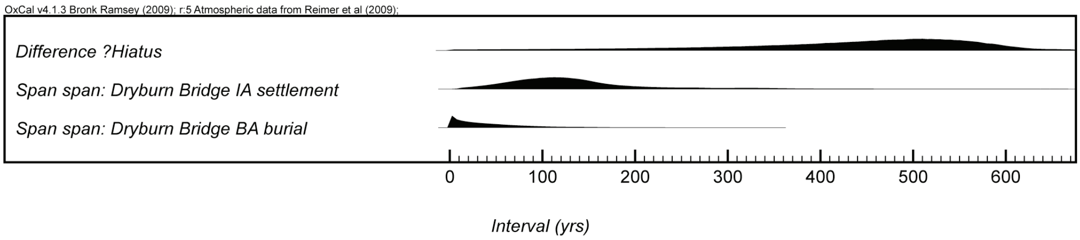

Figure 7.2.7: Probability distributions for the estimated spans of use in the Bronze Age and pre-Roman Iron Age along with the possible hiatus between the pre-Roman and Roman Iron Age use (calculated as *start: Dryburn Bridge Roman – end: Dryburn Bridge IA settlement*). All the probabilities are derived from the modelling shown in Figure 7.2.5

The palisade was out of use by *670–390 cal BC* (*95% probability*; Fig. 7.2.6; *transition: palisade>open*) and probably by *530–415 cal BC* (*68% probability*).

The archaeology shows that there is a shift in the settlement from the earlier timber-built to stone-built roundhouses although it provides no clues as to whether or not that shift was one in a spectrum of continuous activity. The Roman period of use as evidenced by the ring-ditch houses that form an open settlement along with the later dated burials imprecisely date these periods as a result of so few numbers of ^{14}C dates. However, the modelling suggests that the Roman reuse of the site occurred after *90–650 years* (*95% probability*; Fig. 7.2.7; *?Hiatus*) and probably *355–600 years* (*68% probability*). This Roman Iron Age period began in *235 cal BC–cal AD 305* (*95% probability*; Fig. 7.2.6; *start: Dryburn Bridge Roman*) and probably in *cal AD 20–210* (*68% probability*). All dated activity on the site ended in *cal AD 620–1010* (*95% probability*; Fig. 7.2.6; *end: Dryburn Bridge early-Med*) and probably in *cal AD 650–780* (*68% probability*).

7.2.6 Discussion

The radiocarbon dating and Bayesian modelling of Dryburn Bridge indicates a site with a slightly more complex history of use then previously interpreted. While there was clearly at least sporadic use of the site since the Mesolithic, in the Bronze Age people did visit the site and they buried at least four people in two cists. This activity may have taken place over a few generations, but given that the modelled results from the four bodies are not statistically significantly different they could all have died and buried in the same year.

Iron Age settlement

The results of the dating and modelling suggest that the Iron Age settlement and the Roman and later uses are at least two separate episodes of activity. This would situate two identifiable phases of Iron Age activity in the mid-first millennium cal BC.

Broadly, the first phase is enclosed and has post-built structures in it, including House 1, and probably Houses 4, 5, 6, 10 at various times during this phase. The second phase sees the construction of Houses 2 and 9, and based on their positions and orientations to the previous entrances their construction likely coincides with the settlement becoming unenclosed. Because of the lack of radiocarbon dates from the structures and/or associated features it is not possible to estimate when the transition from Phase 1 to 2 took place.

The dating of the Iron Age activity places a lot of weight on the burial activity on the site. If that activity is uniformly distributed through the two phases than the estimates for the *start*, *end*, and *span* of the Iron Age settlement should be accurate. If, however, the burial activity took place late in the settlement sequence (i.e. during the open phase only) then the model will have really only dated the later use.

If adequate and suitable material exists from settlement features, especially the Phase 1 structures and palisade trench, then it should be possible to refine this model substantially and produce more precise estimates while ensuring that the earliest phase is represented in the dating samples.

Post-Iron Age settlement use

The dating for the post-Iron Age use of the site is extremely imprecise as a result of so few dates covering a long period and should be regarded as only broadly dating activity in the Roman and later periods at the settlement. The dating from House 7, Burial 8, and the dog burial are more likely to be related to the Roman period of use, however, the extension of the dating of House 7 to Houses 3 and 8 can only be made through the assumption that these three houses are roughly contemporary.

Burials 7 and 12 would appear to be quite a bit later and may represent early medieval reuse of the site for burial that previously had been unidentified.

7.3 The Dunion

7.3.1 Site description

The Dunion (or Dunion Hill; NT 625 190) is a hillfort approximately 3km south-west of Jedburgh in the Scottish Borders. The hill has been subjected to quarrying over the years, and has been greatly reduced in size as a result. It was subject to archaeological investigations in 1961–2 and again between 1984 and 1986. Prior to the 1980s investigations, many of the known house platforms had been destroyed. As of 1987, quarrying activity on the site has ceased. Only a small portion of the original hill still remains (Fig. 7.3.1).

Excavations in 1961–2 focused on three houses, the wall of a fourth house, and six wall/defence segments (Fig. 7.2.2). While these excavation seasons were extremely short (3 and 2 weeks, respectively), the work established that the settlement was not medieval but later prehistoric in origin. Unfortunately this did nothing to slow quarrying and more than two decades would pass before further excavation took place.

Figure 7.3.1: Aerial photograph of The Dunion in 2007. The portion excavated in 1984–6 still exists in the northeast portion of the hill. Quarrying of the hill has stopped (© 2009 Google)

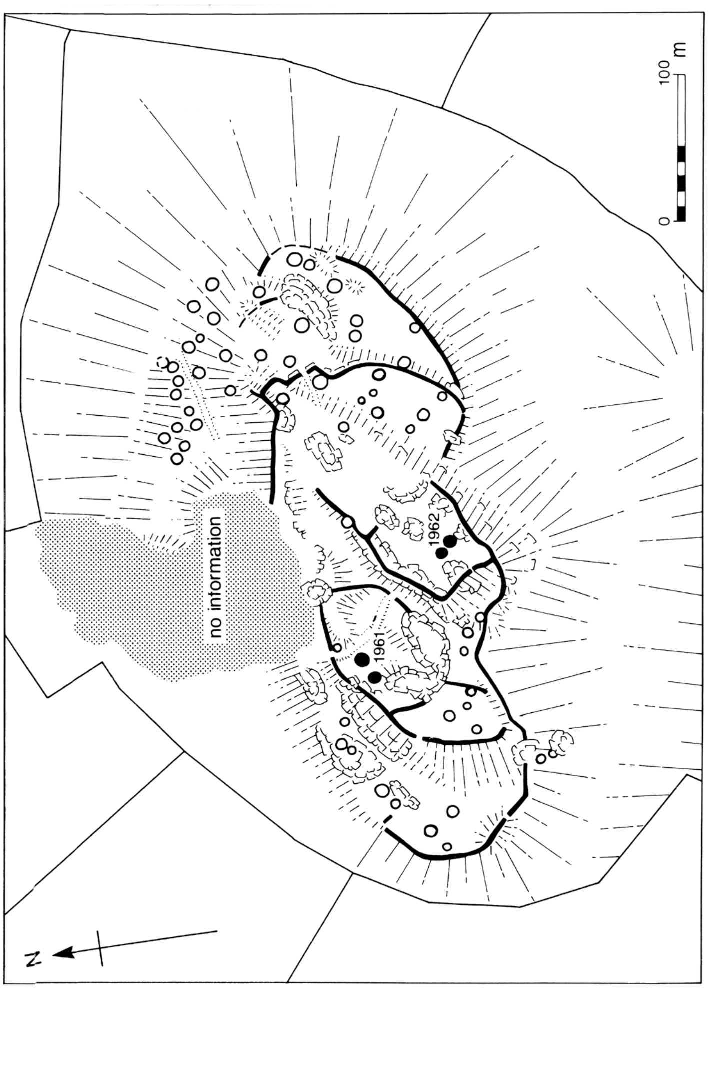

Figure 7.3.2: Plan of The Dunion (after Feacham 1961) showing location of houses excavated in 1961 and 1962 (Rideout et al. 1992, fig. 3.7)

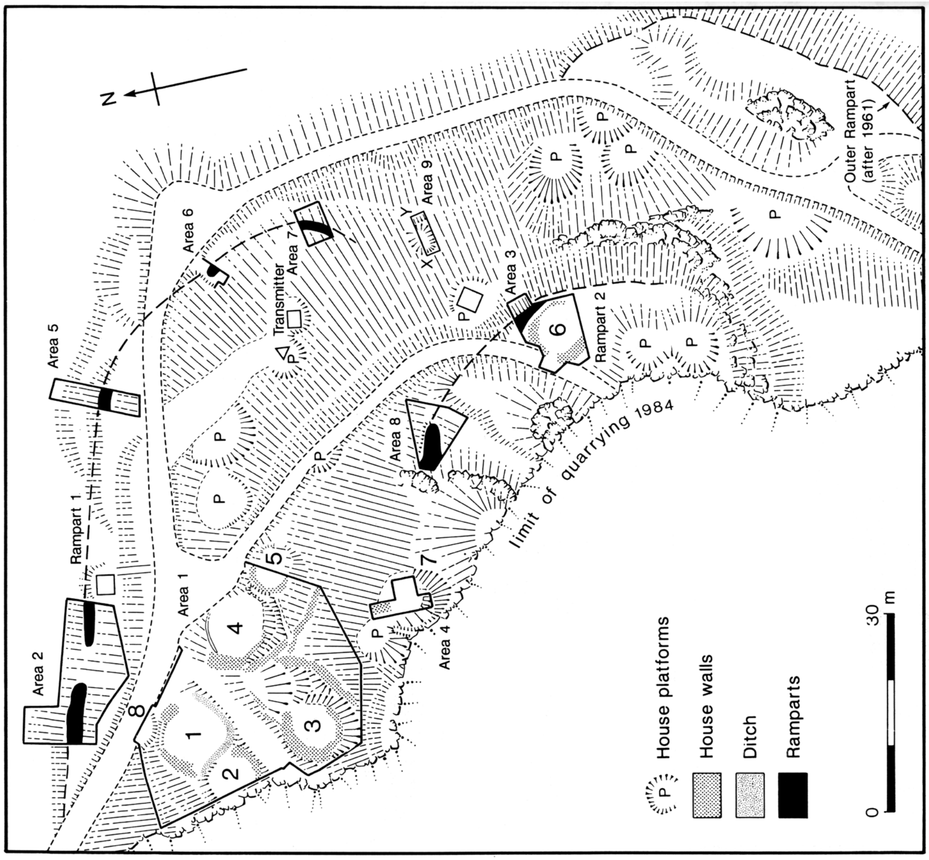

Figure 7.3.3: Plan of The Dunion showing areas excavated in 1984–6 (Rideout et al. 1992, fig. 3.8)

The later excavations, in the 1980s, were confined to what is thought to be the later portion of the site (Fig. 7.3.3). These excavations targeted houses and rampart segments across nine trenches. A series of radiocarbon and thermoluminescent dates were obtained for these excavations and, along with artefactual remains, established that this section of the site was likely to have been occupied at least in the final two centuries cal BC and the 1st or 2nd century cal AD.

More detailed information about the site and the excavation is provided by Rideout et al. (1992).

7.3.2 Sample specifics

A total of 8 samples of bulk charcoal was submitted for radiocarbon dating from pits, fill layers and a posthole. All but one (GU-2177) contained charcoal identified specifically as small diameter roundwood.

The stones from the hearths of three circular structures were sampled and processed for thermoluminescence dating (Appendix I, Table 3).

7.3.3 Model description

There is very little stratigraphy between not only the actual measured samples, but the feature groups as well (Fig. 7.3.4).

The two places where there are clearly stratigraphic relationships are:

- House 6 contains a pit feature (F9017), which produced a ^{14}C date, and is sealed by the wall and paving of the house, and there is a TL date from the hearth (F9014) in the house. These two measurements are used to provide an estimate for when House 6 was constructed;

- The drainage ditch for House 8 (F1710) cuts the ditch of House 1 (F1531) and so the measurements from these two features have been placed in a stratigraphic sequence. These two measurements are used to estimate when House platform 8 was constructed.

Otherwise, all other measurements are not stratigraphically related.

GU-2177 (5550 ±100BP) is a measurement on oak charcoal from a single posthole in House 7. This is the only sample that was noted as having come from large diameter oak, and so is likely long-lived. One suggestion for the antiquity of the post is that it might have been reclaimed from a bog. Similarly, though, there may be other unknown or undocumented problems that have caused this one measurement to be so early. In either case, the result has been excluded from the analysis.

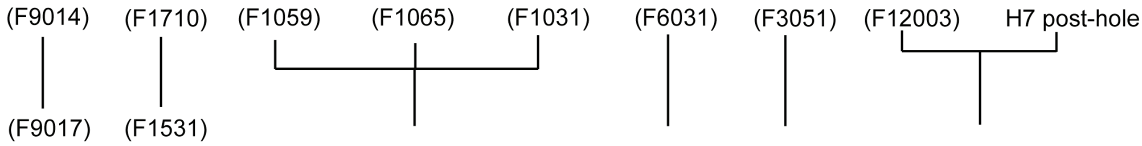

Figure 7.3.4: Site matrix of dated and modelled contexts from The Dunion

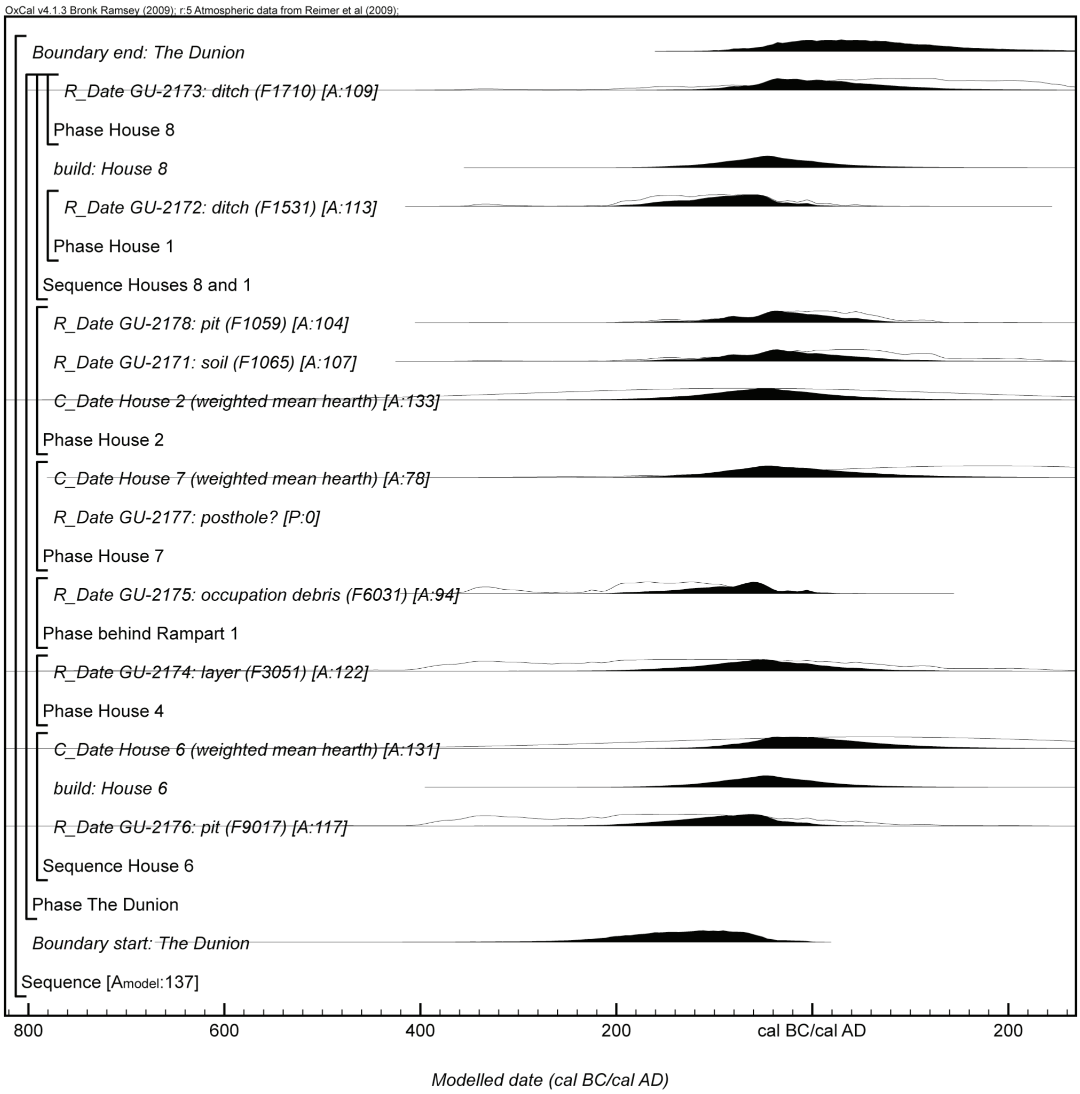

Figure 7.3.5: Chronological model for The Dunion. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

7.3.4 Model results

The model (Fig. 7.3.5) has good agreement between the radiocarbon and thermoluminescence results and the stratigraphy (A_{model}=132). The model estimates that the dated activity on The Dunion began in *270–5 cal BC* (*95%* probability; Fig. 7.3.6; *start: The Dunion*) and probably in *180–60 cal BC* (*68% probability*). Activity lasted for *1–445 years* (*95% probability*; Fig. 7.3.7; *use: The Dunion*), but probably for *20–260 years* (*68% probability*), ending in *95 cal BC–cal AD 245* (*95% probability*; Fig. 7.3.6; *end: The Dunion*) and probably in *45 cal BC–cal AD 110* (*68% probability*).

House 6 was constructed in *170 cal BC–cal AD 90* (*95% probability*; Fig. 7.3.6; *build: House 6*) and probably in *105 cal BC–cal AD 10* (*68% probability*). The house was in use for as many as *1–275 years* (*95% probability*; Fig. 7.3.7; *use: House 6; median 78 years*) and probably *1–125 years* (*68% probability*).

House 8 was constructed in *155 cal BC–cal AD 85* (*95% probability*; Fig. 7.3.6; *build: House 8*) and probably in *100 cal BC–cal AD 10* (*68% probability*). The house was in use for as many as *1–255 years* (*95% probability*; Fig. 7.3.7; *use: House 8; median 76 years*) and probably *1–120 years* (*68% probability*).

7.3.5 Discussion

The 1984–6 excavations of The Dunion covered less than 1/10 hectare of what had once been a greater than 3 hectare hilltop settlement. This area, the only scientifically-dated section, is along the north-east periphery of the settlement and has been thought to be the latest area of habitation. Therefore the results should be used with caution when evaluating archived settlement data from previous surveys and excavations. However, the results do help to present a snapshot of hilltop settlement on The Dunion in the later Iron Age (*c.* 2nd century BC–1st century AD). All of the radiocarbon results, with the exception of GU-2177, are statistically consistent (T'=5.9; v=6; T'(5%)=12.6) and could be of the same actual age. This suggests that this portion of the site may have been occupied for a very short span of time.

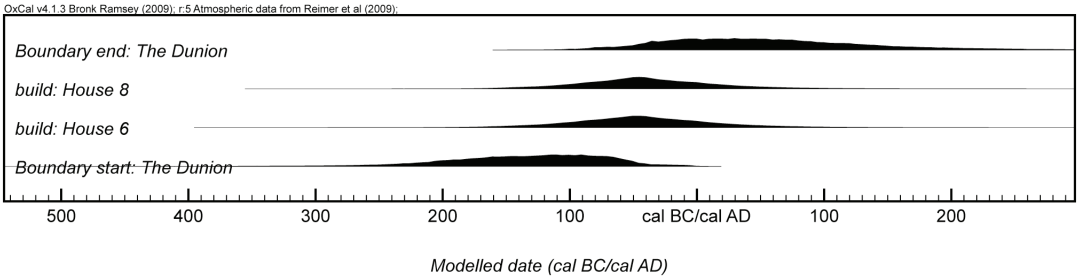

Figure 7.3.6: Probability distributions for event boundaries for the construction of Houses 6 and 8 and start and end of the dated activity on The Dunion. The probabilities are extracted from the chronological model for The Dunion shown in Figure 7.3.5

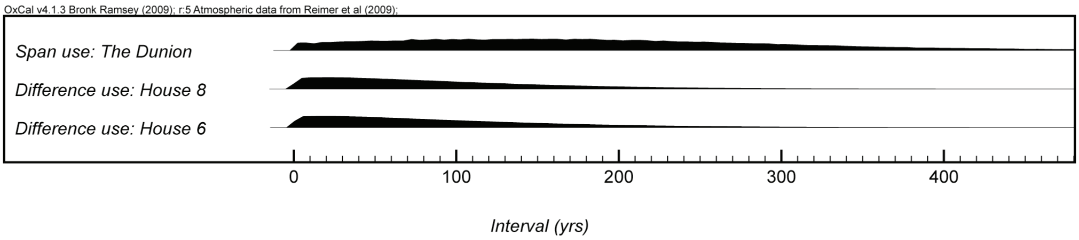

Figure 7.3.7: Probability distributions for the estimated spans of use of Houses 6 and 8, along with the entire dated portion of The Dunion. The probabilities are derived from the modelling shown in Figure 7.3.5

7.4 Eildon Hill North

7.4.1 Site description

Eildon Hill North (NT 555 328) is the most north-east of three summits of the Eildon Hills, lying in the Scottish Borders. The Eildon Hills rise out of the Middle Tweed Basin and can be seen from up to 40km away, clearly dominating the routes through the area. Furthermore, the site overlooks the Roman fort of Trimontium (Newstead), approximately 1.5km to the north-east, and established around AD 80. However, the only clear chronological distinction that could be made prior to excavation on the hill was that the putative Roman signal station post-dated the one native house platform it was built upon (Rideout et al. 1992) (Fig. 7.4.1).

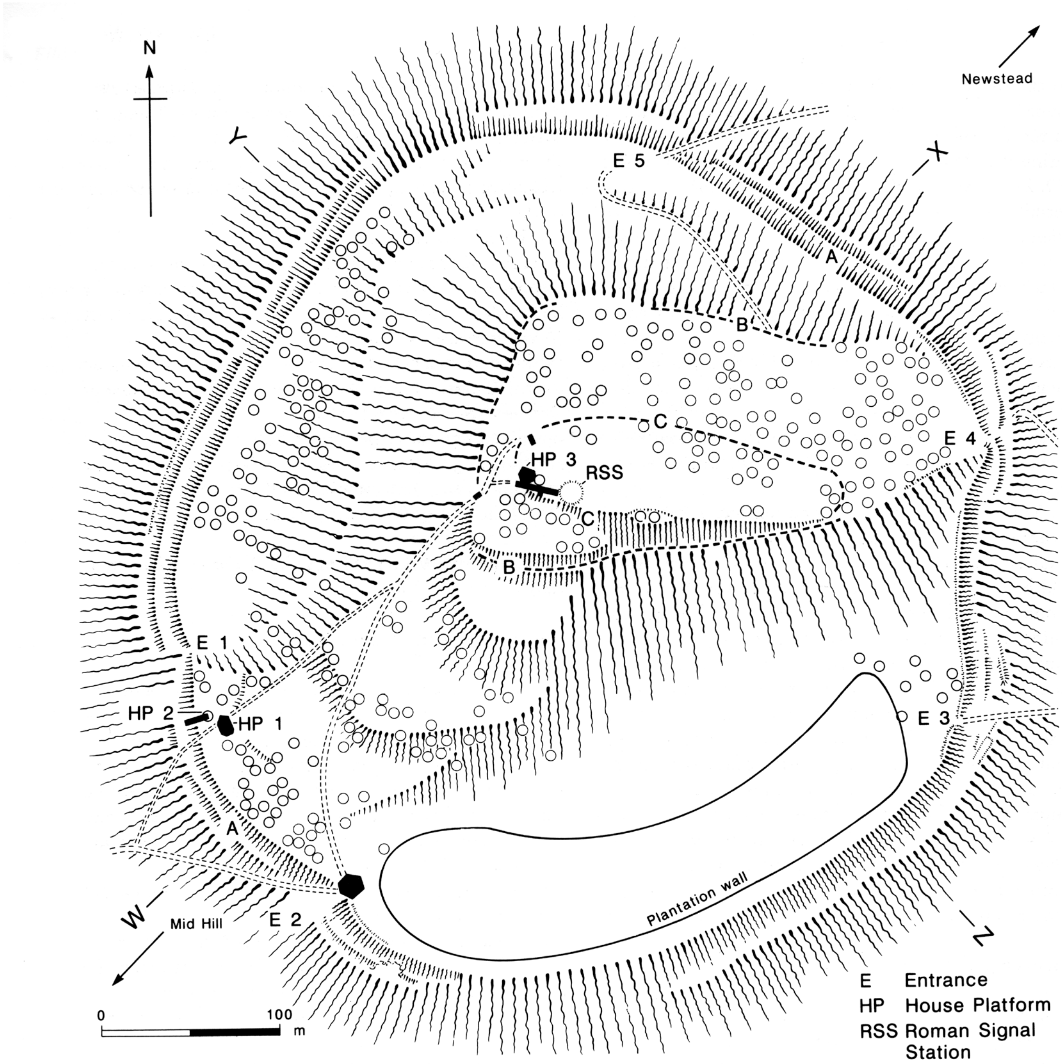

Figure 7.4.1: Eildon Hill North after RCAHMS survey in 1956 (Rideout et al. 1992, fig. 22)

The artefactual evidence at Eildon Hill North includes pottery dated to the 1^{st} millennium BC and a few fragments of Roman glass bead.

7.4.2 Sample specifics

A total of 13 samples of bulk charcoal was submitted from pits, fill layers and postholes. All but one (GU-2194; HP1, E1 hearth (a)) contained charcoal identified specifically as either coming from short-lived species or from small diameter roundwood.

7.4.3 Model description

The radiocarbon dating programme for Eildon Hill North concentrated on material from phases of three house platforms and two pre-rampart features (Fig. 7.4.2).

Radiocarbon dates are available from two pre-rampart features: a supposed hearth (GU-2190 and -2370) and a pit [2] (GU-2197). Given that the two results from the pre-rampart hearth are on identified bulked charcoal and statistically consistent (T'=2.4; v=1; T'(5%)=3.8), the results have been combined prior to calibration to form a weighted mean (2816 ±36BP). While these two features were not directly related stratigraphically, they were both overlain by the rampart in Area A, and the rampart was itself cut by the platform for House 2. From this building, samples were submitted from the hearth (GU-2372), as well as the charcoal-rich floor (GU-2196), which may be the

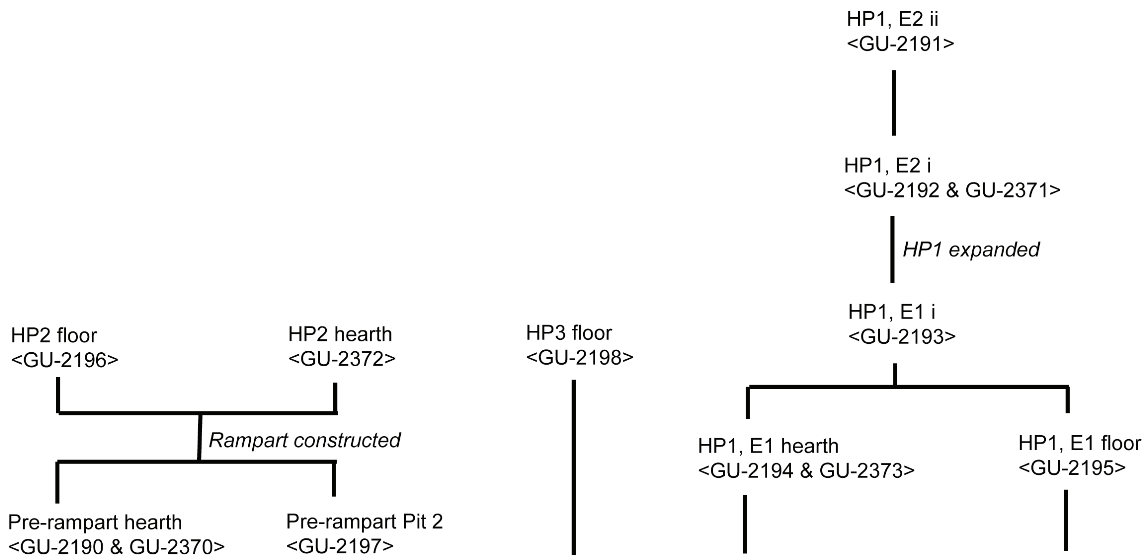

Figure 7.4.2: Site matrix of dated and modelled feature groups from Eildon Hill North

remnants of charcoal dispersion from the hearth. Since the rampart in Area A was constructed between the time of deposition of these two sets of samples, it is possible to use the latest of these two dates to provide a *terminus post quem* for the construction of the rampart in this area of the site.

A total of seven results is available from the two phases of House 1. Three samples represent the phase of use of House 1 and come from the hearth (GU-2194 and -2373) and floor (GU-2195). The two results from the hearth are not statistically consistent (T'=29.2; v=1; T'(5%)=3.8), given that this charcoal was not all identified as short-lived roundwood it is possible that the oak in GU-2194 (all oak was removed from GU-2373) is producing an old wood effect and so the result is included as a *terminus post quem*. This earlier period is followed by an episode of refuse filling from which GU-2193 is derived.

At some point after this, the platform for House 1 was expanded and cut deeper into the hill slope, marking the second discernible phase of use. From this, two results are available from the earlier use (GU-2192 and -2371) and one from the later infilling (GU-2191). The two results (GU-2192 and -2371) from the lower fill of House 1 (episode 2) are noticeably earlier than the third result (GU-2191) and the two results (GU-2196 and -2372) from House 2. It is possible that these two early results date an intermediate phase of use, but given the samples come from just above the interface of episode 1 and 2, which is noted as an indistinct boundary, it is more likely that these two results are on samples that contain an admixture of material from the dispersed hearth of the earlier house floor and the later reuse. Further support is provided by the observation that the lower level of episode 2 also contained a few fragments of pottery that refit with sherds found securely within episode 1 fills, with the idea being that much of this material was reworked during the construction of the new platform. These two results have, therefore, been included as *terminus post quem* dates for episode 1, lower.

Only one sample was submitted from the material of the charcoal-rich floor of House 3 (GU-2198). This house is not related stratigraphically to any other features on the site, but the date does help to situate the house within the overall chronological framework.

Although there are stratigraphic relationships that would make it possible to estimate the construction date for the rampart and the expansion of House 1, these numbers

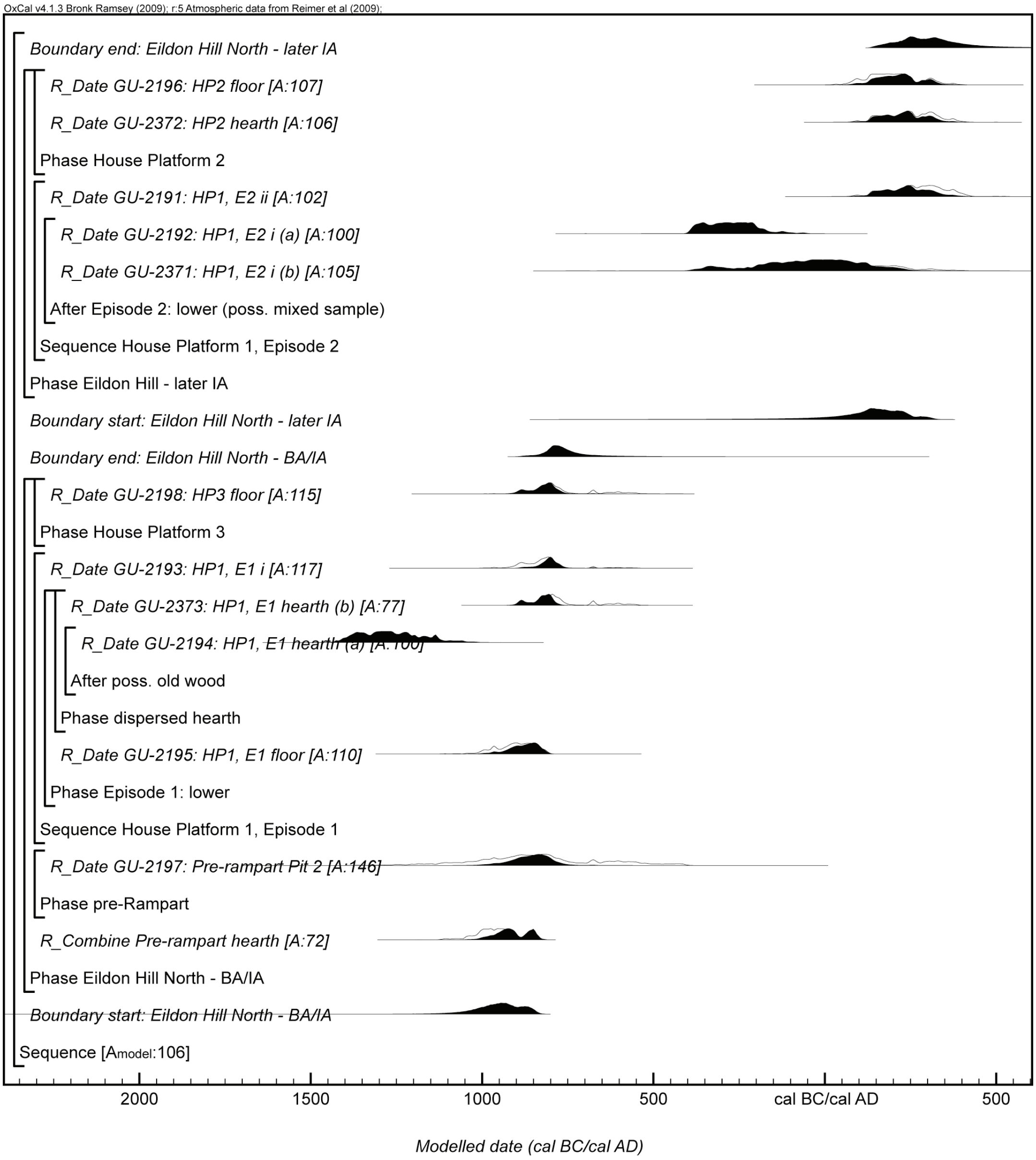

Figure 7.4.3: Chronological model for Eildon Hill North. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

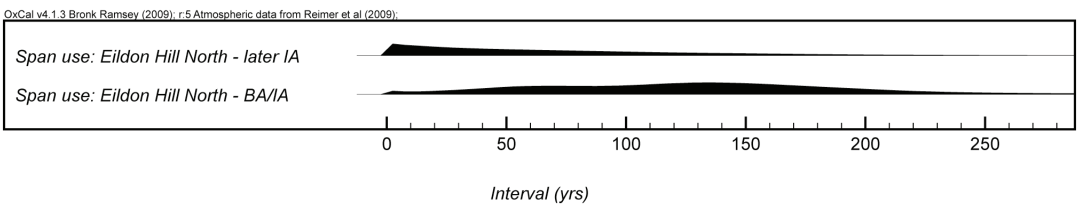

Figure 7.4.4: Probability distributions for the estimated spans of use for the Bronze Age/pre-Roman and Roman Iron Age activity at Eildon Hill North. The probabilities are derived from the modelling shown in Figure 7.4.3

would tell us very little given that over 1000 years appear to have passed between the original settlement on Eildon Hill North and the reuse dated by Houses 1 (episode 2) and 2. Therefore the results have been placed into two sequential groups where those from above *Rampart constructed* and *HP1 expanded* (Fig. 7.4.2) have been assigned to a later Iron Age phase of activity.

7.4.4 Model results

The model has good agreement between the radiocarbon dates and the modelling parameters (A_{model}=106).

The model estimates that the dated activity on Eildon Hill North began in *1105–830 cal BC* (*95% probability*; Fig. 7.4.3; *start: Eildon Hill North - BA/IA*) and probably in *1005–860 cal BC* (*68% probability*). This phase of dated activity ended in *890–570 cal BC* (*95% probability*; Fig. 7.4.3; *end: Eildon Hill North - BA/IA*) and probably in *825–720 cal BC* (*68% probability*). The overall span of dated Bronze Age/Iron Age activity is *1–280 years* (*95% probability*; Fig. 7.4.4; *use: Eildon Hill North - BA/IA*) and probably *45–185 years* (*68% probability*).

While it is not possible to date the construction of the rampart directly, the archaeology suggests, given the lack of any developed soil or sediment at the interface, that the rampart was constructed only a short time after the use of pre-rampart Pit 2. The possibility also exists that the pit, containing an abundance of charcoal along with burnt and unburnt mammal bone, was a foundation deposit. So while the date for Pit 2 provides a meaningful *terminus post quem* date for the rampart construction of *1010–740 cal BC* (*95% probability*; Fig. 7.4.3; *GU-2197: Pre-rampart Pit 2*) and probably *910–795 cal BC* (*68% probability*), if this pit is a foundation deposit then this probability estimate would provide the best estimate for the date of rampart construction.

Reuse of the site began in *260 cal BC–cal AD 330* (*95% probability*; Fig. 7.4.3; *start: Eildon Hill North - later IA*) and probably in *cal AD 60–255* (*68% probability*). The Roman Iron Age activity ended in *cal AD 135–570* (*95% probability*; Fig. 7.4.3; *end: Eildon Hill North - later IA*) and probably in *cal AD 200–385* (*68% probability*). The overall span of dated Roman Iron Age activity is *1–192 years* (*95% probability*; Fig. 7.4.4; *use: Eildon Hill North - later IA*) and probably *1–90 years* (*68% probability*).

The model has also been queried to provide probabilities for the order of the features in the later Iron Age phase and the establishment of Trimontium (Newstead) in AD 80. The model provides a 72% probability that *start: Eildon Hill North - later IA* post-dates AD 80, but the low number of dates (three in this case) for this phase will usually cause an overestimation of the boundaries (Steier and Rom 2000). Looking at the order of the dated material in the later Iron Age phase, there is a 99% probability that the material from House 1 (episode 2) and House 2 post-date the establishment of the Roman fort below.

7.4.5 Discussion

The archaeological evidence suggests that there were two main phases of occupation on Eildon Hill North and all of the dating is in agreement with this argument. The low number of ^{14}C results in the model has resulted in low precision for the estimated dates, especially for the later Iron Age period. However, in spite of producing estimates for the start and end of this later activity that span over 4 centuries, the modelling does suggest that this later dated period of use probably only spanned *1–90 years* (*68% probability*; *use: Eildon Hill North - later IA*) in total.

Through the modelling of Eildon Hill North a snapshot of possible frontier interaction and politics emerges. A hillfort that was settled in the beginning of the 1st millennium cal BC is probably abandoned after a couple of hundred years. While the reasons are unclear, the lacuna in the data almost certainly is real. Something happens in the first century cal AD to cause people to return to the site. They mount the hill and both expand older house platforms and construct new ones. This activity is probably directly related to the incoming Roman army and the founding of Trimontium below. The fact that next to nothing in the way of Roman artefactual evidence was found in the later hilltop contexts seems to suggest little to no meaningful economic interaction between the inhabitants of Eildon Hill North and Trimontium. This paints a picture of a people in relative isolation, and perhaps the structure identified as a Roman signal station, if in use while the hilltop was still settled by natives, was a watchtower. Furthermore, neither seasonal use nor ceremonial occupation can be ruled out. If, however, it was a Roman construction then it speaks volumes to Roman domination. There are clearly more questions raised by the modelling, but it does appear that the data is suggestive of a Roman and native relationship in this area that was not harmonious.

7.5 Fishers Road East

7.5.1 Site description

The site of Fishers Road East (NT 409 754) is comprised of a series of three conjoining enclosures (Haselgrove and McCullagh 2000). As shown in the plan (Fig. 7.5.1), Enclosure 1 is a roughly circular double-ditched enclosure (except along the north-west side). This connects to a large single-ditched enclosure that is subdivided by a cross-ditch into Enclosures 2 and 3. The site was excavated by Durham University in advance of a housing development.

The inner ditch of Enclosure 1 was between 4.0 and 4.5m wide at the top with a relatively flat base, 1.0 to 1.2m wide. Overall the ditch was approximately 1.2m deep. Along the outer edge of this ditch a palisade trench was revealed.

The outer ditch had roughly the same dimensions, although it was noted that there did appear to be greater variation in width and depth throughout the circuit. Both circuits have eastern entrances, with the inner ditches entrance being slightly south of east, which has been suggested may be the result of the two ditches being dug at different times.

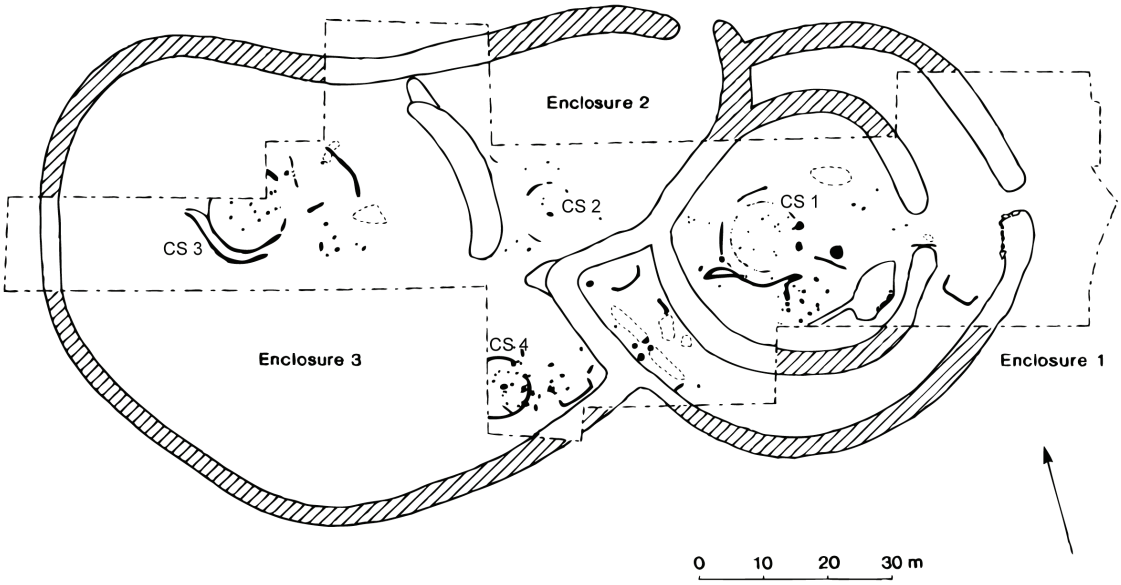

Figure 7.5.1: Site plan for Fishers Road East (Haselgrove and McCullagh 2000, fig. 33)

From the excavation of the junction between Enclosures 1 and 3, it appears as though Enclosure 1 was the earlier of the two ditches. However, the fills indicate that both ditches were likely open at the same time, making it unclear if Enclosure 1 was in use and being cleaned over some period before Enclosure 3 was dug, or if Enclosure 3 was dug very shortly after Enclosure 1 was completed.

The most prominent dividing ditch of Enclosure 2 has no stratigraphic relation to the Enclosure 3 outer ditch. However, the Enclosure 2 ditch was preceded by an earlier ditch (F916) that is cut by the outer ditch. It still remains unclear stratigraphically whether the Enclosure 2 and 3 ditches were in use at the same time, but this does seem likely, even if the Enclosure 2 dividing ditch was in sporadic use, or if what remains are differentially preserved cuts and recuts from the two ditches, where the final Enclosure 3 ditch is wider than the original, unpreserved, ditch and has subsequently cut the earlier dividing ditch.

The ditches exhibit episodes of recutting that obscure earlier ditches, and various segments were noted as intercutting, all of which has created a blurred picture of development. However, in the final excavated form, Enclosures 2 and 3 appear to be formed from a single circuit that is later than the adjoining circuit of Enclosure 1 and its palisade. At several places, in particular the junctions of Enclosure 1/2 and 1/3, there is a similarity in the infilling that suggests the ditches were at least all abandoned at the same time.

There was a total of four circular structures identified through excavation. Circular structure 1 (CS 1) is a timber-built roundhouse, lying within Enclosure 1, with a diameter of approximately 11m. The entrance to the structure is just south of east and aligned with the entrance to the inner circuit. Near CS 1, to the south/south-east, is a rectilinear arrangement of postholes with stone packing that likely formed a single post structure – [1190].

The second circular structure (CS 2) lies within the area of Enclosure 2, while CS 3 and 4 are situated within Enclosure 3. CS 2 was highly truncated, as a result of being situated in one of the highest areas of the site. CS 3 and 4 were much better preserved. While CS 3 was 9.25m in diameter with an east-north-east entrance, CS 4 was approximately 12.75m in diameter with an entrance just north of east.

It has been suggested that based on position and alignment, CS 1 and 4 were integral to their respective enclosures (1 and 3). Furthermore, there is some evidence to suggest that CS 1 was subject to rebuilding, repair, or modification as some posts appear to have been replaced. CS 2 is peculiar in its situating tightly (although not entirely blocking) within the entrance between Enclosures 2 and 3, suggesting that this structure either pre- or post-dates the enclosures. The stake holes of CS 3 also indicate that more than one phase is likely, and it was noted that the structure cuts at least one earlier feature [789].

A total of 12 pottery sherds of later Bronze Age through to Iron Age date was recovered from the site. There were no artefacts of Roman date recovered.

7.5.2 Sample specifics

A total of 41 radiocarbon results is available from carbonized plant macrofossils found in 29 separate contexts from across the site. Thirty-one results are on fills from ditches. A further eight results are on features associated with post-built structures and roundhouses, with a single date each on the palisade and a presumably late soil horizon.

7.5.3 Model description

There are only direct stratigraphic relationships between radiocarbon samples from within the three ditches. All of the other samples are either grouped together on spatial grounds or are stratigraphically isolated (Fig. 7.5.2).

Three radiocarbon results are available from CS 1, including the lower fill of the gully [149] (AA-25729), and the fills from entrance post [1010] (AA-25718) and posthole [1018] (AA-25717). A single thermoluminescence result is available from a sherd from stake hole [1004] in CS 1 (Dur96TLqi 192-1; AD140 ±150, ±190). Additionally, a single radiocarbon result is available from a posthole in PS 1190 [683] (AA-25716) that is spatially associated with CS 1. None of these results are stratigraphically related.

Two results are available from CS 3, including one from the fill of gully [770] (AA-25734) and one from the fill of entrance post [747] (AA-25733). Neither result is stratigraphically related.

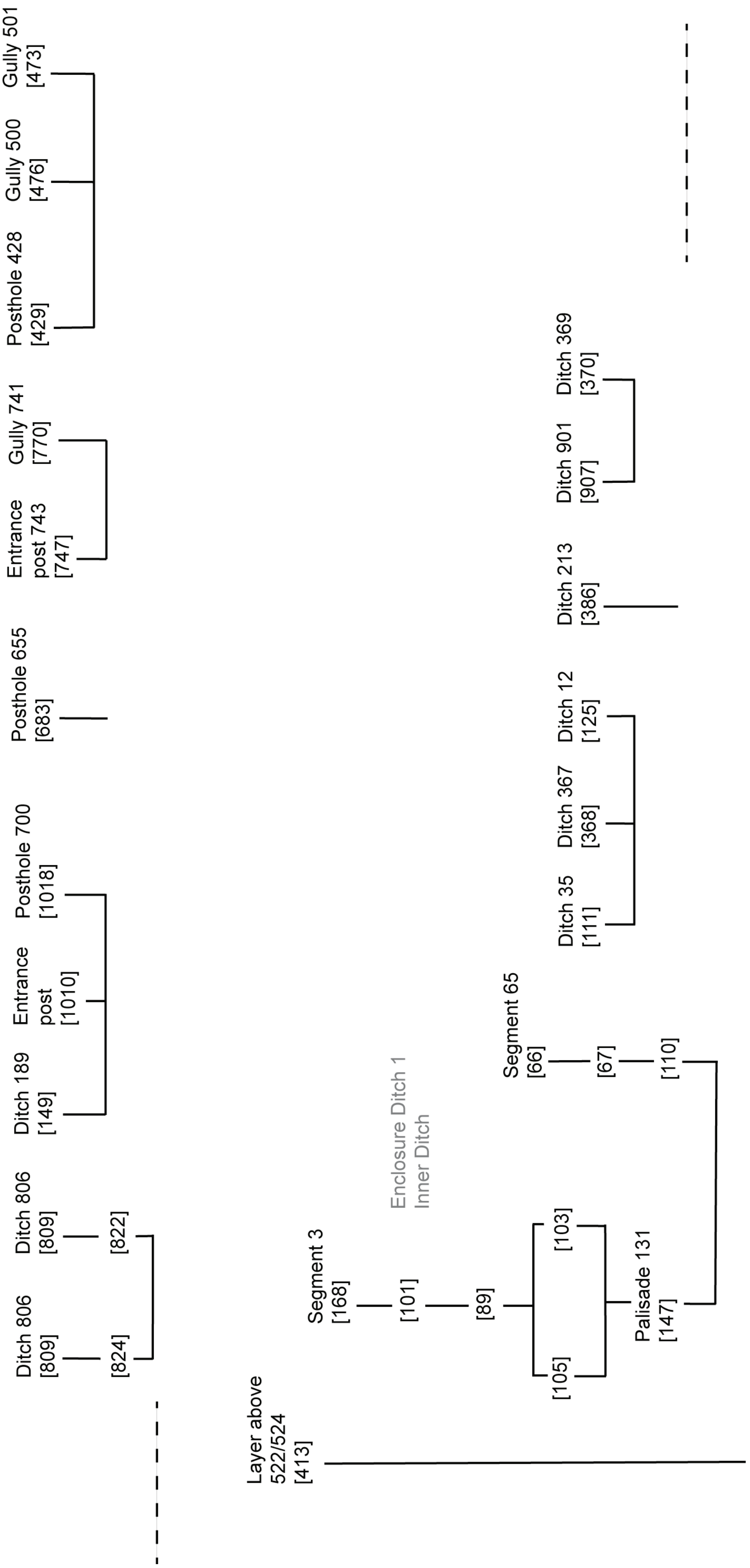

Figure 7.5.2: Site matrix of dated and modelled contexts from Fishers Road East

Three results are available from CS4, including two from fills of the ring gully [473 and 476] (AA-25715 and -25728) and one from the fill of posthole [429] (AA-25735). None of these results is stratigraphically related.

A total of 17 results is available from the fills of two ditch segments [3 & 65] of the Enclosure 1 Inner Ditch. Segment [3] has a sequence beginning with a result from the Palisade [147] (AA-25732), which is overlain by fills from Episode 3 [103] (OxA-7401 and -7402) and [105] (OxA-7520, -7521, -7522, and AA-25737). AA-25732 and -25737 are both too recent, dating to the medieval to modern periods and Roman Iron Age periods respectively, and have been excluded. OxA-7520 and -7521 are both results on bulked spelt glume bases, and given the fragile nature of the sample type and that they are unlikely to survive unless buried rapidly (Van der Veen, pers. comm.) these results have been combined (T'=0.1; v=1; T'(5%)=3.8) to create a weighted mean (2060 ±39BP). While [103] and [105] are not related to each other directly, both are overlain by another Episode 3 fill [89] from which two results are available (OxA-7399 and -7400). OxA-7399 is too old for its position and has been excluded as residual in [89]. [89] is in turn followed by two results from Episode 3 fill [101] (OxA-7518 and -7519) and one result from an upper fill of Episode 4 [168] (AA-25738).

Five results are available from Section [65] of the Enclosure 1 Inner Ditch. The sequence begins with a single result from basal fill [110] (AA-25736) and is followed by two results from a middle fill [67] (OxA-7523 and -7524) and two further results from the upper fill [66] (AA-25725 and -25726). AA-25725 is intrusive and has been excluded from the model.

Four results are available from three sections of the Outer Ditch of Enclosure 1. There are two results from middle fill [111] (AA-25719 and -25720) with one result each from middle fill [368] (AA-25721) and secondary fill [125] (AA-25727). AA-25727 is an intrusive medieval grain of charred barley and has been excluded from the model. None of these results is stratigraphically related.

Two results are available from one context [386] (AA-25730 and -30363), the secondary fill in the Enclosure 3 ditch section 213. Both measurements are on *Ranunculus* sp. seeds, which is known to tolerate tidal estuaries (Spink 1992) and as such could have a mixed marine and terrestrial carbon reservoir if they derive from such an environment along the Forth. These results have been excluded from the

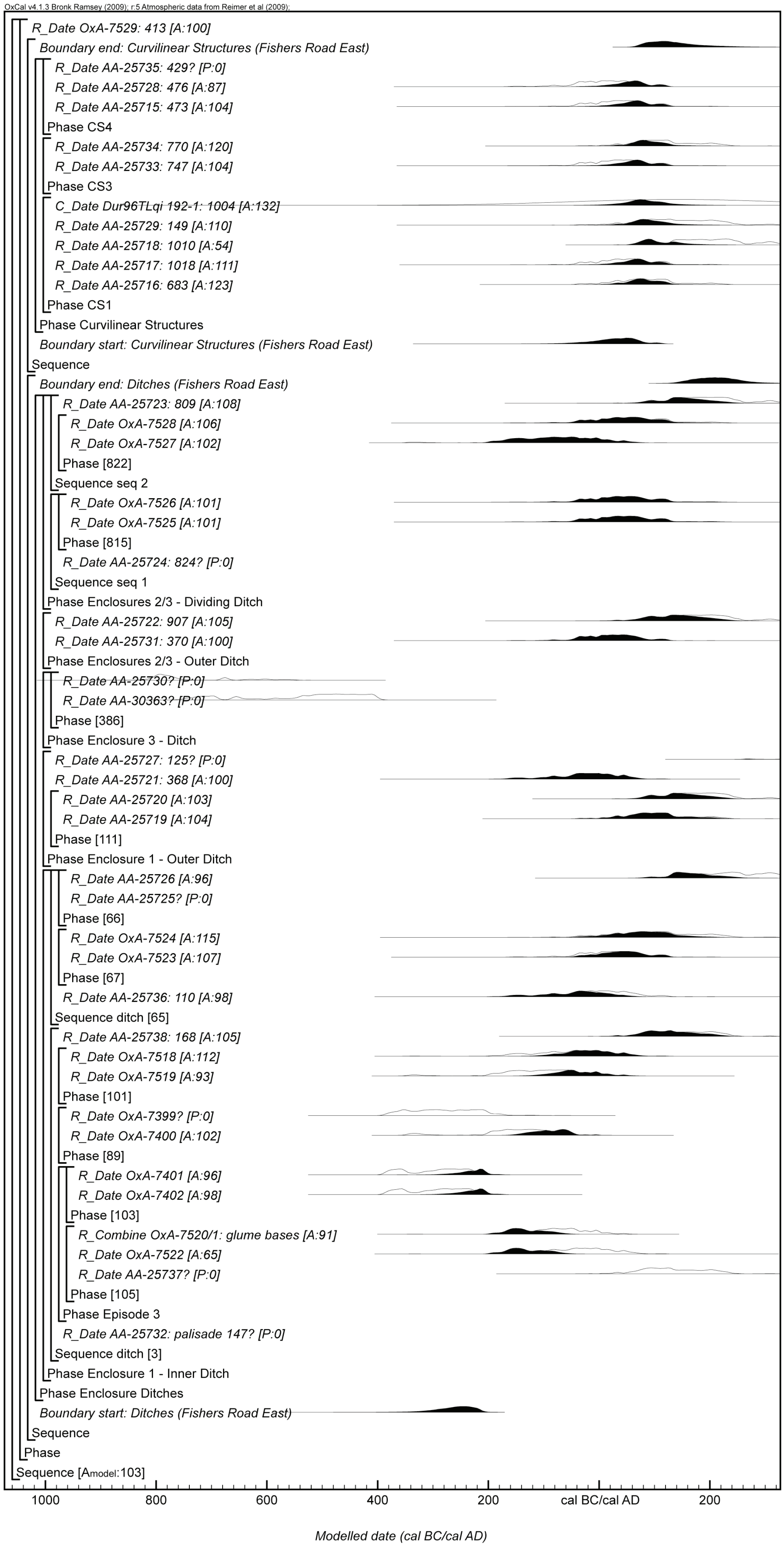

Figure 7.5.3: Chronological model for Fishers Road East. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

model as they are too old for their position and very likely suffer from a mixed offset that is unknown.

Two samples were dated from middle fills in two sections of the Enclosure 2/3 Outer Ditch. One sample came from [907] (AA-25722) and the other from [370] (AA-25731). AA-25722 is on a sample of carbonized *Potamogeton* sp. seeds and AA-25731 is from a sample of charred *Ranunculus* sp. seeds.

There were two dated ditch sequences in the Enclosure 2/3 dividing ditch [806]. The first sequence has one result from a lower fill [824] (AA-25724) and two results from an upper fill [815] (OxA-7525 and -7526). AA-25724 is from a charred barley grain that returned a result of 23,680 ±230BP, which is clearly to old and most likely the result of contamination or a measurement error and has been excluded from the model. The second sequence has two results available from the lower fill [822] (OxA-7527 and -7528) and one from an upper fill [809] (AA-25723). The two sequences are not related stratigraphically.

A final sample comes from presumably late soil deposit [413] (OxA-7529) overlaying stones [522/524].

7.5.4 Model results

The model (Fig. 7.5.3) has good agreement between the radiocarbon dates and the stratigraphy (A_{model}=103). The model estimates that the ditches were dug in *350–205 cal BC* (*95% probability*; Fig. 7.5.4; *start: Ditches (Fishers Road East)*) and probably in *290–220 cal BC* (*68% probability*). The ditches went out of use by *cal AD 135–305* (*95% probability*; Fig. 7.5.4; *end: Ditches (Fishers Road East)*) and probably by *cal AD 165–255* (*68% probability*). The overall use of the ditches was *360–610 years* (*95%*

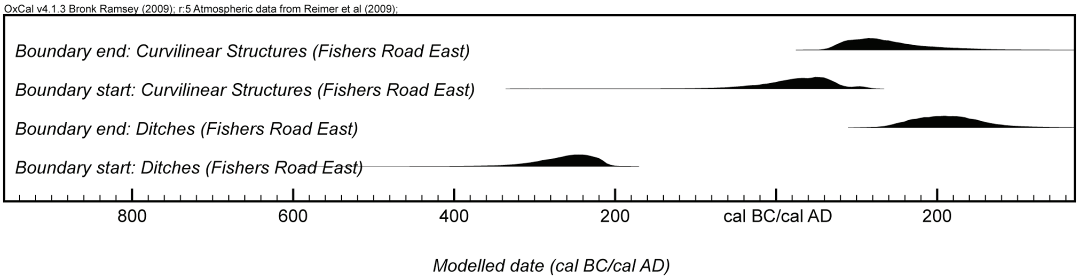

Figure 7.5.4: Probability distributions for event boundaries for the start and end of the Ditch and Curvilinear Structure activity extracted from the chronological model for Fishers Road East shown in Figure 7.5.3

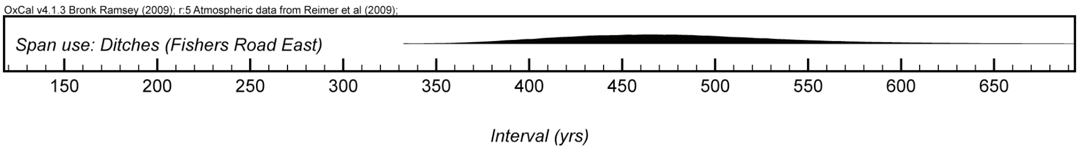

Figure 7.5.5: Probability distribution for the estimated span of use for the ditches at Fishers Road East. The probability is derived from the modelling shown in Figure 7.5.3

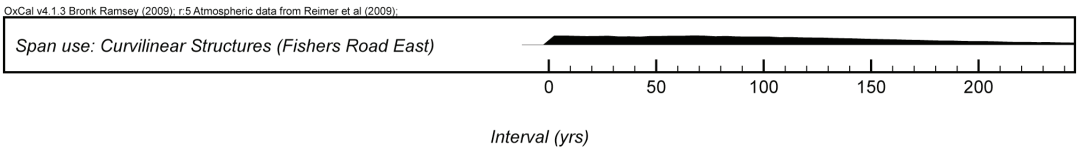

Figure 7.5.6: Probability distribution for the estimated span of use for the curvilinear structures at Fishers Road East. The probability is derived from the modelling shown in Figure 7.5.3

probability; Fig. 7.5.5; *use: Ditches (Fishers Road East)*) and probably *405–525 years* (*68% probability*).

The dated curvilinear structures first started being used in *70 cal BC–cal AD 115* (*95% probability*; Fig. 7.5.4; *start: Curvilinear Structures (Fishers Road East)*) and probably in *10 cal BC–cal AD 75* (*68% probability*). The dated structures went out of use by *cal AD 60–255* (*95% probability*; Fig. 7.5.4; *end: Curvilinear Structures (Fishers Road East)*) and probably by *cal AD 75–165* (*68% probability*). These structures were in use for *1–280 years* (*95% probability*; Fig. 7.5.6; *use: Curvilinear Structure (Fishers Road East)*) but probably *1–145 years* (*68% probability*).

7.5.5 Discussion

There was an absolute lack of material that was deemed suitable for dating which precluded many of the key stratigraphic contexts from being dated. As a result of the longevity of the settlement the model has too little data to provide a degree of precision. Of particular interest here is that the dating of three of the four recovered circular structures places them 100 years or more later than the beginning of the enclosure activity. This would suggest that either the earliest enclosure activity was not associated with a settlement or that the earliest settlement remains were unrecovered.

7.6 Fishers Road West

7.6.1 Site description

The site at Fishers Road West (NT 406 752) is a cropmark enclosure lying immediately south of Port Seton, East Lothian (Haselgrove and McCullagh 2000). The cropmark had been interpreted as either a ditched or part-ditched and part-palisaded enclosure. Excavation in 1994 by AOC (Scotland) revealed that the site was indeed a ditched enclosure with as many as four phases of ditch construction/re-digging (Fig. 7.6.1).

The initial ditch only appears in a few areas with a flattened U-shaped profile and, through soil thin-section analysis, is thought to have filled with little human input. This Phase 1 ditch is only visible in the two sections of one trench.

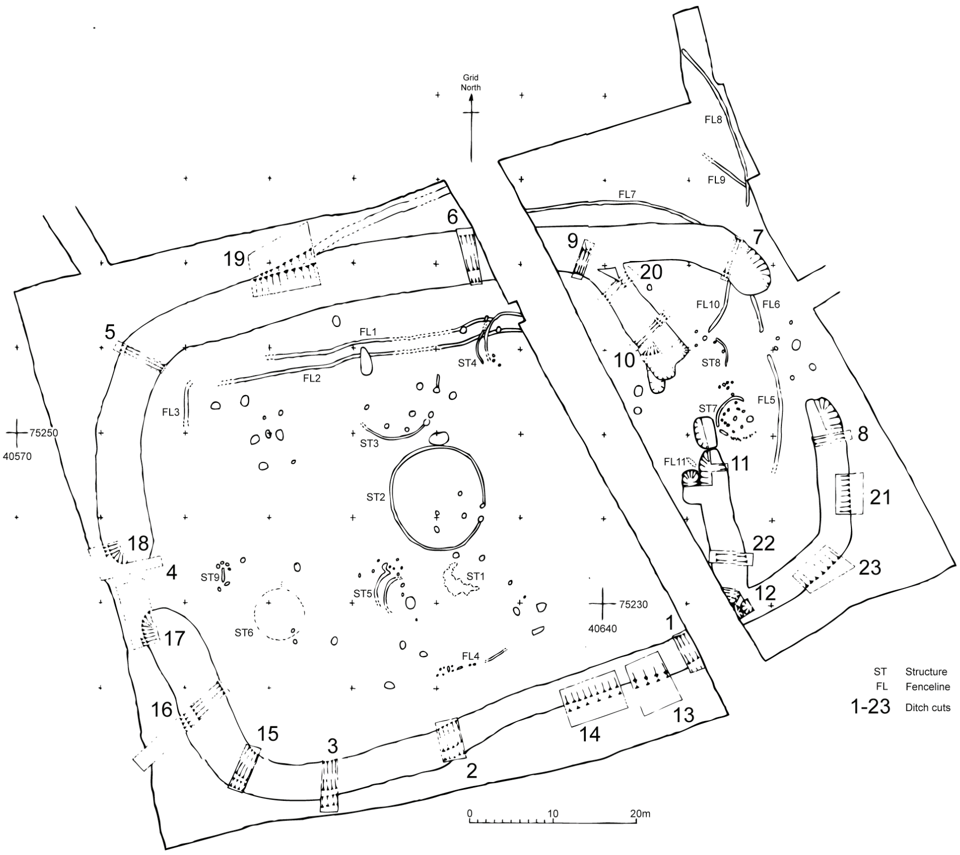

Figure 7.6.1: Site plan for Fishers Road West (Haselgrove and McCullagh 2000, fig. 7)

The Phase 2 ditch is less ephemeral and appears in 11 of 12 trenches in the western portion of the excavation. While this ditch is rather shallow in comparison to the later ditches, the later ditches replicate its path, cutting and truncating its fills.

The Phase 3 ditch is only unequivocally recorded at the inner ditch terminals on the eastern side. The digging of the Phase 4 ditch was presumed to have removed all other traces of the Phase 3 construction (save a few sections where there are either traces of the Phase 3 ditch or else earlier Phase 4 ditch remnants).

The final ditch (Phase 4) was substantially deeper and broader than the previous enclosure ditches. In this phase the eastern portion of the site gained and 'outer-courtyard' while still maintaining entrances on the east and west sides. The eastern entrance terminals were revetted with sandstone blocks and there are the possible vestiges of a gate structure.

A total of nine structures (or fragmentary enclosures) was identified within the enclosed area. Of the 18 radiocarbon dates obtained on material from the site, only three are directly from features associated with two structures, with two others from isolated pits (one pit was adjacent to a structure). The remaining 13 measurements are from material retrieved from the fills of the ditches. The location of all samples is shown in the site plan.

There was an absolute dearth of artefactual remains, with the excavation recovering eight stratified Iron Age pottery sherds and one unstratified Roman pottery sherd of a possible mid-2nd century AD date.

7.6.2 Sample specifics

A total of 18 radiocarbon results is available from single carbonized plant macrofossils found in 18 separate contexts from across the site including the fills of pits and a stake hole along with discrete fills of ditches and gullies.

7.6.3 Model description

The features dated at Fishers Road West comprise segments of the enclosure ditch, one structure, and three pits. The dating matrix is shown in Figure 7.6.2.

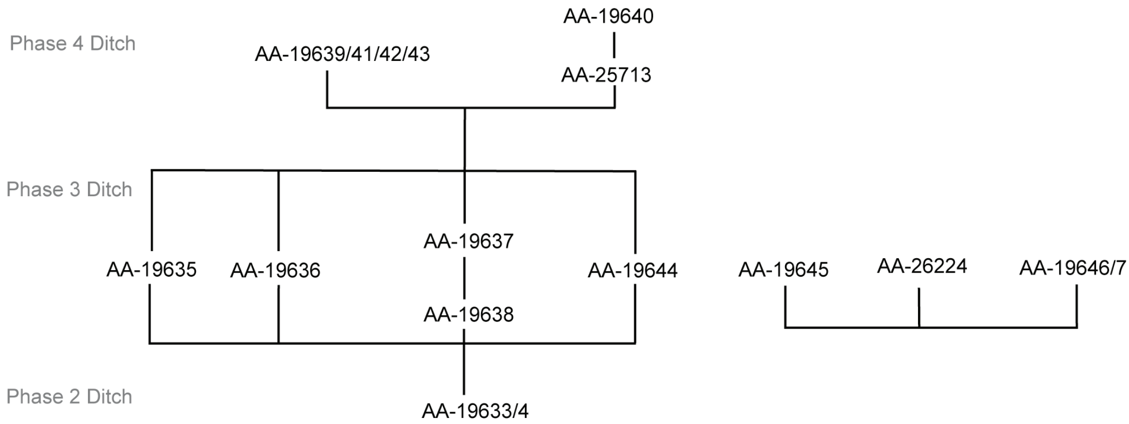

Figure 7.6.2: Site matrix of modelled dates from Fishers Road West

The earliest contexts at Fishers Road West from which material was submitted for dating are two fills in Ditch [3] from Phase 2. Although the fills have been labelled "upper" and "lower", as they come from two separate ditch segments they have not been stratigraphically related. Furthermore, the results from these two samples on single grains of *Hordeum* sp. and *Avena* sp. (AA-19633 and -19634, respectively) calibrate to the 15th century cal AD or later and so have been excluded from the model since they are clearly intrusive.

There are five samples submitted from Phase 3 ditch fills, spread across three sections. One measurement on a single grain of barley is from the latest fill of section 6 (AA-19635), two stratigraphically unrelated single grains of barley come from section 11 (AA-19636, primary fill and -19644, unrecorded fill) and two more single barley grains come from a stratigraphic sequence from section 20 (AA-19637 upper fill and -19638, primary fill). The modelling suggests that AA-19644 is too late for its position within the model. Unfortunately the location from which this sample was retrieved is not well published, while the other sample (AA-19636) is recorded as having been retrieved from the primary fill of this ditch phase. Since AA-19644 appears to be too late and its attribution to this phase is suspect, it has been excluded from the model.

A total of six results is available from the Phase 4 ditch fills and spread across five sections. AA-19641, on a bulk sample of hazel and willow charcoal from section 12, has a low individual index of agreement (A=34) and given it is slightly earlier than the other Phase 4 ditch dates suggests that it either could be residual or represent an outlier measurement. Two results from section 13 are stratigraphically related, with AA-25713 (*Hyoscamus nigers* seeds) coming from the basal fills and AA-19640 (single barley grain) coming from further up the profile and providing a *terminus post quem* for the overlying windblown sand. AA-19639 is on a single grain of *Triticum aestivo-compactum* from a fill of the western entrance of the Phase 4 ditch. AA-19642 is on a single grain of barley from the primary fill of the northern terminal of the east entrance of the ditch. Finally, AA-19643 is on a single barley grain from the putative rampart with the Phase 4 ditch that seals ditch [3] fills.

A total of four results is available from habitation-related features located within the enclosure. Two samples were submitted from a stake hole (single barley grain) and the ring gully (single indeterminate grain) from Structure 7 (AA-19646 and -19647), while the other samples came from a pit (single indeterminate grain) in Structure 4 (AA-19645) and a pit (single barley grain) adjacent to Structure 1 (AA-26224).

A grape pip was dated from an isolated pit near the western entrance. The pit was truncated and capped by topsoil. The calibrated result (AA-25714) is given as post-1950 and has been excluded from the model.

7.6.4 Model results

The model has good agreement between the radiocarbon dates and the stratigraphy (A_{model}=65). The model estimates that Phase 3 (Enclosure) started in *365–60 cal BC* (*95% probability*; Fig. 7.6.3; *start: Phase 3 Enclosure (Fishers Road West)*) and probably in *235–110 cal BC* (*68% probability*). The Phase 4 began in *190–45 cal BC* (*95% probability*; Fig. 7.6.3; *start: Phase 4 Ditch (Fishers Road West)*) and probably in *160–80 cal BC* (*68% probability*). The Phase 4 period of use ended in *155 cal BC–cal AD 115* (*95% probability*; Fig. 7.6.3; *end: Phase 4 Enclosure (Fishers Road West)*) and probably in *80 cal BC–cal AD 55* (*68% probability*).

The difference between *start: Phase 3 Enclosure (Fishers Road West)* and *build: Phase 4 Ditch (Fishers Road West)* was used to estimate that the Phase 3 enclosure was in use for *1–210 years* (*95% probability*; Fig. 7.6.4; *use: Phase 3 Ditch*) and probably for *1–100 years* (*68% probability*).

The difference between *build: Phase 4 Ditch (Fishers Road West)* and *end: Phase 4 Enclosure (Fishers Road West)* has been used to estimate that the Phase 4 enclosure was in use for *1–255 years* (*95% probability*; Fig. 7.6.4; *use: Phase 4 Ditch*) and probably for *10–150 years* (*68% probability*).

The dated activity associated with the digging of pits and construction of houses/structures has not been modelled. There are only four results and they calibrate over a period of nearly 2 millennia. The four results are given here in Figure 7.6.5 as they

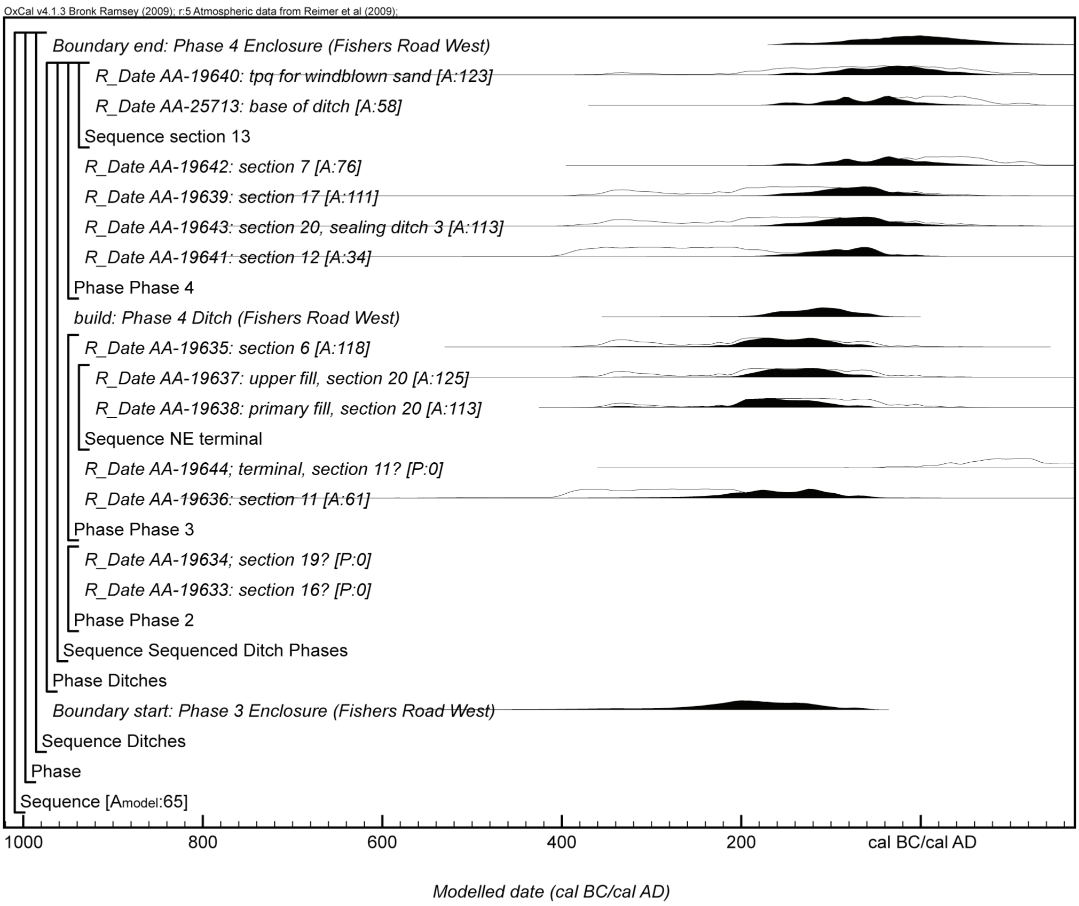

Figure 7.6.3: Chronological model for Fishers Road West. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

show that activity took place in and around the site over this period of time, but the paucity of data makes it nearly impossible to determine which of the dates, if any, might be residual or intrusive. The excavation report does note that the contexts associated with Houses 4 and 7 were shallow and highly susceptible to bioturbation and infiltration (Haselgrove and McCullagh 2000, 29).

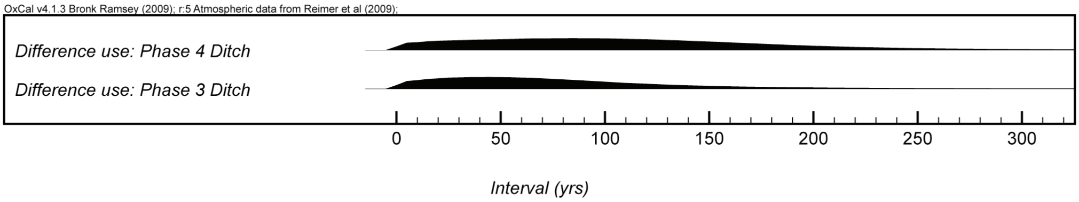

Figure 7.6.4: Probability distributions for the estimated spans of use for the Phase 3 and 4 enclosure ditches at Fishers Road West. The probabilities are derived from the modelling shown in Figure 7.6.3

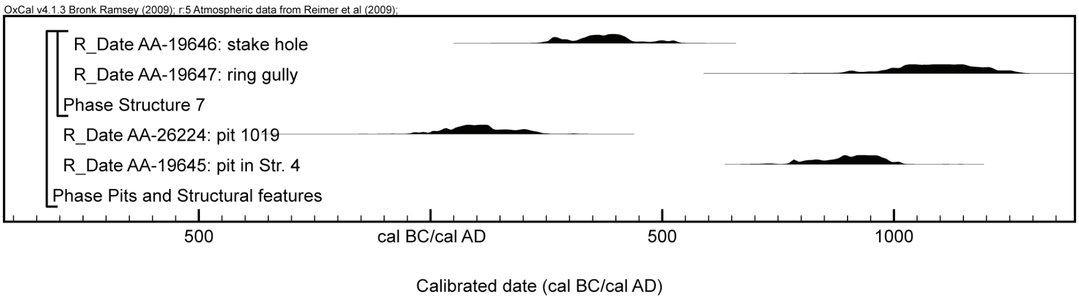

Figure 7.6.5: Calibrated radiocarbon dates from Structure 4 and 7 and an isolated pit from Fishers Road West

7.7 Knowes Farm

7.7.1 Site description

The site at Knowes Farm (NT 614 776) is a rectilinear enclosure situated just above the River Tyne (20m OD) approximately 4km northwest of Traprain Law. The enclosure is trapezoidal in shape and measures approximately 48 x 38m with an internal area estimated at 0.14ha (Fig. 7.7.1). The site was excavated in 2004 and has been published (Haselgrove 2009).

The site has two main phases – enclosed and post-enclosure/open settlement. The early activity associated with the enclosure either had no visible settlement activity, or that activity was later removed through the later creation of scoops. The enclosure had

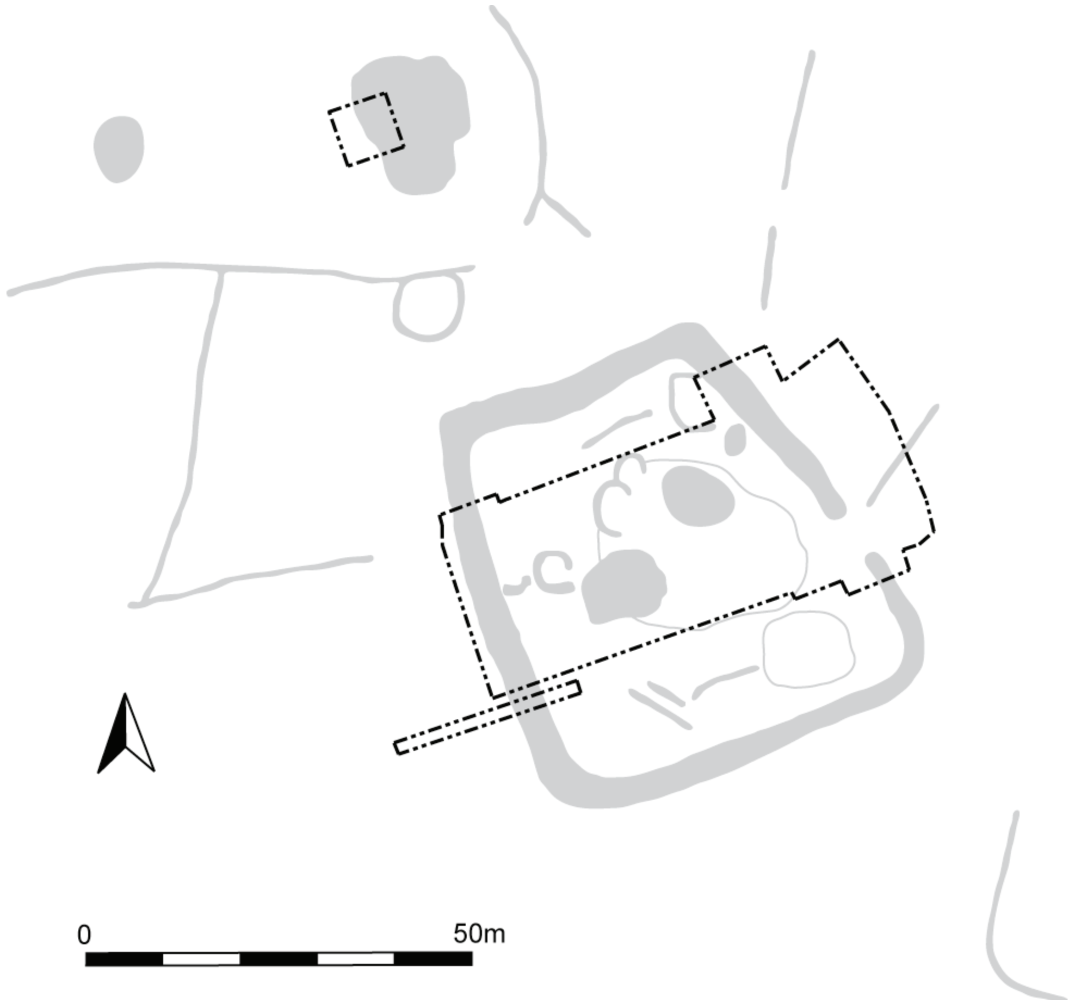

Figure 7.7.1: Site plan for Knowes Farm (after Haselgrove 2009, fig. 5.3 (A))

the entrance to the east. When the enclosure ditch had filled in stone paving was placed over the ditch terminals.

The interior has a large scooped feature. There were two large circular structures (CS) and a third smaller one excavated. CS 3 cuts the earlier enclosure ditch and is thought to be an ancillary structure to CS 2.

At some point a cist grave was dug through the later cobbling at the ditch entrance.

7.7.2 Sample specifics

A total of 25 samples of charcoal, carbonized grain and nutshell, waterlogged wood, and cremated human bone was submitted from 20 individual contexts that included fills of ditches, pits, and the cist grave along with occupation layers.

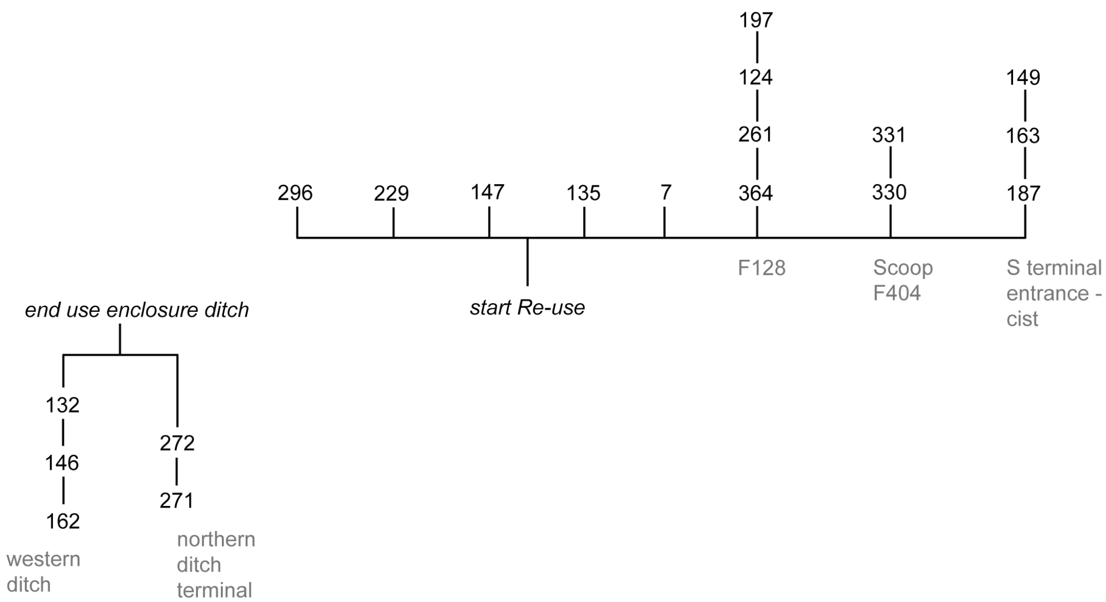

Figure 7.7.2: Site matrix of dated and modelled contexts at Knowes Farm

7.7.3 Model description

Of the 25 dates from the site, one is modern (SUERC-10581) and has been excluded from further modelling (Fig. 7.7.2). The occupation has been separated into two phases. The enclosure ditch was certainly dug first, but was almost certainly not completely infilled when the scooped settlement was occupied. As such, the model allows for the possibility of overlap between the start of the scooped settlement and the final use of the ditch circuit.

Dates were obtained from sections through the western ditch and the northern terminal of the eastern ditch. Taking the western ditch first, three dates are from the primary fill [162, 189] of the first recut F242 (SUERC-10575, -10576, and -10580); a fourth is from the primary fill [146] of the second recut F243 (SUERC-10569); whilst the last derives from one of its higher fills [132] (SUERC-10567). While these samples form a vertical sequence, all five measurements are statistically consistent (T'=2.6; ν=4; T'(5%)=9.5) and could be the same age, suggesting that deposition was fairly rapid. The samples from the northern terminal of the ditch consists of four samples from the recut F405, two of them from the lowest fill [271], one of them barley, one of them waterlogged hazel (SUERC-10587 and -10588), the other two from an overlying deposit of sand [272], both charred barley (SUERC-10589 and -10590). As with the group from the western ditch, all four measurements are statistically consistent (T'=4.4; ν=3; T'(5%) =7.8), implying that here too, deposition was fairly rapid.

All the results from the ditch fills were subjected to a chi-square test, but were found not to be statistically consistent (T'=19.4; ν=8; T'(5%)=15.5). Results from a preliminary run of the model suggested that SUERC-10590 was inaccurate given its stratigraphic position. Given the archaeological evidence and the fact that the measurement passes tests of consistency within its smaller group, it seems likely to be an outlier. After excluding the date, the model shows that there is a *0% probability* of the measurement either being accurate, or in the correct position.

A total of 14 radiocarbon results was obtained from the features associated with the scooped settlement, two of them from scoop F404 near the entrance. One of these came from sand [330] overlying the second of the four surfaces [329] in this scoop (SUERC-10595), the other from the bedding of the fourth surface [F130] (SUERC-10596). Another three measurements come from elsewhere within the central scooped area; one from the matrix of the revetment wall along the northern edge of scoop [F284] (SUERC-10585); a second from behind the revetment wall of scoop at the south-western corner [F232] (SUERC-10570), and a third from sand [296] below the stone paving in the northern part of the same scoop [F273] (SUERC-10591).

Another group of four dates came from contexts within the isolated scooped structure [F128], to the west. Two were obtained from the fill [364] of a shallow depression [F378] in the base of the scoop, (SUERC-10597 and -10598), but SUERC-10598 has been excluded from the modelling as it is 1000 years too early and is clearly reworked material. A third date came from the deposits [261] within the oven (SUERC-10586), providing a date for the use of the structure, whilst a fourth date came from the silt [124], which accumulated after the structure, went out of use (SUERC-10566). Another date came from the fill [135] of the smaller adjacent scoop [F129] to the west (SUERC-10568).

Four dates were obtained from the contents of the stone cist inserted in the top of the the southern terminal of the enclosure ditch after this had almost completely filled up. Two of the measurements are on fragments of cremated human bone from the lower [187] and upper [149] fills (SUERC-10579 and -10571), whilst the other two were on charred barley and birch charcoal from the middle [163] fills of the cist (SUERC-10577 and -10578). The cremated bone turned out to be not only much older than the charcoal in the middle fill, but also older than the dated material found in other ditch sections, suggesting that it is curated or redeposited. The two dates on the human bone have therefore been excluded from the model, whilst those from middle fill have been retained, providing a *terminus post quem* for the filling of the cist.

Finally, a single date was obtained from charred wheat found in the trilobate pit complex [F5] 30m to the north of the enclosure (SUERC-10565), suggesting that it is contemporary with the settlement.

7.7.4 Model results

The model has good agreement (A_{model}=62) with the stratigraphic relationships of the samples (Fig. 7.7.3). Based upon this, it estimates that the enclosure was constructed by *185–50 cal BC* (*95% probability*; Fig. 7.7.4; *start: use Enclosure ditch*) and probably by *130–60 cal BC* (*68% probability*). The ditch was open for *1–210 years* (*95% probability*; Fig. 7.7.5; *span: Enclosure ditch*) and probably *1–110 years* (*68% probability*). It was largely infilled by *95 cal BC–cal AD 60* (*95% probability*; Fig. 7.7.4; *end: use Enclosure ditch*), probably in the period *60 cal BC–cal AD 10* (*68% probability*).

The use of the interior represented by the scooped settlement and associated features began in *210–40 cal BC* (*95% probability*; Fig. 7.7.4; *start: Knowes Farm interior settlement*) and probably in *140–60 cal BC* (*68% probability*). The scooped settlement persisted for *135–395 years* (*95% probability*; Fig. 7.7.5; *span: Knowes Farm interior*

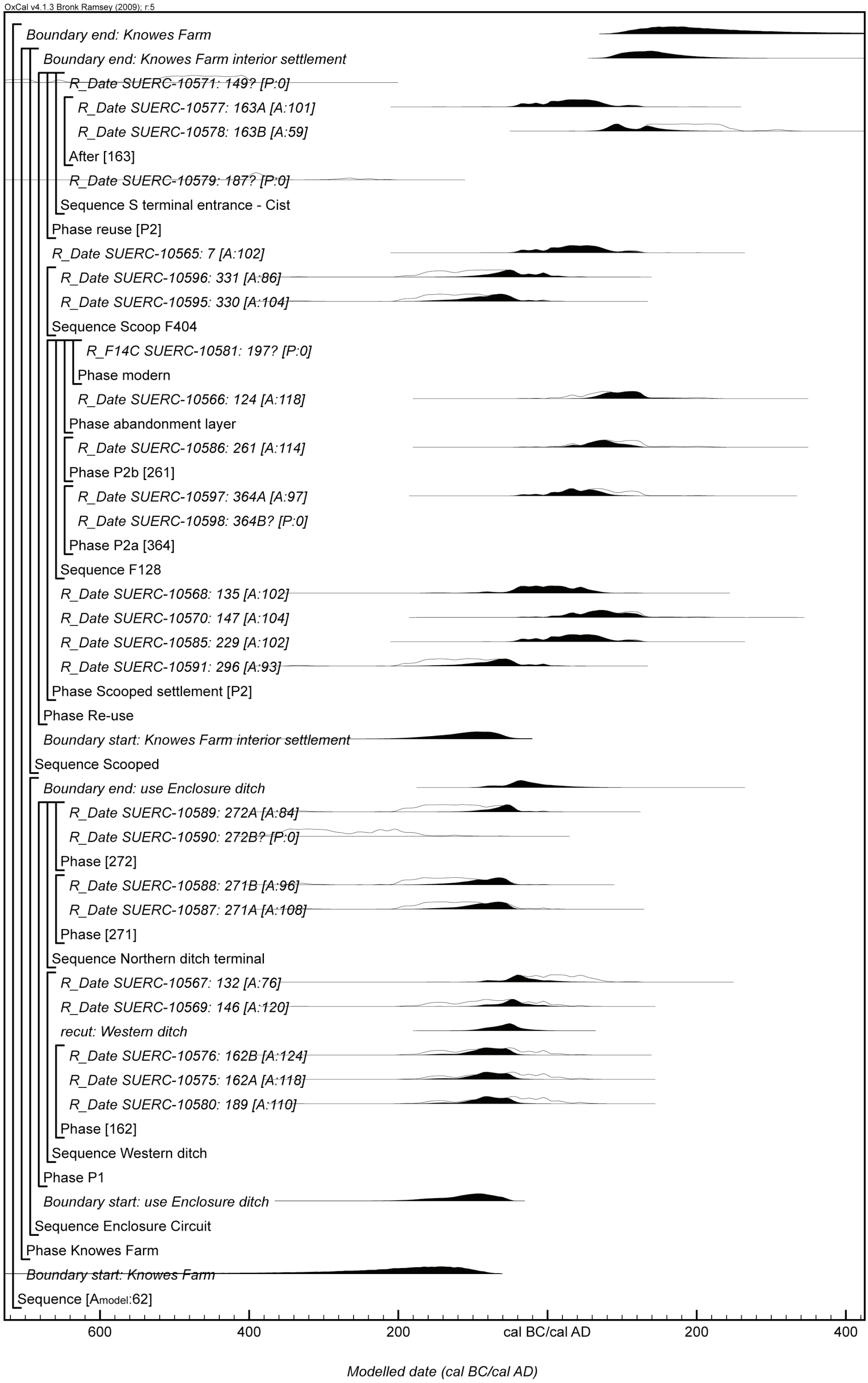

Figure 7.7.3: Chronological model for Knowes Farm. The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

settlement) and probably *175–300 years* (*68% probability*). The settlement ended in *cal AD 75–230* (*95% probability*; Fig. 7.7.4; *end: Knowes Farm interior settlement*) and probably in *cal AD 95–170* (*68% probability*). The model estimates that there is a *96% probability* that the scooped settlement was constructed while the enclosure ditch was still open.

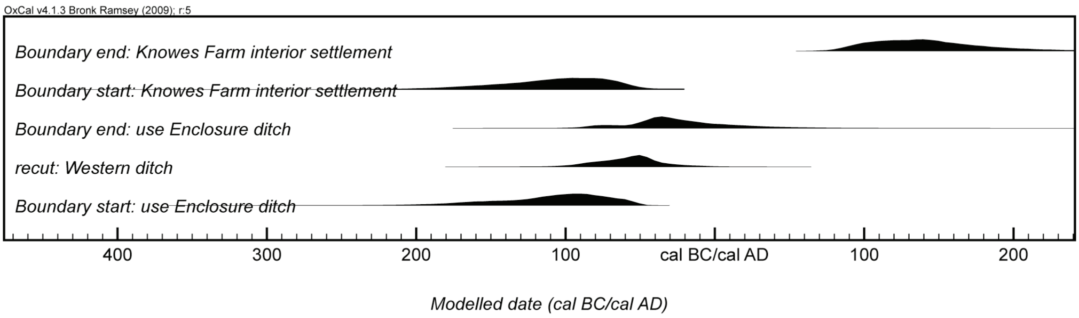

Figure 7.7.4: Probability distributions for event boundaries associated with the Enclosure and Scooped settlement activity, as extracted from the chronological model for Knowes Farm shown in Figure 7.7.3

The spans when each of the two sequential cuttings of the Western enclosure ditch were open was calculated from the model. Using the calculated difference between *start: use Enclosure ditch* and *recut: Western ditch* provides an estimate for the period of time that the first cut of the ditch was open of *1–135 years* (*95% probability*; Fig. 7.7.6; *span: Western ditch 1*) and probably of *1–70 years* (*68% probability*). Calculating the difference between *recut: Western ditch* and *end: use Enclosure ditch* provides an estimate for the period of time that the recut of the ditch was open of *1–100 years* (*95% probability*; Fig. 7.7.6; *span: Western ditch recut*) and probably of *1–45 years* (*68% probability*).

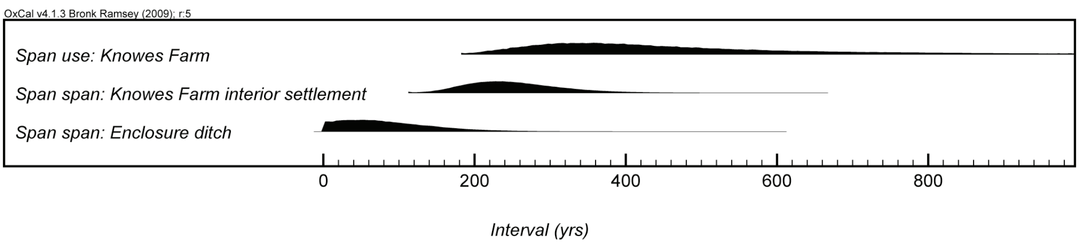

Figure 7.7.5: Probability distributions for the estimated spans of use for the Enclosure, Scooped settlement, and site of Knowes Farm as a whole. The probabilities are derived from the modelling shown in Figure 7.7.3

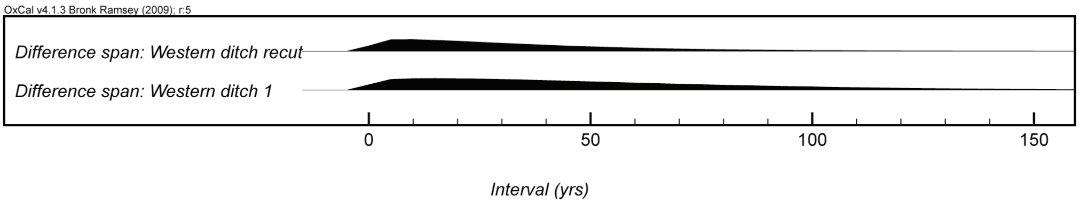

Figure 7.7.6: Probability distributions for the estimated spans of use for sequential cuttings of the Western enclosure ditch at Knowes Farm. The probabilities are derived from the modelling shown in Figure 7.7.3

7.7.5 Discussion

The dating of the settlement at Knowes is complex. The scooped settlement is itself complex and internal developments and changes remain poorly dated, but its construction appears to be roughly contemporaneous to the enclosure ditches. The entire settlement probably begins somewhere in the 50 years either side of 100 cal BC. The major, identifiable and dated, recuts of the Western enclosure ditch take place in the course of a lifetime or perhaps two. These major recutting events may well be part of a community cycle aiding in social cohesion across the landscape. This may be especially true if only a fraction of the major recutting episodes are recovered archaeologically. While the scooped settlement continued in use into the 2nd century cal AD, the enclosure ditch was most likely (99% probability) out of use before the Roman army made its way into Scotland in AD 80.

7.8 Phantassie Farm

7.8.1 Site description

The site at Phantassie Farm (NT 5961 7688) is a small unenclosed settlement, broadly dated to the closing centuries BC and opening centuries AD. A minimum of 15 buildings were identified from the excavation throughout all phases along with cobbled surfaces, working areas, and boundaries. The settlement has been separated into five broad phases of activity, although it has been acknowledged that structures and activity areas were used in multiple phases and even remodelled at times, adding a further level of complexity when unraveling the specific settlement history (Figs. 7.8.1 and 7.8.2). The site was excavated in 2002 and is published (Lelong and MacGregor 2008).

Phase 1

The first phase of settlement was ephemeral with no real evidence of structures beyond arcing lines of stones and fragments of daub along with scatterings of domestic refuse (animal bones, charred cereals, etc) at the base of the stones. A shallow hollow was excavated that contained midden material, including pottery debris, hearth waste, and some fragments of human bone. Furthermore, a scoop was excavated into the bedrock from which further domestic refuse was retrieved.

Phase 2

The second phase at Phantassie is much more substantial than the first with the construction of "buildings, pathways and boundaries in stone, defining the physical parameters and patterns of movement in the farmstead more formally" (Lelong 2008, 157). The features include a sub-rectangular house [1] with a fenced yard and cobbled pathway, which was further enclosed in a boundary demarcated by large boulders up to 0.5m in diameter, some of which were water-worn. Other features included a hard standing for cattle, and a more formal entrance gate. Various multi-posted features are also attributed to this phase and a midden store – a human-modified hollow that was enclosed by a light-wall and likely used over the course of much of the settlement use for rubbish disposal.

Phase 3

By Phase 3 the settlement was growing busier and becoming more crowded. The earlier sub-rectangular building [1] is abandoned at some time and filled with midden

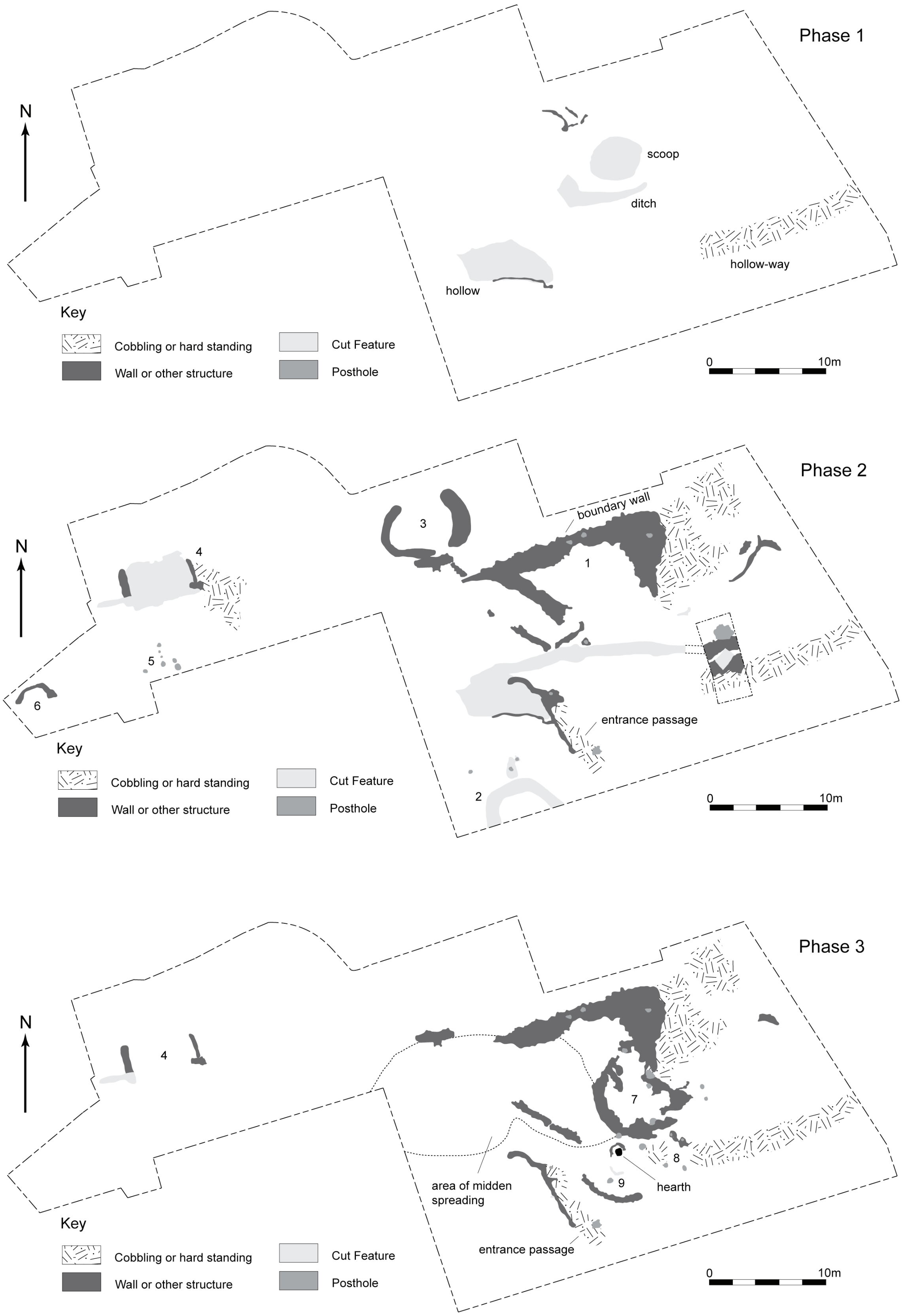

Figure 7.8.1: Site plans for Phases 1–3 at Phantassie Farm (Lelong and MacGregor 2008, figs. 7.5, 7.10, and 7.22)

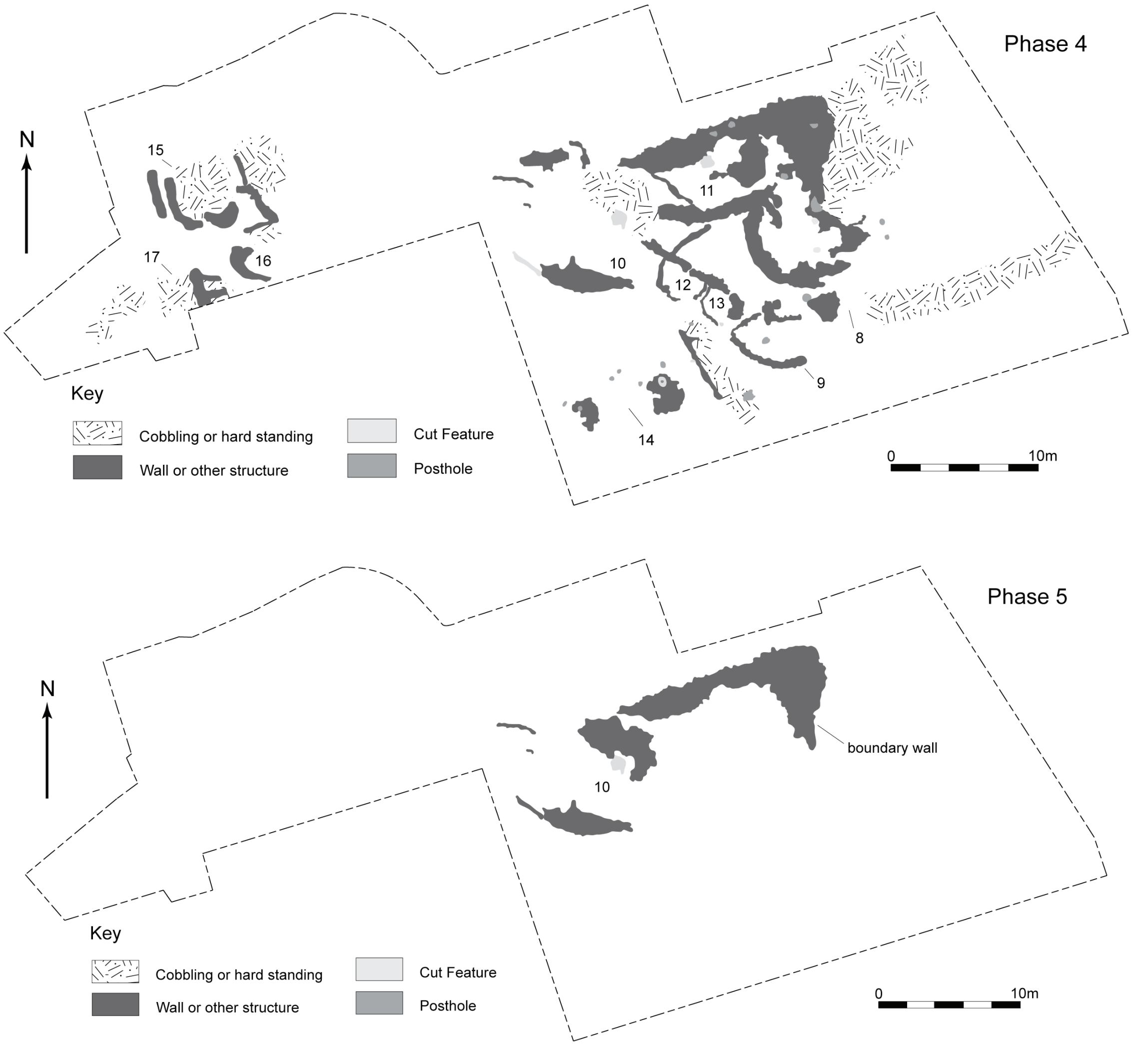

Figure 7.8.2: Site plans for Phases 4 and 5 at Phantassie Farm (after Lelong and MacGregor 2008, figs. 7.29 and 7.42)

material. The entrance path was worn to such an extent that it was filled with rubble and kerbed on one side to form a metalled path 2m across. New structures in the settlement included a cellular building [7], a covered porch [8] near the eastern entrance, and a house [9] still represented archaeologically by a stone arc and internal hearth.

Phase 4

The fourth phase of activity is marked by the construction of new buildings over the midden that had been spread over the sub-rectangular structure [1]. The buildings included [10] that overlay the midden as well as the northern walls of [1] and [12] and [13] that are two smaller semi-circular celled structures built against the old eastern wall of [1]. Structure [9] appears to have been remodelled at this time as well, with a new northern wall base constructed along with an entrance threshold and new hearth setting. Buildings [7] and [8] also appear to have remained in use at this time, although it is believed that the floor of the porch [8] was no longer being swept clean. The midden store was also still in use and a further three outbuildings were constructed ([15], [16], and [17]).

Phase 5

The fifth and final phase of settlement sees perhaps structure [10] still in use along with [7], although falling into disrepair. Structure [11] almost certainly fell down or was dismantled and the settlement is clearly in ruins with the debris of daily life scattered throughout the site in visible layers.

7.8.2 Sample specifics

In total, 59 radiocarbon dates were obtained on cremated bone, charcoal, and carbonized seeds from across the site and throughout the stratigraphy.

7.8.3 Model description

The stratigraphic relationship between the sampled contexts at Phantassie is given in the matrix shown in Figure 7.8.3. Although there are 5 phases of development identified at the site, the matrix only clearly separates the four contexts of the Phase 1 scoop and related features from the remaining later phases. This is due in large part to the fact that nearly all of the structures are thought to be in use, in either their original or modified form, across multiple phases, and as such, the model presented here gives preference to the site stratigraphy.

Phase 1 features

The earliest features on the site (Phase 1) include a scoop, ditch, and hollow. Two results are available from a stratigraphic sequence in hollow [132] and includes SUERC-5518 on *Betula* sp. charcoal from the lower fill (308) and SUERC-5630 on *Betula* sp. charcoal from the upper fill (116). A result (SUERC-5624) is available from the fill (305) of pit (368). The result is likely residual in the context and has been excluded from the model. A fourth result (SUERC-5620) on a charred cereal grain is available from an early occupation spread (388) that also stratigraphically predates the paving (067) in Phase 3 Structure 8.

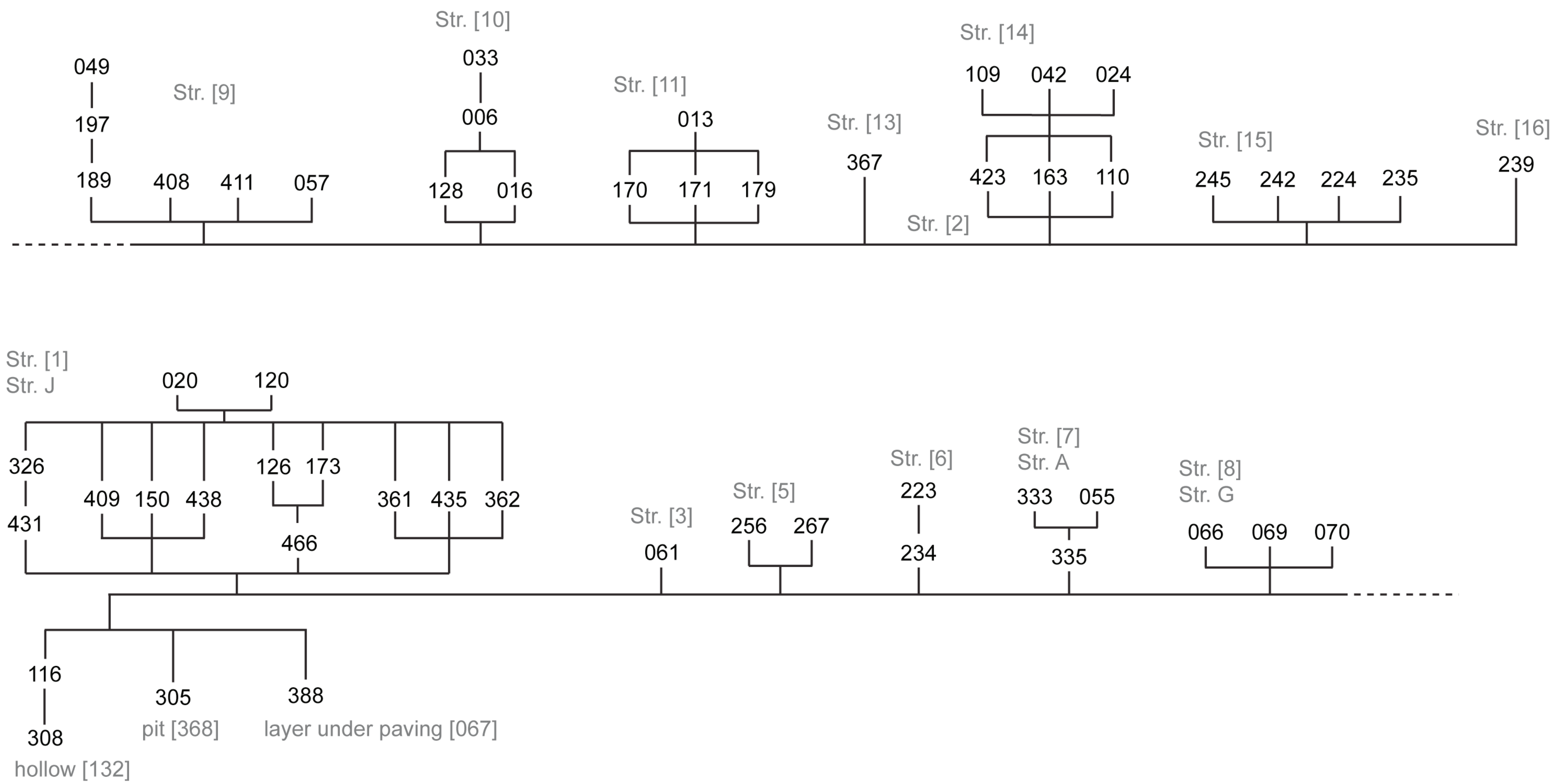

Figure 7.8.3: Site matrix of dated and modelled contexts and feature groups from Phantassie Farm

Structure 1

There are two radiocarbon results from material in a sequence in the hard-standing of Structure [1]. SUERC-5634 is on a charred barley grain from the lower layer/old ground surface (431), while SUERC-5627 is on *Betula* sp. charcoal recovered from the overlying occupation surface (326).

Three results are available from fills in ditches in the yard adjoining Structure [1]. SUERC-5637 is on hazel charcoal from a fill (150) in ditch (399). SUERC-5636 is on a grain of barley recovered from a fill (438) in ditch (436). The result is likely residual given its context and has been excluded from the model. SUERC-5628 is on a piece of hazel charcoal from a fill (409) in ditch (439).

There is a sequence of results related to pre-Structure [1] ground surface and the structure walls overlying the area. SUERC-5644 is on a charred barley grain from the pre-structural occupation surface. SUERC-5519 is from a barley grain that was recovered from the fill (173) of a wall cut (366), while SUERC-5490 is on a fragment of hazel charcoal that was recovered from the fill (126) of the wall. There is no identified relationship between the two samples related to the walls of Structure [1]. Both SUERC-5519 and -5644 are too recent given their stratigraphy and likely intrusive. They have, therefore, been excluded from the model.

Three occupation deposits from within the structure were also dated. SUERC-5638 is on a fragment of *Alnus/Betula* sp. charcoal from deposit (362). SUERC-5635 is on a fragment of hazel charcoal from deposit (435). SUERC-5625 is on a piece of *Salix* sp. charcoal from deposit (361). The result is too recent and likely to be intrusive and so has been excluded from the model.

Two midden deposits were dated that accumulated after Structure [1] fell out of use. SUERC-5521 and -5618 are both on hazel charcoal from the midden deposit (020) to the south of the structure, while SUERC-5508 (*Betula* sp. charcoal) and SUERC-5616 (alder charcoal) are from the larger midden deposit (120) that seals the structure.

Structure 2

Three contexts from structure [2] were dated. The first result (SUERC-5502) is on a charred barley grain from a scorched deposit from the floor. A second result (SUERC-5501) is on a piece of *Betula* sp. charcoal from the post-pipe (163) in post-pit

(111). The final result (SUERC-5629) is on a piece of *Betula* sp. charcoal from the fill (423) of another posthole (426) that is also stratigraphically earlier than Structure [14]. As such, the entirety of Structure [2] has been positioned earlier than Structure [14].

Structure 3

There is one result (SUERC-8196) on hazel charcoal from deposit (061) that is beneath the wall of Structure 3 and so provides a *terminus post quem* for the construction of the structure.

Structure 5

There are two results (SUERC-5530 and -5531) on charcoal and charred grain, respectively, from fill (256) of a pit (257) and fill (267) of a post-pit (268) from Structure 5.

Structure 6

There is a sequence in Structure 6. One result (SUERC-5506) is on hazel charcoal from a construction deposit (234) for the rebuilding of a wall and provides a *terminus post quem* for that event. The structure has post-abandonment deposit (223) from which a sample of hazel charcoal provides SUERC-5491. This result is too old and likely to be residual, and so has been excluded from the model.

Structure 7

Three contexts were dated in Structure 7 that form a sequence. There is one result (SUERC-5529) available on a fragment of Prunoideae charcoal recovered from upper fill (335) that is beneath the paving of the large scoop (368) within which the structure is situated. SUERC-5496 is from a charred barley grain from occupation deposit (055), while SUERC-5527 is from a charred barley grain that was in fill (333) of posthole (349). Both SUERC-5496 and -5527 are stratigraphically later than SUERC-5529 but are not related to one another. Given SUERC-5529 should pre-date the structure, and SUERC-5496 and -5527 should relate to the use of the structure, it is possible to use this information to estimate when Structure 7 was constructed.

Structure 8

Three stratigraphically unrelated contexts in Structure 8 were dated. One result (SUERC-5492) is available from a charred barley grain recovered from occupation deposit (066) from the interior floor. SUERC-5486 is a result on a charred grain of barley that was part of hearth rake-out dump (070) that was recovered from on paving (067). SUERC-5645 is also a charred barley grain recovered from the matrix (069) of the south wall of the structure.

Structure 9

Seven measurements are available from six contexts in Structure 9. One result (SUERC-5639) is available on Prunoideae charcoal from layer (189) sealed beneath the wall (056). SUERC-5640 is from a charred barley grain recovered from ground surface (408) beneath the structure, but not necessarily sealed by a wall so included here as likely representing deposition through active use of the structure. There is another result (SUERC-5488) on hazel charcoal from fill (057) of large posthole (158). A sample of *Triticum* sp. from hearth rake-out deposit (049) produced SUERC-5511, while a piece of *Salix* sp. charcoal produced SUERC-5510 from the same deposit. SUERC-5510 is likely residual in its context and has been excluded from the model. One result (SUERC-5520) is available from a piece of hazel charcoal from lower fill (197) of the hearth pit (331) associated with the structure. A charred barley grain from fill (411) of posthole (413) produced SUERC-5626.

Given SUERC-5639 should pre-date the structure, and the other results should relate to the use of the structure, it is possible to use this information to estimate when Structure 9 was constructed.

Structure 10

There are four results from as many contexts in Structure 10 that form a sequence. Two results are available (SUERC-5497 and -5617) from a charred barley grain and hazel charcoal, respectively, derive from midden deposits (128 and 016) that predate the structure. A piece of hazel charcoal produced a result (SUERC-5516) for the occupation deposit (006) that overlies the midden material. A final result (SUERC-5614) is available for a charred barley grain that was recovered from deposit (033) that was built-up against the tumble of wall (035) and so should post-date the use of the building. The result was substantially recent compared to the other results from Phantassie and may be intrusive, but is more likely to be a statistical outlier. In either case it has been excluded from the model.

Structure 11

There are four results from as many contexts in Structure 11 that form a sequence. Two results (SUERC-5522 and -5526) are on hazel charcoal and a charred barley grain from midden (170) and ground surface (171), respectively, while a third (SUERC-5509) is on hazel charcoal from fill (179) of posthole (177). All three contexts predate the floor (092 and 093) of Structure 11. The fourth result (SUERC-9040) is on cremated human bone from a dump (913) of scorched material that was recovered from against fallen wall (100) and should post-date the use of the structure. The result is likely to be residual and has been excluded from the model.

Structure 13

There is a single result (SUERC-7345) on *Betula* sp. charcoal from fill (367) of posthole (366) in Structure 13. The result is likely residual and had been excluded from the model.

Structure 14

Three stratigraphically unrelated contexts in Structure 14 were dated. One result (SUERC-5500) is available from a charred barley grain recovered from spread (024) within Structure 14. SUERC-5489 is a result on *Betula* sp. charcoal from fill (042) of posthole (121), while SUERC-5487 is a result on a charred barley grain from fill (109) of posthole (108). SUERC-5489 has been excluded from the model since it is residual.

Since Structure 2 is stratigraphically earlier than Structure 14, it has been positioned as such in the model and the sequence has been used to estimate when Structure 14 was constructed.

Structure 15/Midden Store

The midden store (Structure 15) had four dated contexts producing six radiocarbon measurements. Two results (SUERC-5528 and -5700) are available on Maloideae charcoal and a charred barley grain from the lower fill (245). The two results are not statistically consistent ($T'=5.4$; $\nu=1$; $T'(5\%)=3.8$) and suggest the material is of different actual ages. Two results (SUERC-5498 and -5499) on a fragment of hazel charcoal and a charred barley grain are available from the upper fill (224). The two results are not statistically consistent ($T'=18.9$; $\nu=1$; $T'(5\%)=3.8$). A result (SUERC-5517) on a fragment of blackthorn charcoal is available from another upper fill (242) context. One result (SUERC-5507) on hazel charcoal is available from the matrix (235) of the stone wall surrounding the feature. Although the midden store was sampled in upper and lower layers that would normally be modelled as a sequence, it appears that the feature was actively used in the past with material removed and other fresh material put in the hollow so that the sequence is effectively mixed. SUERC-5498 was substantially older than the other results from Phases 2–5 on the site and is probably residual. It has been excluded from the model.

Structure 16

One result (SUERC-5512) is available on a fragment of hazel charcoal from a layer (239) that is sealed by the wall (205) of Structure 16.

Modelling the settlement

The model presented in the site dating matrix and the description above preserves the sequencing within the feature groups identified by the excavator. That is to say that ^{14}C dates from contexts sealed under structure walls are modelled as being earlier than those from contexts associated with the use of the structure, which are earlier than deposits that post-date the structure (i.e. midden build-up against walls or within the structure).

Phase 1, which consists of pre-settlement features, has been modelled two ways: 1) in such a way that it is independent of the later results, and so can overlap completely in time; and 2) so that it preserves the sequence provided by the fact that these earliest scoops and hollows are all earlier than the main settlement features of Phases 2–5. The results are essentially identical and the model that allows the pre-settlement features to remain independent of the later features has been preferred.

7.8.4 Model results

The model (Fig. 7.8.4) has good overall (A_{model}=69) agreement between the radiocarbon dates and the prior information. The model estimates that activity associated with the early scoops began in *485–40 cal BC* (*95% probability*; Fig. 7.8.5; *start: Phantassie Farm Phase 1*) and ended in *170 cal BC–cal AD 270* (*95% probability*; Fig. 7.8.5; *end: Phantassie Farm Phase 1*). The early scooped activity lasted for *1–655 years* (*95% probability*; Fig. 7.8.6; *use: Phantassie Farm Phase 1*) or probably *1–175 years* (*68% probability*). Given the low number of results in this phase these are likely overestimates and the *68% probabilities* might provide a better estimate for the duration of this early activity.

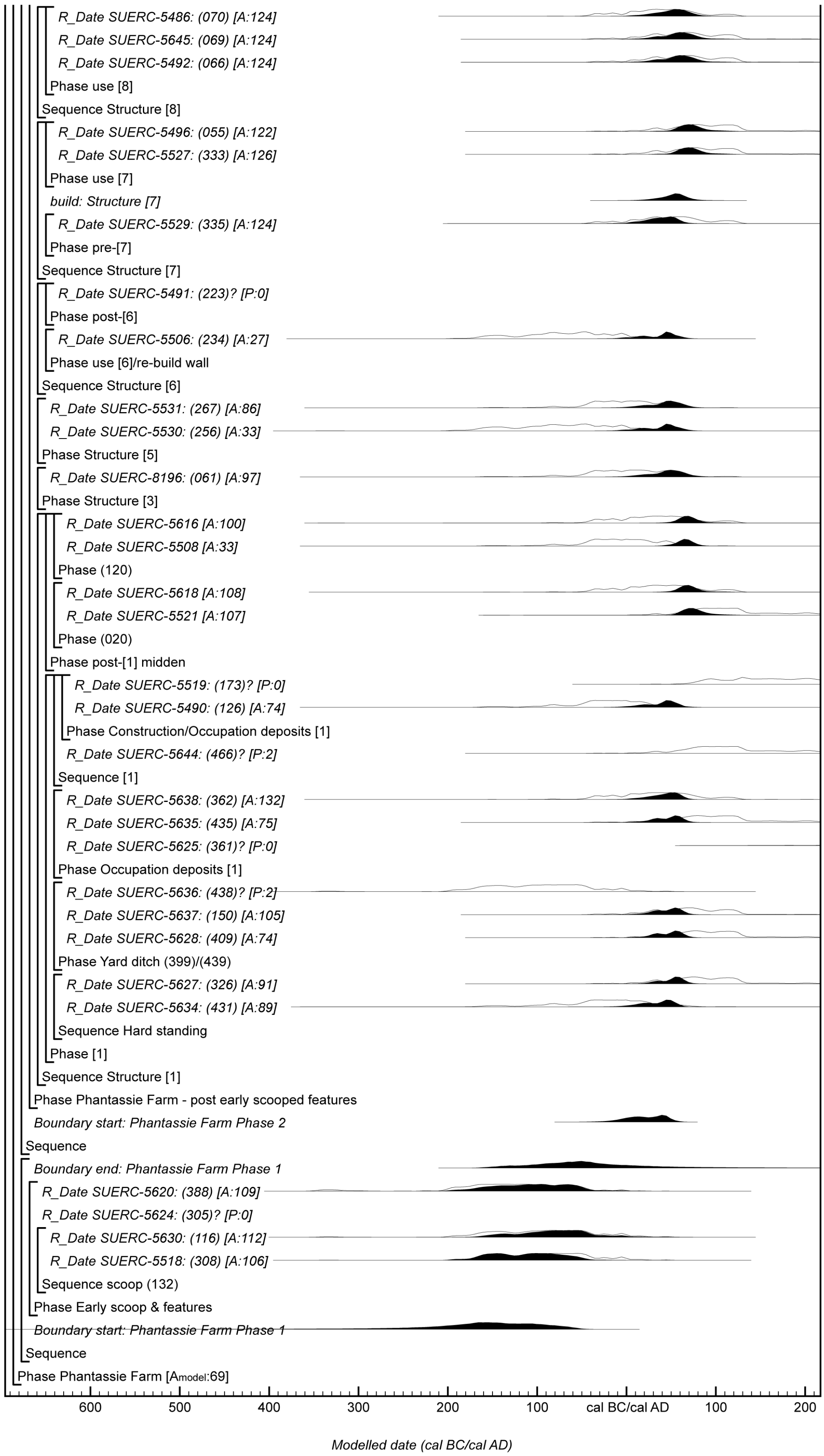

Figure 7.8.4: Chronological model for Phantassie Farm (continued on the next page). The model structure is defined by the brackets and keywords. The format is as described in Figure 4.2.3

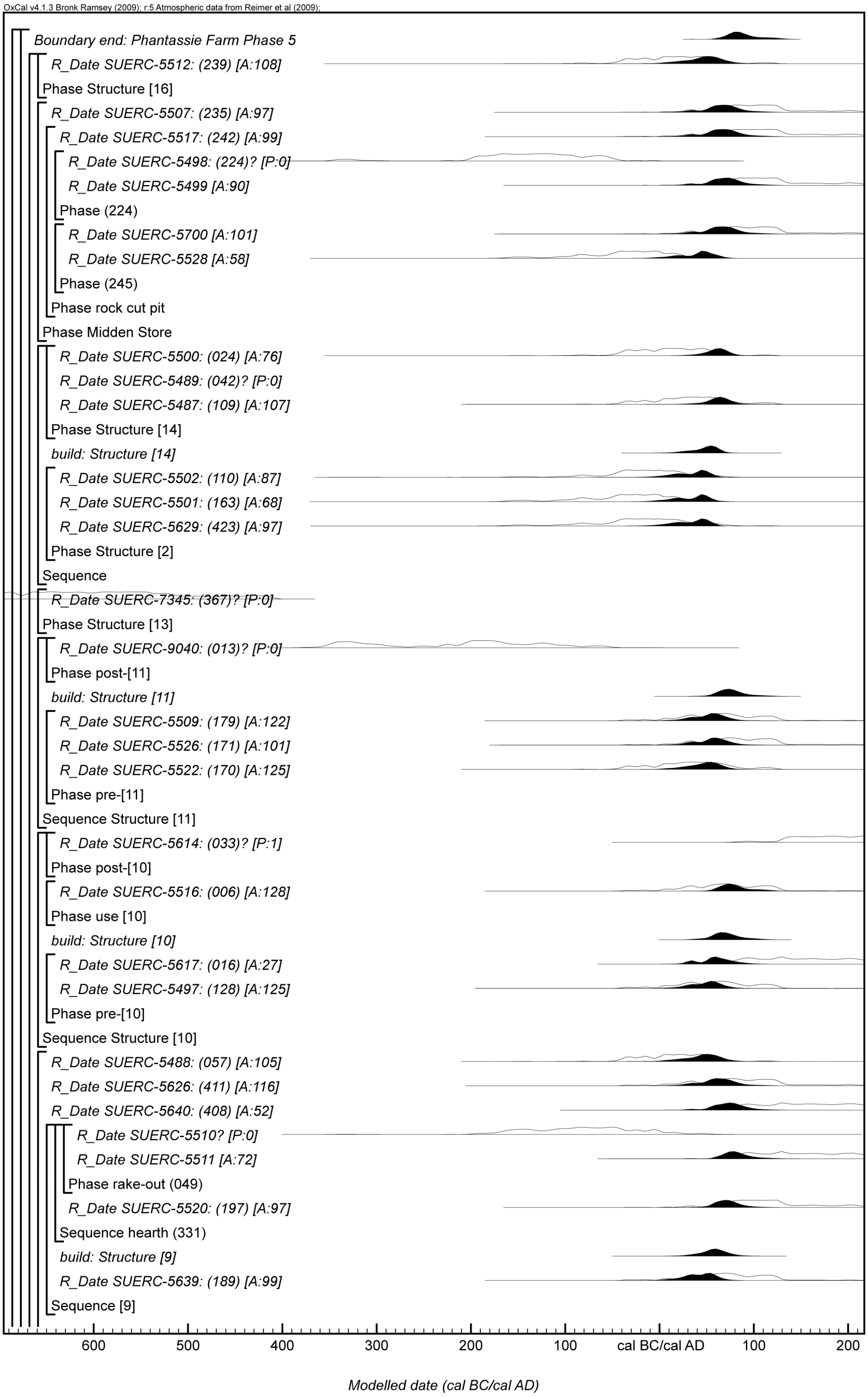

Figure 7.8.4 (cont.): Chronological model for Phantassie Farm (continued fro the previous page)

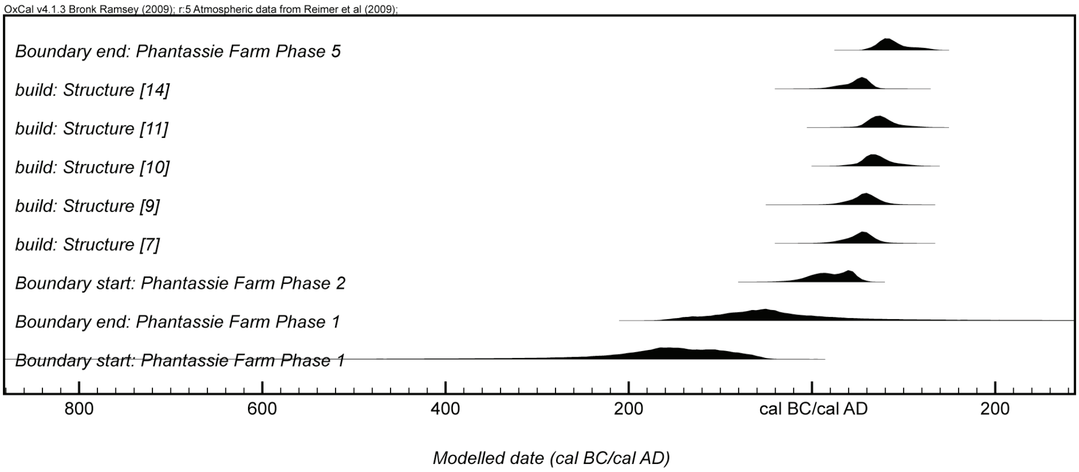

Figure 7.8.5: Probability distributions for event boundaries associated with beginning and end of select Phases and the construction of structures 7, 9, 10, 11, and 14, as extracted from the chronological model for Phantassie Farm shown in Figure 7.8.4

The Phase 2 settlement activity at Phantassie began in *20 cal BC–cal AD 60* (*95% probability*; Fig. 7.8.5; *start: Phantassie Farm Phase 2*) and probably in *cal AD 5–50* (*68% probability*).

There was enough prior information available to estimate the construction dates for five structures on the site:

- Structure 7 was constructed in *cal AD 20–80* (*95% probability*; Fig. 7.8.5; *build: Structure [7]*) and probably in *cal AD 40–70* (*68% probability*)
- Structure 9 was constructed in *cal AD 25–90* (*95% probability*; Fig. 7.8.5; *build: Structure [9]*) and probably in *cal AD 40–75* (*68% probability*)
- Structure 10 was constructed in *cal AD 35–105* (*95% probability*; Fig. 7.8.5; *build: Structure [10]*) and probably in *cal AD 55–85* (*68% probability*)
- Structure 11 was constructed in *cal AD 45–110* (*95% probability*; Fig. 7.8.5; *build: Structure [11]*) and probably in *cal AD 60–90* (*68% probability*)
- Structure 14 was constructed in *cal AD 20–75* (*95% probability*; Fig. 7.8.5; *build: Structure [14]*) and probably in *cal AD 40–70* (*68% probability*).

This data could also be used to provide probabilities for any structure being constructed prior to another (Table 7.8.1).

		τ_2				
		7	**9**	**10**	**11**	**14**
	7	---	59%	83%	93%	46%
τ_1	**9**	41%	---	77%	89%	37%
	10	17%	23%	---	69%	14%
	11	7%	11%	31%	---	5%
	14	54%	63%	86%	95%	---

Table 7.8.1: Probabilities that one structure was constructed before another is given for $\tau_1<\tau_2$

The final phase of activity at Phantassie Farm ended in *cal AD 60–125* (*95% probability*; Fig. 7.8.5; *end: Phantassie Farm Phase 5*) and probably in *cal AD 70–100* (*68% probability*). The span of post-scoop settlement was probably only a few generations, lasting for *1–135 years* (*95% probability*; *use: Phantassie Farm post-early scooped features*) and probably *20–90 years* (*68% probability*).

The estimate dates of construction for some of the buildings was used to calculate a span for the settlement phases with which they are associated. The difference between *build: Structure [7]* and *start: Phantassie Farm Phase 2* has been used to estimate that Phase 2 spanned *1–80 years* (*95% probability*; Fig. 7.8.8; *span: Phantassie Farm Phase 2*) and probably *1–40 years* (*68% probability*). The difference between *build: Structure [11]* and *build: Structure [7]* was used to estimate that Phase 3 spanned *10–75 years* (*95% probability*; Fig. 7.8.8; *span: Phantassie Farm Phase 3*) and probably *1–35 years* (*68% probability*). Finally, the difference between *end: Phantassie Farm Phase 5* and *build: Structure [11]* was used to estimate that Phases 4 and 5 spanned *1–40 years* (*95% probability*; Fig. 7.8.8; *span: Phantassie Farm Phases 4/5*) and probably *1–20 years* (*68% probability*).

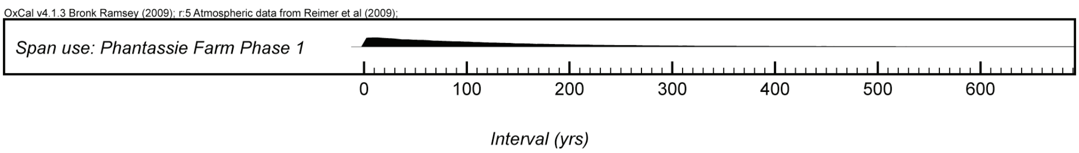

Figure 7.8.6: Probability distribution for the estimated spans of use for Phase 1 at Phantassie Farm. The probability is derived from the modelling shown in Figure 7.8.4

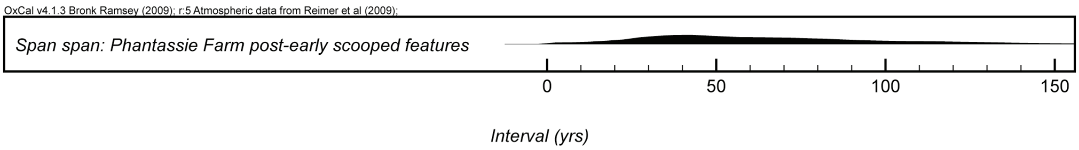

Figure 7.8.7: Probability distribution for the estimated span of use for Phases 2–5 at Phantassie Farm. The probability is derived from the modelling shown in Figure 7.8.4

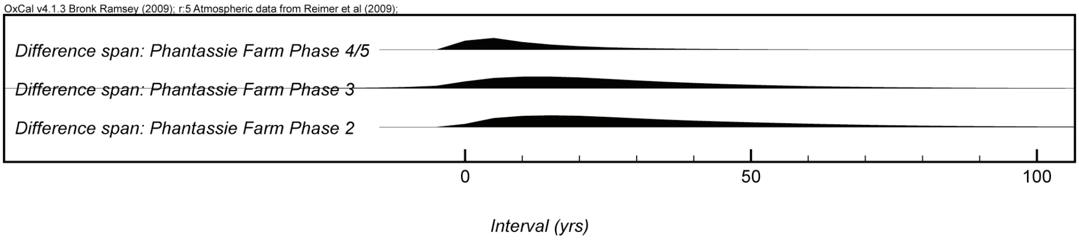

Figure 7.8.8: Probability distributions for the estimated spans of Phases 2, 3, and 4/5 at Phantassie Farm. The probabilities are derived from the modelling shown in Figure 7.8.4

7.8.5 Discussion

Despite the lack of stratigraphy between most of the structures, the radiocarbon dating and Bayesian modelling of the site, for the most part, support the observed site sequencing.

None of the structures where a construction date could be estimated (7, 9, 10, 11, & 14) was thought to have been constructed in Phase 2. Structure 7 and 9 were placed within Phase 3, while the other three were placed in Phase 4. The modelling suggests that perhaps Structure 14 was constructed earlier and might be closer to a Phase 3 structure, given there is an 86% and 95% probability that it predates Structures 10 and 11, respectively.

The modelling of Phantassie Farm further illustrates the complexity of these settlements and just how quickly they are transformed. Four phases of the site probably encompassed *20–85 years* (*68% probability*; *span: Phantassie Farm post-early scooped features*), so that a person leaving the site in the latter third of the *1st century cal AD* perhaps was intimately connected to someone who was at the founding of the post-scooped settlement, a grandparent or perhaps even great-grandparent.

Often when looking at archaeological sites where there are a few archaeological phases and evidence for much remodelling we envision long timescales. The remodelling of the settlement at Phantassie Farm was of a quickening pace. Up to *75 years* elapsed between the beginning of Phase 2 and the construction of structure 7 (*95% probability*; *span: Phase 2*) and probably *1–40 years* (*68% probability*). As many as *70 years* passed between the construction of structures 7 and 11 (*95% probability*; *span: Phase 3*) and probably *1–35 years* (*68% probability*). After the construction of structure 11 as many as *40 years* passed before the end of the settlement activity (*95% probability*; *span: Phase 4/5*) and probably *1–15 years* passed (*68% probability*). Within this later prehistoric central Britain stone-built settlement, the identified transformations appear to follow a pattern of near generational change.

7.9 Standingstone

7.9.1 Site description

The site of Standingstone (NT 566 733) is dominated by a curvilinear enclosure on a low hill (~110m OD) approximately 2km south-west of Traprain Law. The site has an estimated internal area of 0.15ha (Fig. 7.9.1). The site was excavated in 2003 and has been published (Haselgrove 2009).

Pre-enclosure activity on the hill includes Neolithic pits and Early Bronze Age urned cremations. Other pre-enclosure activity, thought to be more closely related to the Iron Age activity, includes an oven/hearth pit, palisade, linear ditch, various scoops, and post settings for a curvilinear structure/screen.

The enclosure is formed of a penannular ditch and palisade that were erected between 3 and 3.5m apart. It is possible that the palisade was a revetment for the bank. It was replaced at some point in the past – as seen in the southwest of the site – somewhat altering the course in that area.

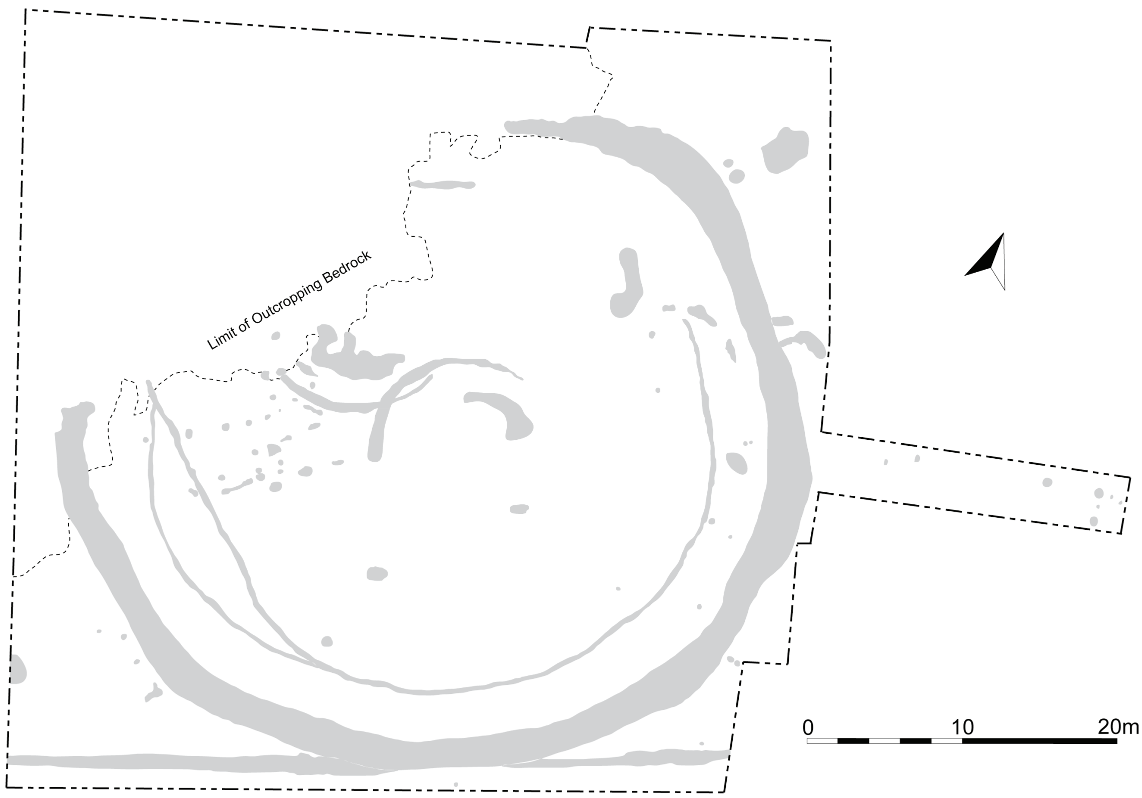

Figure 7.9.1: Site plan from Standingstone (after Haselgrove 2009, fig. 4.3)

The remains of three circular structures (CS) of ring-ditch house tradition were excavated within the enclosure. Although CS 2 was seen to replace CS 1, there is no direct relationship between either and the smaller CS 3.

Further details on the site can be found in Haselgrove (2009).

7.9.2 Sample specifics

A total of 26 samples of charcoal, carbonized grain, and charred and cremated human bone was submitted for radiocarbon dating from 25 discrete contexts that included fills of pits, postholes, ditches, occupation layers, and a burial.

7.9.3 Model description

The model places the radiocarbon results into three groups based on archaeological phasing (e.g. the various pre-enclosure features; the enclosure phase; and the later curvilinear structures). A total of 26 results was obtained from material from this site (Fig. 7.9.2). Due to the very poor condition of botanical material from the site, this is significantly fewer that had originally been hoped for, but they nevertheless provide a good overall framework for the site. Despite all the precautions, three samples proved to be modern (SUERC-10529, -10549, and -10550) and are excluded from the model.

Eight results are available from seven unrelated pre-enclosure contexts (21, 46, 132, 140, 197, 228, 231, and 233). There are two results (SUERC-10535 and -10536) on single carbonized cereal grains from the fill [21] of Pit F56 that contained much stone and charcoal. The two results are statistically consistent ($T'=0.5$; $\nu=1$; $T'(5\%)=3.8$), with SUERC-10536 providing the best estimate for the date of the feature. SUERC-10537 is on a sample of emmer wheat from a grain cache [45] in Pit F46. SUERC-10548 is a result on a fragment of birch charcoal from the fill [132] of posthole F131, which lies just inside the 2nd palisade. SUERC-10549 is a modern result on a carbonized barley grain in the fill [140] of posthole/pit F139. SUERC-10551 is a result on a single fragment of hazel charcoal from the fill [197] posthole F196, which lies outside the enclosure. SUERC-10555 is a result on a fragment of birch charcoal from the fill [228] of Pit F227, which is cut by the enclosure ditch. SUERC-10556 is a result on a fragment of hazel charcoal from the fill [231] of Pit 230 that lies at the end of the palisade trench. SUERC-11893 is a result on cremated human bone from the fill [233] of a cinerary urn (SMF35) F232. These eight dates do not form a coherent continuous pre-enclosure phase, but more accurately represent the immediately pre-enclosure

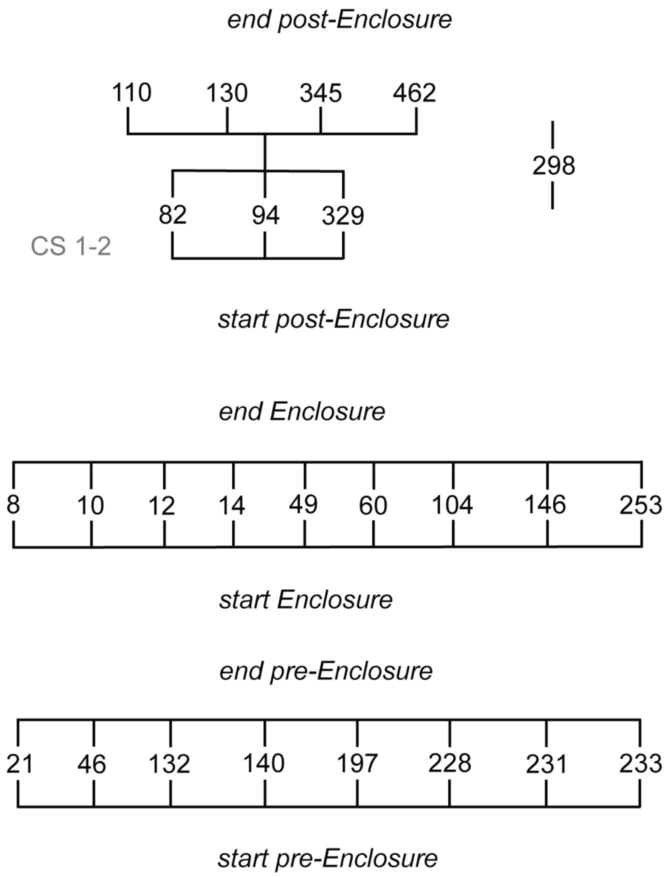

Figure 7.9.2: Site matrix of dated and modelled contexts from Standingstone

activity along with earlier episodic activity in the Bronze Age associated with a cache of grain and a cremation burial.

Seven measurements come from contexts that were not stratigraphically related, but have been assigned to the construction and occupation of the enclosure, including fills and features associated with the palisade and ditch (8, 10, 12, 14, 49, 60, 104, 146, and 253). The seven measurements are not consistent (T'=213.0; ν=6; T'(5%)=12.6). Two of the results (SUERC-10545 and -10557) are too young when compared to the other results and presumably represent later material incorporated in these deposits when the site was reoccupied. After excluding these, the remaining results are consistent (T=4.3; ν=4; T'(5%)=9.5). SUERC-10528 is a result on a charred barley grain from the fill [8] of posthole F7, which is cut into the outer (1st) palisade. SUERC-10529 is a modern result on a charred barley grain from the upper fill [10] of Palisade F13. SUERC-10530 is a result on a charred grain of wheat from fill [12] of posthole F11, in the inner stretch in Palisade F13. SUERC-10531 is a result on a fragment of birch charcoal from the upper fill [14] of the Palisade F13. SUERC-10538 is a result on a charred cattle tooth from the third fill [49] from the top of the north-west ditch terminal F3[10]. SUERC-10539 is a result on a hazel nutshell from fill [60] of posthole F61, which is part of a structure next to the palisade trench. SUERC-10545 is a result on carbonized hazel nutshell from the upper fill [104] of Palisade F103. SUERC-10550 is a modern result on a charred grain of barley from the fill [146] of shallow posthole F145. SUERC-10557 is a result on a carbonized hazel nutshell from the upper fill [253] of enclosure ditch F252.

Finally, eight samples are available from an equivalent number of contexts associated with the three curvilinear structures. Three results are available from CS 1 and include: SUERC-10540 on a fragment of birch charcoal from the charcoal-rich fill [82] over the cobbled surface of sunken floor feature F79; SUERC-10541 on a fragment of hazel charcoal from the fill [94] of a section of gully F106; and SUERC-10559 on a fragment of birch charcoal from the fill [329] of posthole F328 that lies at the end of gull F106. CS 2 is stratigraphically later than CS and four results are available from an equal number of contexts associated with this structure. SUERC-10546 is a result on a fragment of hazel charcoal from the fill [110] of the 2nd cut of the CS 2 gully F360. SUERC-10547 is a result on a single charred emmer grain from fill [130] in the central sunken floor feature F451. SUERC-10560 and -10561 are results on charred hazel nutshell from the fills (345 and 462) of the 1st and 2nd cuts of the CS 2 gully. Both results are too early given their stratigraphic position, and, given the robust nature of hazel nutshell, are likely to be residual in their respective contexts. Both results, consequently, have been excluded from the modelling. A final result, SUERC-10558, is available on a charred grain of emmer wheat from the fill [298] of sunken floor feature F297. This final result is not related to the others through direct stratigraphy.

7.9.4 Model results

The model (Fig. 7.9.3) has good overall agreement (A_{model}=81%) with the stratigraphic relationships of the various samples. The model estimates that the construction of the enclosure began in *960–850 cal BC* (*95% probability*; Fig. 7.9.4; *start: Standingstone Enclosure*), and probably in *945–900 cal BC* (*59% probability*) or *880–860 cal BC* (*9% probability*). Its use finished in *935–805 cal BC* (*95% probability*; Fig. 7.9.4; *end: Standingstone Enclosure*), and probably in *920–885 cal BC* (*37% probability*) or *870–*

[10] Although the process of charring bone can degrade the collagen and adversely affect the accuracy of the radiocarbon date (Van Klinken 1999), SUERC-10538 does appear to accurately date the sample.

835 cal BC (*31% probability*). The overall span of enclosure activity was *1–75 years* (*95% probability*; Fig. 7.9.5; *use: Standingstone Enclosure*) and probably *1–30 years* (*68% probability*).

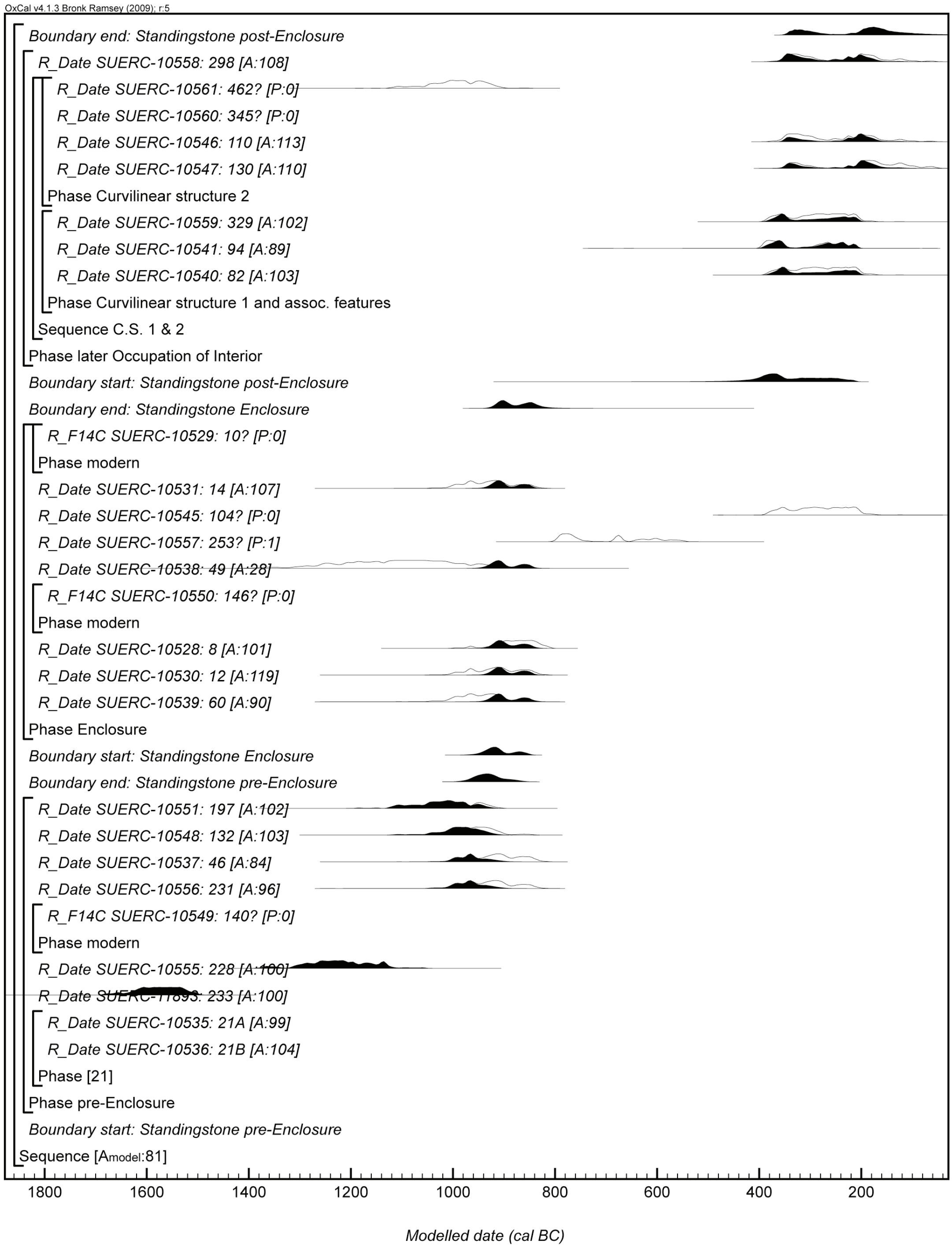

Figure 7.9.3: Chronological model for Standingstone. The model structure is as described in Figure 4.2.3

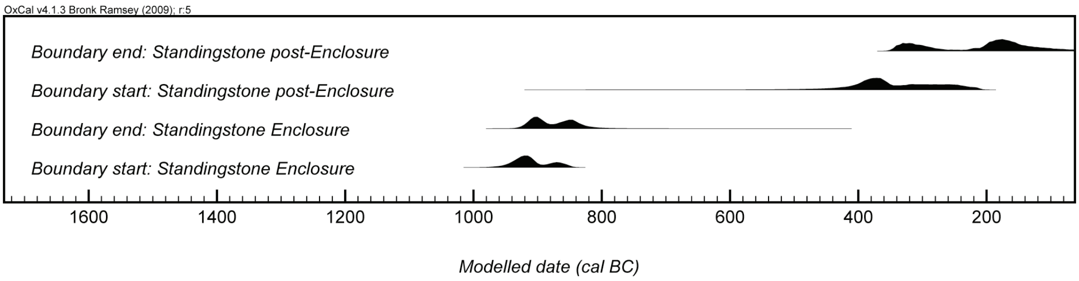

Figure 7.9.4: Probability distributions for event boundaries associated with the Enclosure and post-Enclosure activity, as extracted from the chronological model for Standingstone shown in Figure 7.9.3

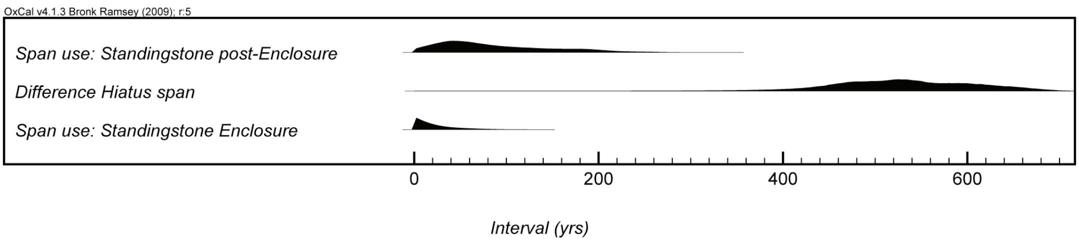

Figure 7.9.5: Probability distributions for the estimated spans of use for the Enclosure, post-Enclosure, and Hiatus in settlement at Standingstone. The probabilities are derived from the modelling shown in Figure 7.9.3

There was then a hiatus between the use of the enclosure and the later re-occupation represented by the curvilinear structures, which lasted between *380–690 years* (*95% probability;* Fig. 7.9.5; *Hiatus span*) and probably between *455–620 years* (*68% probability*). The building of the curvilinear structures began in *465–210 cal BC* (*95% probability*; Fig. 7.9.4; *start: Standingstone post-Enclosure*), and probably in *405–345 cal BC* (*38% probability*) or *325–245 cal BC* (*30% probability*). This activity ended in *355–50 cal BC* (*95% probability*; Fig. 7.9.4; *end: Standingstone post-Enclosure*), and probably in *345–290 cal BC* (*23% probability*) or *210–130 cal BC* (*45% probability*). The overall span of activity associated with these structures was *1–210 years* (*95% probability*; Fig. 7.9.5; *use: Standingstone post-Enclosure*) and probably *1–120 years* (*68% probability*).

7.9.5 Discussion

The results from Standingstone are of a Late Bronze/Early Iron Age enclosure and palisade. If there was a settlement in the interior of the enclosure, any trace was destroyed by the later activity associated with the construction and use of the curvilinear structures in the 4^{th}–2^{nd} centuries cal BC.

In a faulting review, Sharples (forthcoming) has argued that on morphological grounds the site is probably a mid-Iron Age defended settlement and that the ditched enclosure and palisade should date to the same period as the structures. The archaeology, as excavated and recorded, does not support this hypothesis. As Sharples' argument goes, all of the dated material from the enclosure ditch and palisade trench was likely residual except for the SUERC-10545 from the upper fill (104) of the palisade trench. It should be noted that the other result (SUERC-10557) that was considered too recent in the enclosure ditches was from a charred hazel nutshell recovered in the upper fill (253) of the ditch. The two modern results in the series of dates from enclosure-related contexts come from the upper fill (10) of the palisade trench (SUERC-10529) and from the fill (146) of a shallow posthole (SUERC-10550). Given that the interpretation had been of a later settlement being sited within a vestigial earthwork (Haselgrove 2009), it is not unreasonable to expect more recent material in the upper fills. However, for anyone who disagrees with the excavator's interpretation, and would prefer to view the site as a ditched and palisaded enclosure surrounding a settlement of curvilinear structures, the modelled dates for the curvilinear structures would provide the best estimate for such a settlement. Although such a model should include the single result isolated from a sea of residual material in the ditches, the probability distributions shown in Figure 7.9.4 are all extremely bi-modally distributed. Even if further samples had been available from post-enclosure contexts, it is unlikely they would have overcome the bi-modality. Simulations with up to two-dozen additional dates were run and suggested that very little extra precision would be gained without the addition of stratigraphic constraints.

7.10 Tweed–Forth Discussion

The dated and modelled settlements from the Tweed-Forth region present a variety of types. All of the sites were selected because they were later prehistoric settlements and they had a substantial number of radiocarbon dates with which to work for the purpose of constructing Bayesian models. While the region has been defined as the Tweed-Forth, it may have made equally good sense to refer to it simply as south-east Scotland. The settlements are split between the upland sites of Eildon Hill North and The Dunion on the Scottish side of the Cheviots and the remaining sites along the coastal plain of East Lothian, thereby perhaps more aptly defining the region by the modern political boundary rather than geographic barriers that might have been used in the past.

Reflecting briefly on the two dated and modelled Scottish hillforts, Eildon Hill North probably could have been excluded from this research given that the primary dated activity is in the earlier Iron Age and the later activity in the Roman Iron Age is extremely imprecise. Perhaps the lack of precision and fact that a small edge of the settlement at The Dunion was all that was dated could be reason enough to exclude it as a settlement from the research programme. It might also be argued that these two settlements should be discussed in relation to the other Cheviot Hill sites in the project. While they most certainly have more in common with sites such as Wether Hill, it was decided to keep the sites in Scotland as a coherent group because these sites all have dating that was, in essence, 'inherited' by the project. The dates from these sites were not chosen within an explicit Bayesian framework. Furthermore, they had no additional dates made available and so could not be worked into a Bayesian framework. These sites represent, in many, ways the type of analyses that are available and the results possible given these circumstances.

All of the modelled 'events' that have been discussed in the chapter sections above have been graphed again together in Figure 7.10. Two themes are picked out here in the Scottish data: the dating of the enclosures and the relationship of the settlements to the advance of the Roman army.

Enclosures in East Lothian

Four of the East Lothian sites in this study were enclosed within ditches in the later prehistoric period: Fishers Road East, Fishers Road West, Knowes Farm, and

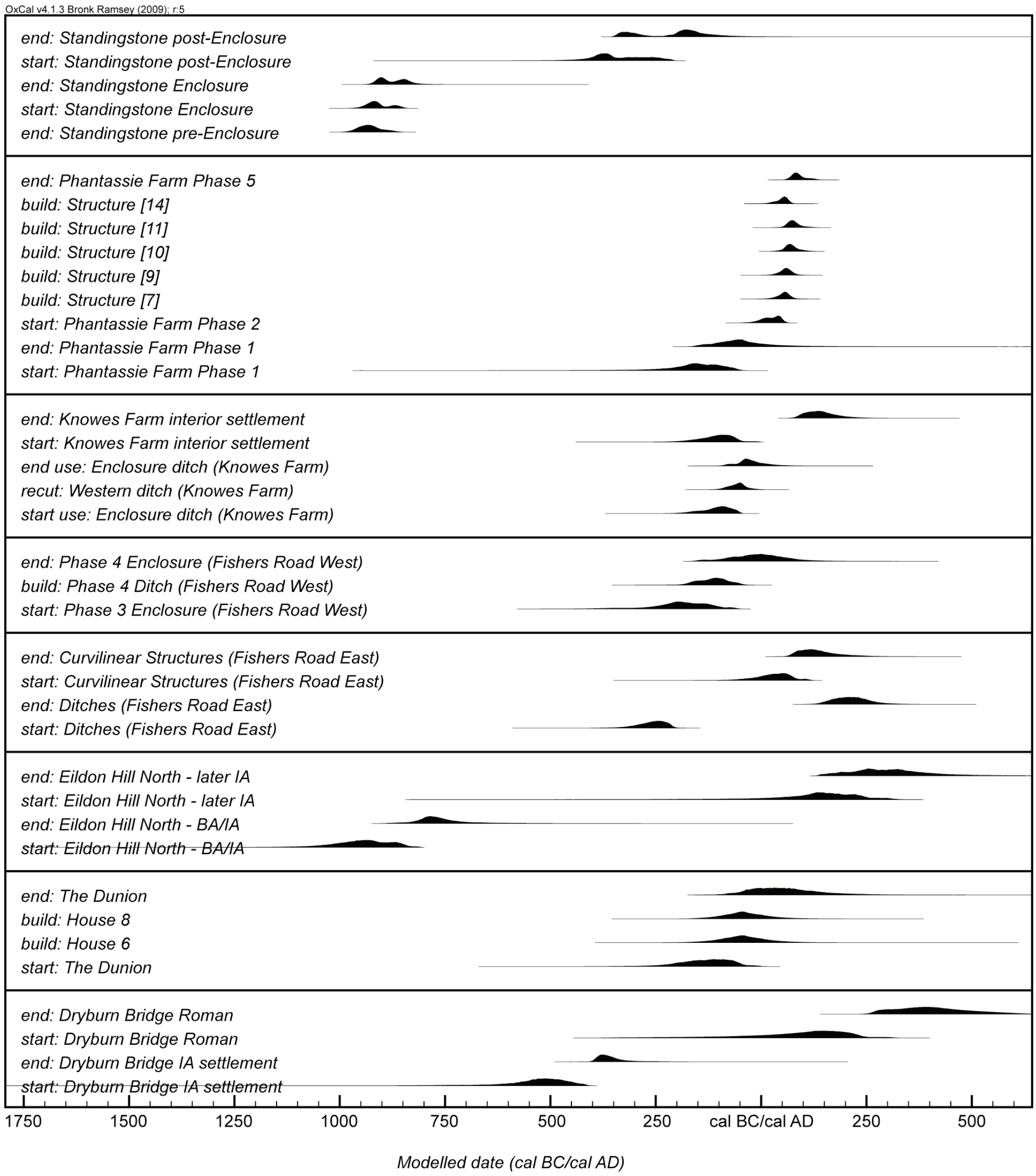

Figure 7.10: Modelled probabilities for the 'events' associated with the sites discussed from the Tweed-Forth region. The probabilities are derived from the modelling discussed in the previous sections of this chapter

Standingstone. Fishers Road East and Knowes Farm are rectilinear enclosures, while Fishers Road West and Standingstone represent curvilinear forms.

The probability that any one start date for the ditched enclosure phase of each of the four settlements is before another is presented in Table 7.10.1. Given that there is a difference in interpretation on which dated phase of Standingstone is an accurate representation of the enclosed phase, the probabilities for the start of both the enclosed and post-enclosed phases are provided. It is not surprising that Haselgrove's enclosure at Standingstone is the earliest of the four, having 100% probabilities that it predates all other enclosure activity. However, Haselgrove's post-enclosure activity at Standingstone (Sharples' enclosed phase) is probably earlier than the other enclosed settlement phases. Knowes Farm appears to be the latest enclosure of the four with two of the other sites having 100% probability of predating it and the enclosed phase at Fishers Road West having a 87% probability of starting earlier. Finally, there is an 83% probability that the ditches at Fishers Road East were constructed prior to the enclosure of Fishers Road West. The inferred order of the sites, therefore, is Standingstone » Fishers Road East » Fishers Road West » Knowes Farm.

Order	start: Ditches (Fishers Road East)	start: Phase 3 Enclosure (Fishers Road West)	start: use Enclosure ditch (Knowes Farm)	start: Standingstone Enclosure	start: Standingstone post-Enclosure
start: Ditches (Fishers Road East)		83	100	0	16
start: Phase 3 Enclosure (Fishers Road West)	17		87	0	8
start: use Enclosure ditch (Knowes Farm)	0	13		0	0
start: Standingstone Enclosure	100	100	100		100
start: Standingstone post-Enclosure	84	92	100	0	

Table 7.10.1: Order matrix for the start probabilities of the ditched enclosure phases of the site in the Tweed-Forth region

This ordering is interesting since, leaving Standingstone aside for the moment, the other three settlements appear to be enclosed in the period between *350–205 cal BC* (*95% probability*; Fig. 7.10.1; *start: Ditches (Fishers Road East)*) and probably *290–220 cal BC* (*68% probability*) and *185–50 cal BC* (*95% probability*; Fig. 7.10.1; *start: use Enclosure ditch (Knowes Farm)*) and probably *130–60 cal BC* (*68% probability*). These three sites present different morphological characteristics, with the middle-dated site, Fishers Road West, clearly being curvilinear (kidney-shaped) in form, while the other two are sub-rectangular or rectilinear. What further confounds the issue is that there is a 100% probability that *start: Phase 3 Enclosure (Fishers Road West)* occurred before *end: Ditches (Fishers Road East)*, so that two very different forms of enclosed settlement that existed within *c.* 300m of one another were contemporarily inhabited in the landscape.

Haselgrove and McCullagh (2000) have argued that while Fishers Road West may have appeared sub-rectangular as a cropmark, in some respect in plans for Phases 3 and 4, they regard it as a curvilinear enclosure, and it may well be. The three sites show just how different the form of enclosure can take in what may have been just a century or two. The lack of precision with these models as a result of not being dated within a rigorous Bayesian framework further underscores the need for targeted dating and analysis of these type of sites to better understand their interrelationships and contemporaneity.

Roman penetration into Scotland

The second theme that is picked up here with the dating of these settlements has more specifically to do with the timing of their habitation and any transformations in relation to what is happening in the region at the time of the Roman arrival in Britain and advance in to Scotland (Table 7.10.2). If AD 80 is taken as the date the Roman army first arrives at the Clyde-Forth then only Standingstone would appear to certainly have been uninhabited (100% probability), while there is a 91% probability that Fishers Road West was also abandoned at this time.

The later re-use of Dryburn Bridge might coincide with the Roman arrival north of the Tweed. Although this period of the dating is only supported by three radiocarbon dates and so is very imprecise, it nevertheless gives only a 40% probability that re-use occurred prior to AD 80.

The enclosure at Knowes Farm predates the Roman conquest (100% probability) and so probably does the end of the ditches' use (95% probability), although the interior settlement would appear to have been long-lived and extended perhaps beyond the construction of Hadrian's Wall in AD 122 (69% probability).

The two hillforts are enigmatic in that the dated activity on The Dunion almost certainly begins prior to the Roman conquest (100% probability) but there is a 66% probability that it ends prior to AD 80. Given the low number of dates in and the imprecision of the model I would argue that an abandonment around, or even before, this time is quite possible, but further dating and modelling would be required to go further. The Iron Age activity on Eildon Hill North, on the other hand, would appear to be rather late. There is a 72% probability the activity post-dates the arrival of the army on Scotland and people were living on the hilltop almost certainly during and after the construction of the Antonine Wall (99% probability). While The Dunion may have been depopulated around the time of the Roman advance and founding of Newstead, the repopulation of

Eildon Hill North appears to be in reaction perhaps to the founding of the Roman town at it base. The paucity of Roman material on the site suggests very little interaction between the inhabitants of the two settlements and so perhaps Eildon Hill North became a place of refuge in an increasingly hostile and Roman controlled landscape.

As mentioned before, Fishers Road West was probably abandoned prior to the Roman arrival in Scotland. but this period is when Fishers Road East appears to have been at its height, with respect to the dated structures, having a 93% probability the structures pre-date AD 80 and an 94% probability that they continue past that date. The ditches at Fishers Road East have a 100% probability of dating before and after AD 80.

Like Fishers Road East, the settlement at Phantassie Farm almost certainly pre-dates AD 80 (100% probability) and has a 68% probability of post-dating this same date. Unlike Fishers Road East, though, Phantassie Farm is a small, unenclosed farmstead. Much of the dated activity at Phantassie would appear to pre-date AD 80 and while there is a 68% probability that the settlement lived on beyond AD 80, there is an 82% probability that it was abandoned before the Roman army had fully withdrawn from the Clyde-Forth to the Tyne-Solway in AD 103.

The data are suggestive of a dynamic settlement pattern, not only with morphologically distinct settlements coexisting in close proximity, but with regard to social relations between Romans and natives. Fishers Road East and Knowes Farm appear to have enjoyed lives that encompassed much of the time the Roman army was in Scotland, while Phantassie Farm did not prosper. Eildon Hill North, although in a different area of southeastern Scotland, may have made a refuge for the surrounding populace and likely speaks directly to the nature of relations between the natives in the area and the inhabitants of Newstead (Trimontium).

Further work is much needed to explore these questions. To do the settlement history in Scotland any justice, this work needs to be carried out within an explicit Bayesian framework, so that that the dating is tailored specifically to the questions at hand and that the highest level of precision can be obtained.

Order	55 BC	AD 43	AD 70	AD 80	AD 103	AD 122	AD 142
start: Dryburn Bridge IA settlement	100	100	100	100	100	100	100
end: Dryburn Bridge IA settlement	100	100	100	100	100	100	100
start: Dryburn Bridge Roman	16	31	37	40	47	54	63
end: Dryburn Bridge Roman	0	0	0	0	0	0	0
start: The Dunion	92	100	100	100	100	100	100
build: House 6	40	92	96	97	98	99	99
build: House 8	37	92	96	97	98	99	99
end: The Dunion	6	48	61	66	74	80	85
start: Eildon Hill North - BA/IA	100	100	100	100	100	100	100
end: Eildon Hill North - BA/IA	100	100	100	100	100	100	100
start: Eildon Hill North - later IA	11	21	25	28	34	41	51
end: Eildon Hill North - later IA	0	0	0	0	0	0	1
start: Ditches (Fishers Road East)	100	100	100	100	100	100	100
end: Ditches (Fishers Road East)	0	0	0	0	0	0	2
start: Curvilinear Structures (Fishers Road East)	5	60	87	93	97	100	100
end: Curvilinear Structures (Fishers Road East)	0	0	2	6	25	43	61
start: Phase 3 Enclosure (Fishers Road West)	100	100	100	100	100	100	100
build: Phase 4 Ditch (Fishers Road West)	96	100	100	100	100	100	100
end: Phase 4 Enclosure (Fishers Road West)	22	79	88	91	95	96	98
start: use Enclosure ditch (Knowes Farm)	97	100	100	100	100	100	100
recut: Western ditch (Knowes Farm)	51	100	100	100	100	100	100
end: use Enclosure ditch (Knowes Farm)	15	95	98	99	99	100	100
start: Knowes Farm interior settlement	94	100	100	100	100	100	100
end: Knowes Farm interior settlement	0	0	0	1	13	31	53
start: Phantassie Farm Phase 1	99	100	100	100	100	100	100
end: Phantassie Farm Phase 1	43	83	87	88	90	91	92
start: Phantassie Farm Phase 2	0	82	100	100	100	100	100
build: Structure [7]	0	22	89	97	100	100	100
build: Structure [9]	0	15	80	94	100	100	100
build: Structure [10]	0	3	50	75	96	100	100
build: Structure [11]	0	1	33	64	93	99	100
build: Structure [14]	0	27	97	100	100	100	100
end: Phantassie Farm Phase 5	0	0	9	32	82	94	100
end: Standingstone pre-Enclosure	100	100	100	100	100	100	100
start: Standingstone Enclosure	100	100	100	100	100	100	100
end: Standingstone Enclosure	100	100	100	100	100	100	100
start: Standingstone post-Enclosure	100	100	100	100	100	100	100
end: Standingstone post-Enclosure	96	99	99	100	100	100	100

Table 7.10.2: Order matrix for the calculated ‘event’ posterior density estimates from the settlements modelled from the Tweed-Forth region and the probability that they each occur prior to specific calendar dates (55 BC: first arrival of Caesar to Britain; AD 43: start of Roman conquest; AD 70: Roman army in North Yorkshire; AD 80: Roman army at the Forth-Clyde; AD 103: Roman army back to the Tyne-Solway; AD 122: construction of Hadrian’s Wall; AD 142: construction of Antonine Wall)

CHAPTER 8: DISCUSSION

The results of the radiocarbon dating and Bayesian modelling undertaken while pursuing this project and presented in this thesis have broad implications for not only developing a more nuanced understanding of the Iron Age in east-central Britain, but for how the chronology of settlements can be reconstructed. The results show the diversity of questions that can be asked using the Bayesian approach, not only at individual sites but on a regional basis as well. Here some of the same questions that were identified and explored at the sub-region level are examined again across the entire study area, examining not only the timing of identified changes but the tempo at which some of these changes occur. Furthermore, the project has brought to light specific potential problems and methodological considerations that should be looked at in more detail so that other researchers are aware of potential pitfalls.

8.1 Timing of change

In the previous chapters (4–7), the results were explored site-by-site. However, these site-based models only allow a view of the dynamics in one locale. It is possible to develop and ask questions that build out from the site and, in this case, investigate the timing and tempo of change across a region. This second level of comparison, provides a whole new realm of interpretation. Modelling at the level of the site allows us to ask questions that are geared to the individual inhabitants and their adaptations or motivations that result in the settlement being transformed, which as argued in Chapter 2 is tied to social change as well. The regional approach allows us to look at the timing of those changes across space and through time and begin asking questions related to regional social dynamics, such as changing economies or politics. This has been discussed in some detail in Chapters 4–7 after the presentation of results within each sub-region. Here it is taken further, looking at the timing of these changes across east-central Britain with particular interest paid to the transformation of sites from open to enclosed and also identifiable changes that are occurring in the decades surrounding the invasion of Britain by the Roman military in AD 43, and the annexation of northern England from the AD 70s.

8.1.1 A landscape enclosed

Previously we have seen that the rectilinear enclosed farmstead is one of the most prevalent settlement types for the later Iron Age in east-central Britain. Five settlements in this project, Thorpe Thewles, East Brunton[11], West Brunton, Fishers Road West[12] and Knowes Farm, had phases of dated activity that fit into this category

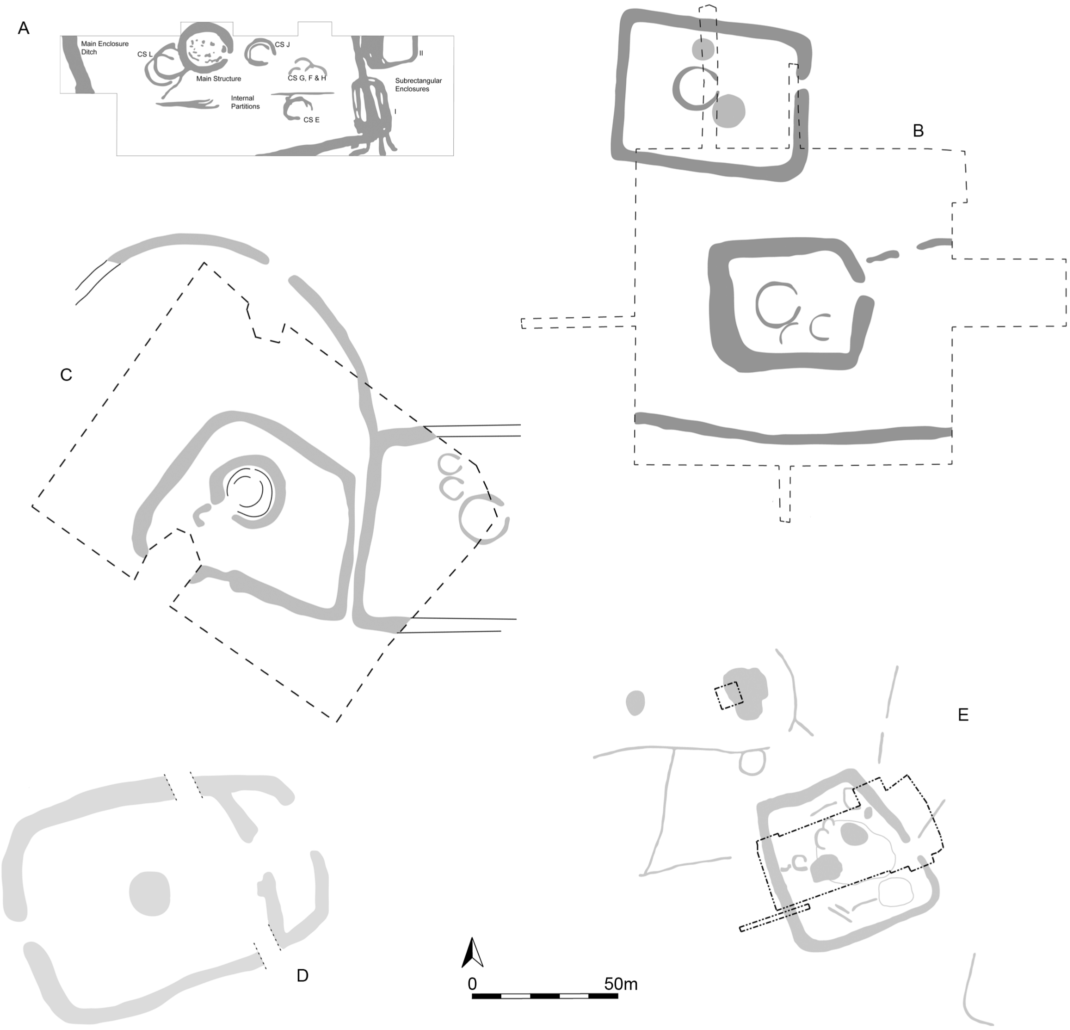

Figure 8.1: Plan of five rectilinear enclosed settlements in the study region. Thorpe Thewles and West Brunton are 'typical' and form, while East Brunton and Fishers Road West are more unusual (A: Thorpe Thewles Phase II; B: West Brunton; C: East Brunton; D: Fishers Road West; and E: Knowes Farm)

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[11] The site at East Brunton also contains an element that fits well with this typical farmstead, however, it also has other monumental enclosure ditches as well. It is, therefore, atypical, but discussed here as well because of the spatial and temporal association it has with West Brunton.

[12] Haselgrove et al. (2001) have argued that Phase 3 at Fishers Road West, despite appearing somewhat sub-rectangular in plan, is best described as a curvilinear enclosure. I have included it here because 1) it does not appear to me to be curvilinear in the same sense as sites such as Standingstone or Fishers Road East, and 2) the date of enclosure accords well with the other agreed rectilinear enclosed settlements that are dated from the Tees to the Forth.

(Fig. 8.1). These sites span the study area from the very southern edge near the Tees to the northern edge along the Forth. What they have most in common is that they were built in the lowlands and that the inhabitants at all five appear to have practiced a mixed agricultural regime.

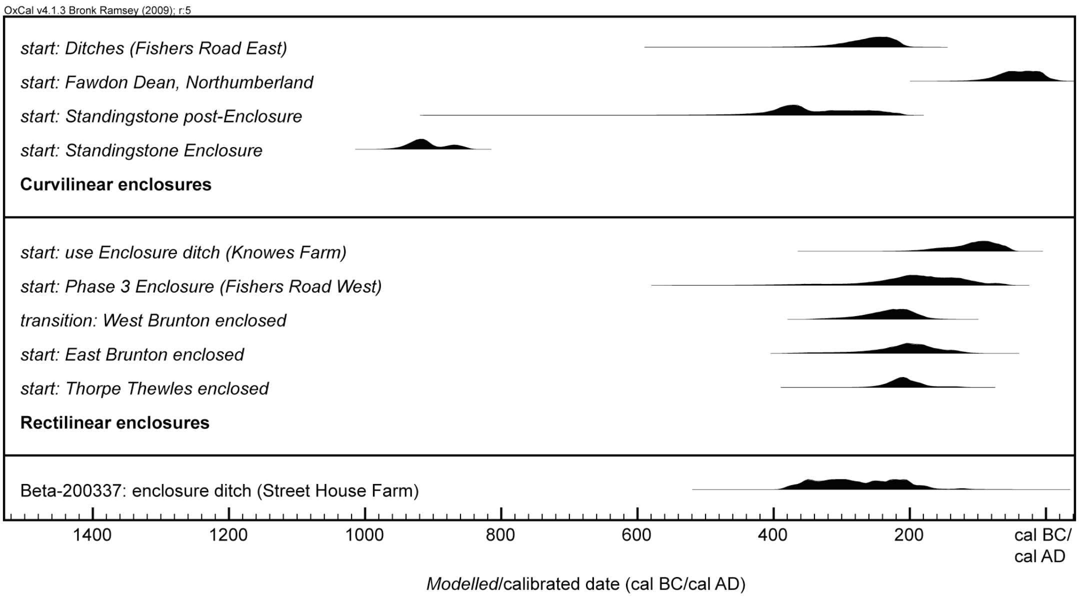

Figure 8.2: Probability density functions for the start of enclosure activity from both rectilinear and curvilinear enclosures in the study area

The settlements vary slightly in overall character and in the types of settlements that pre- and post-date these enclosed phases. Thorpe Thewles is followed immediately by an open phase of settlement as the ditches were deliberately infilled and habitation spilled over the former boundaries. East and West Brunton began as unenclosed settlement before their respective enclosures were constructed. Fishers Road West had two earlier phases of 'enclosure' activity with Phase 3 defining the monumental enclosure that is represented in plan. Finally, Knowes Farm began as an enclosed settlement, for which dating is only provided from the remains of the ditches, that was followed by a later phase of open 'scooped' settlement activity.

The modelling of these five sites suggests that this form of settlement most probably dates from the end of the *3rd century cal BC* (Fig. 8.2). The results (Table 8.1) suggest that the enclosed phases at Thorpe Thewles, East Brunton, and West Brunton are almost certainly earlier than the earliest dating for the enclosure ditch at Knowes Farm (*97%*, *95%,* and *99% probabilities*, respectively), and that the main enclosed phase

(Phase 3) at Fishers Road West probably predate Knowes Farm as well (*87% probability*).

Although the enclosure activity at Knowes Farm would appear to be later, the other four sites are still spread across the entire region from north to south and are not easily distinguishable temporally. The modelling at present would suggest that this type of site could possible represent a specific horizon of development. Furthermore, it must be remembered that at Knowes Farm the earliest dated material is from the enclosure ditch. Traces of earlier habitation were probably obliterated by a later settlement constructed by literally cutting, or ‘scooping’, into the underlying bedrock. As such, it is possible that the Knowes Farm enclosed settlement could date to to an earlier period if the enclosure ditch had been recut in antiquity, removing the earliest basal deposits.

Probability $\tau_1<\tau_2$	τ_2				
τ_1	Knowes Farm	Fishers Road West	West Brunton	East Brunton	Thorpe Thewles
Knowes Farm		13	1	5	3
Fishers Road West	87		28	41	38
West Brunton	99	72		68	70
East Brunton	95	59	32		47
Thorpe Thewles	97	62	30	53	

Table 8.1: Order matrix for the five rectilinear enclosures discussed in the text. The probability is given that $\tau_1 < \tau_2$

With the case of Knowes Farm in mind, a later settlement sitting comfortably within an earlier enclosure ditch, it may be relevant here to revisit the results from Street House Farm. Street House was a complex settlement with four identified phases of intercutting structures set within a large rectilinear enclosure ditch. The site model shows that it started in *150–15 cal BC* (*95% probability*; Fig. 4.4.3; *start: Street House Farm*). There was only one result directly from the enclosure ditch (Beta-200337) on a carbonized cereal grain in the primary fill and the modelling of the dates from the settlement activity within the enclosure suggested that this one date is too early. Although the result was excluded from the modelling, the question is now raised as to whether earlier traces of settlement at Street House remain undated from within the enclosure. Although the internal settlement features were well-dated, along with carbonized residues on a selection of Iron Age pottery from across the site, given that Beta-200337 is from the primary ditch fill, it is entirely plausible that the settlement at Street House Farm also originates around 200 cal BC.

The internal structure of Street House Farm bears some resemblance to a combination of Phases II and III at Thorpe Thewles (Fig. 8.3). The large CS 4 at Street House looks very much, in size and position, like the Main Structure in Thorpe Thewles Period II. CS 4 was later cut by an equally large CS 2 that has a large CS 3 subsequently constructed and 'sharing' a drip gully (very similar in appearance to Main Structure and CS L at Thorpe Thewles). At Street House it was already fairly certain that CS 1, which has its gully completely within the diameter of CS 2 is of a different phase. That structure along with CS 5 and 7, and the various linear ditches and gullies are very similar in appearance to Phase III (open phase) at Thorpe Thewles. The modelled estimates for the start of the open phase at Thorpe Thewles and the start of Kilton Thorpe Lane, also an open settlement, along with the morphological changes in the size of the internal structures and the overall layout of features certainly makes it seem quite possible that perhaps Street House Farm was an earlier enclosed settlement that is later open, only unlike Thorpe Thewles has not been identified as spilling over the earlier enclosure ditches. Since the ditch was only sampled in this one area, without more data this can only remain a suggestion.

Turning briefly to the dated curvilinear enclosures in the project (Fig. 8.2), they appear to date from anytime in the *1st millennium cal BC*. Even if Sharples' view that the date of the enclosure at Standingstone[13] is best represented by the later material from the site, then curvilinear enclosures would still date to a period covering approximately the last 4 centuries of the 1st millennium. This further reinforces the position that the construction of rectilinear home/farmsteads form an archaeological horizon across the study area.

It is unclear what the social dynamics were at the time driving the shift to dispersed enclosed rectilinear settlement. It is not that ditched enclosures are new and

[13] The Standingstone enclosure is horseshoe-shaped and does not form a complete circuit. It may well be enigmatic or could simply represent be a variant of the curvilinear enclosure form.

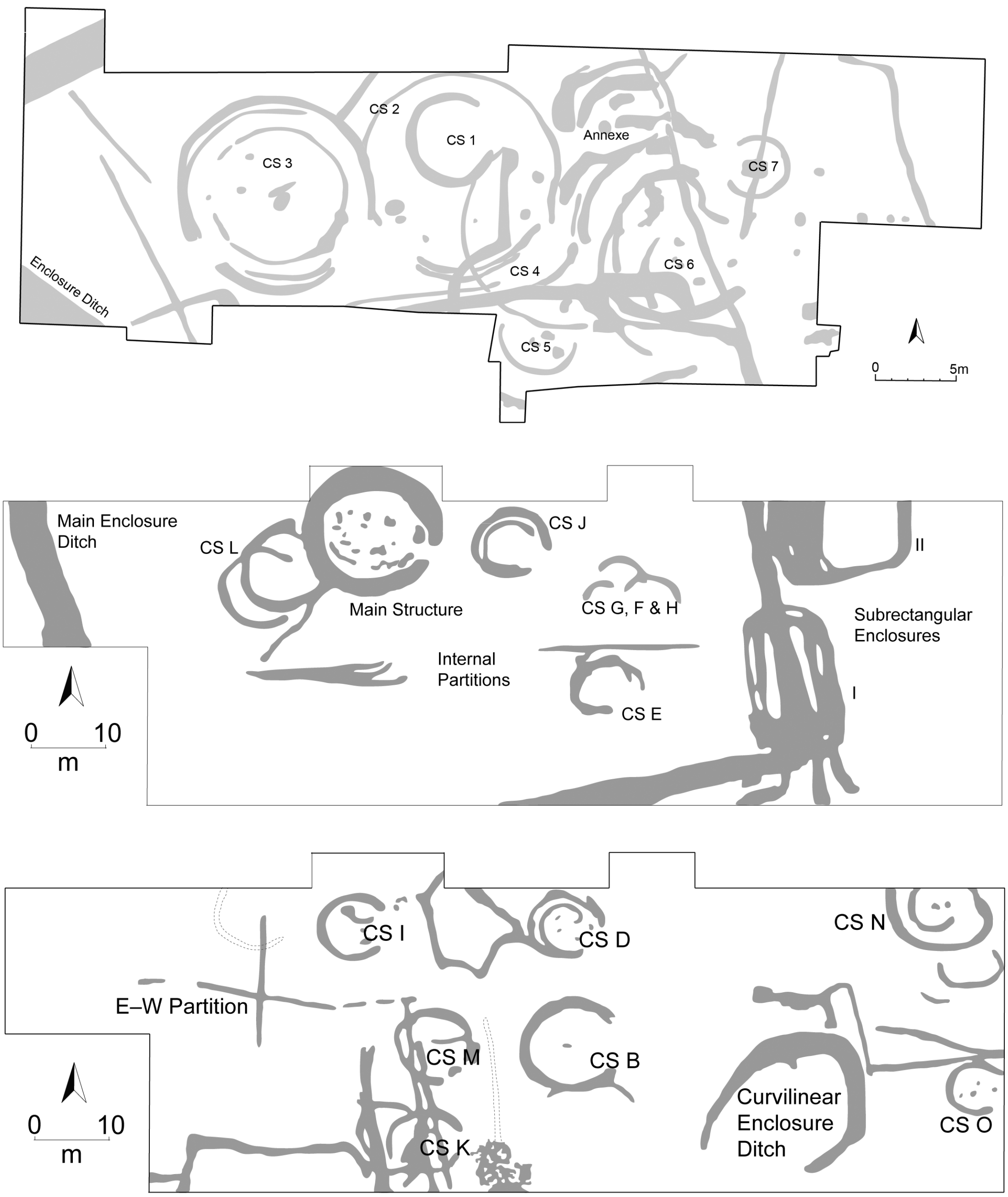

Figure 8.3: Plans (from top to bottom) of all phases at Street House Farm, Phase II (Enclosed) and Phase III (Open) at Thorpe Thewles

innovative, but that the rectilinear form is the new innovation. The joint probability[14] for West Brunton (34%) suggests that it may be the earliest of the settlements of the group, followed by Thorpe Thewles at 10%. Perhaps it is not surprising that these two settlements are very much in the 'classic' form of rectilinear farmstead with centralized

[14] the joint probability has been calculated by multiplying together the probabilities that ($\tau_1 < \tau_2$) ($\tau_1 < \tau_3$)($\tau_1 < \tau_4$) so that for West Brunton the joint probability that it is the earliest of the sites = .99 * .72 * .68 * .70

roundhouse. These are perhaps followed in order by East Brunton (8%) and Fishers Road West (4%), two settlements that exhibit a flattening of the enclosure ditch to more closely resemble a rectangular form, but which are clearly not of the 'classic' types noted above or at other sites such a West Brandon (Jobey 1962b) and West House, Coxhoe (Haselgrove and Allon 1982). East Brunton is even further suggestive of the curvilinear form in that the sub-rectangular enclosure is surrounded on two sides by a half-circular outer enclosure.

While it is perhaps too easy to discuss the shift in terms of people moving into an area, it is perhaps worthwhile considering the possibility that there is an archetypal rectilinear enclosed settlement being built at around *200 cal BC* in the Tees–Tweed region and represented here by the settlements at Thorpe Thewles and West Brunton. This is later being emulated by other groups in the region and perhaps as far north as the Forth at sites such as Fishers Road West. Whether this juxtaposition is one of migrating versus indigenous population, or simply different communities/groups coexisting in the same general area and rapidly adopting the settlement form of a neighbour is a question that will require much more detailed research. Perhaps the first place to look is outside of this study region, to the neighbouring areas, for examples where rectilinear ditch digging is prevalent, maybe a bit further south into East Yorkshire where not only do the enclosures for the living take a rectilinear form, but so to do many of the enclosures to the dead (Dent 1999).

This does not mean to suggest that more functional reasons may not have existed for the shift in settlement form, such as a political situation requiring greater need for defence. But if defence in a time of warring and raiding is the primary purpose of the shift to these enclosures, I would expect to see nucleated settlements remain and becoming enclosed as there is far greater strength and protection in numbers.

8.1.2 The world opening up

While it would appear that rectilinear enclosed farmsteads replace a pattern of open settlement, or settlements within palisades, around *200 cal BC*, within 150 years the pattern seems to shift once again, at least within the Tees (Fig. 8.4). In the two decades leading up to 50 cal BC, The Tofts at Stanwick is settled with a few roundhouses and slight enclosure ditches/fences. At this same time, Thorpe Thewles is seeing its Main Enclosure Ditch being deliberately infilled and the settlement extending beyond the former bounds. Around 50 cal BC the curvilinear Enclosure 2 ditch is dug at Stanwick, which is very similar in form and size to the Curvilinear Enclosure Ditch at Thorpe Thewles. Within a few decades of 50 cal BC, the open settlement at Kilton Thorpe Lane is founded, only to be occupied perhaps for a generation. Furthermore, if the dated activity at Street House Farm is actually mostly comprised of an unidentified open phase of settlement that is in the same location as an earlier disused and perhaps completely filled enclosure ditch (see Chapter 4.4), then it too might possibly date to near the middle of the 1st century cal BC.

Further north along the Northumberland coast, East and West Brunton do not return to open phases of settlement. I have argued earlier that the data for the estimated end date for West Brunton remain relatively unresolved. However at East Brunton dated activity, and so the enclosure activity, at the site ended in *170 cal BC–cal AD 5* (*95% probability*; Fig. 6.2.4; *end: East Brunton*) and probably in *145–50 cal BC* (*68% probability*). There is a 76% probability that *end: East Brunton* occurred prior to 55/54 cal BC. The enclosed phase at Pegswood began on the site in *25 cal BC–cal AD 55*

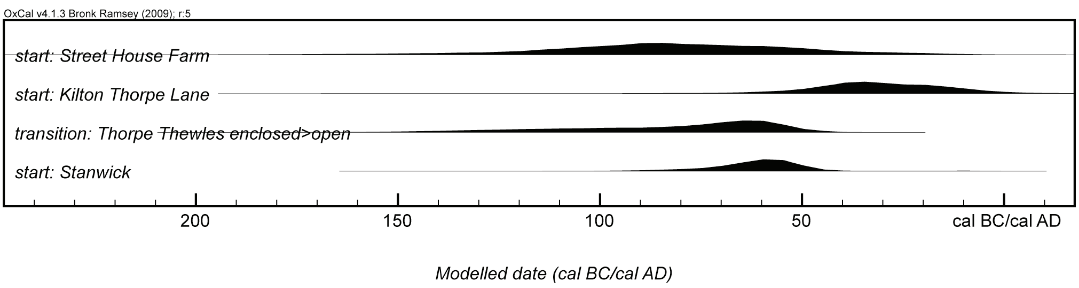

Figure 8.4: Probability density functions for the start of open settlement activity at sites in the Tees valley

(*95% probability*; Fig. 6.4.4; *start: Pegswood enclosed*), and probably *AD 10–50* (*68% probability*). This enclosed phase was preceded by a poorly dated open phase of settlement. There is only a 1% probability that the enclosed phase began prior to 55/54 cal BC. So while the data from West Brunton and Pegswood are less robust when compared to the Tees valley, they do leave open the possibility that there was shift to open settlement that remains largely undated in this area as well.

8.1.3 Settlement change and the encroaching Roman world

It is perhaps not coincidence that a major transition in settlement form occurred with the arrival of Caesar in 55/54 BC. While Caesar's arrival probably only directly affected south-east England, the impact of not only his arrival but of the later Roman conquest of Britain can be seen in the way settlements were being (re)structured in the study area throughout the period from 55 BC to at least the late 2nd century AD after Roman occupation settled along the Tyne–Solway isthmus. A question remains regarding the encroaching Roman army into central Britain and the native response. Do they fortify their settlements? Do they abandon their settlements and move elsewhere? Do they adopt new forms of settlements that are no longer viewed archaeologically as native? The answers to these questions perhaps can be deduced directly from the Tees and the Cheviot Hills data, but also to a lesser degree from the data along the Northumberland coast and even in the Lothians of Scotland.

Tees valley

In the Tees a possible horizon of farmstead enclosure, beginning around 200 cal BC has already been identified, which is visible from Thorpe Thewles and Street House Farm all the way northward to the Forth. Also, a shift to more open and extensive settlements has been identified in the Tees with Thorpe Thewles becoming open a decade or two before 50 cal BC and Kilton Thorpe beginning as an open settlement a couple decades after this point. However, with the exception of Street House Farm, the dated smaller native settlements in the Tees appear depopulated in the decades leading up to the arrival of Claudius in Britain in AD 43 (Fig. 8.5).

Thorpe Thewles was transformed from an open settlement into an area of stock enclosure in *50 cal BC–cal AD 40* (*95% probability*; Fig. 4.5.4; *transition: Thorpe Thewles open>cattle enclosure*) and probably in *45–1 cal BC* (*68% probability*). Activity at Kilton Thorpe Lane ended in *40 cal BC–cal AD 55* (*95% probability*; Fig. 4.2.3; *end: Kilton Thorpe Lane*) and probably in *30 cal BC–cal AD 20* (*68% probability*). Stanwick appears to have become depopulated in *cal AD 20–80* (*95% probability*; Fig. 4.3.10; *end: Stanwick*) and probably in *cal AD 25–50* (*68% probability*).

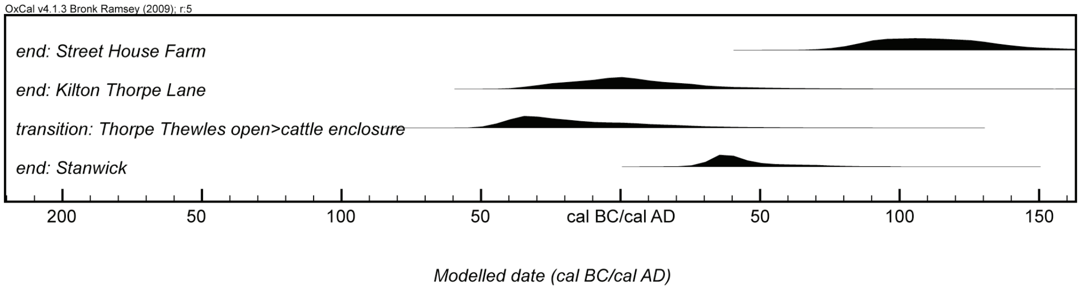

Figure 8.5: Probability density functions for the end of open settlement activity at sites in the Tees valley

The period between the arrival of Julius Caesar in the south in 55/4 BC and the Claudian conquest in AD 43 must have been one of significant change. While at this point we can only begin to imagine what that period might have been like in central Britain, it does seem likely that social instability in the South, triggered by the attacks by Caesar, helped to create new opportunities in the area through the further development, or perhaps opening, of direct and more regular trade networks to the Continent.

The southern territories, in this period between invasions, were being organized into client kingdoms. There likely existed a system of fosterage whereby the sons of the rulers were raised and educated within the Empire before returning to Britain to rule (Creighton 2000; 2006). The increased interaction between Rome and the South in the first decade after Caesar's visit possibly alienated the groups of central Britain, causing them to further develop the existing exchange networks and economies. In fact, at this time central Britain was probably very much on its own. Given the civil unrest, or war, in the Republic following the assassination of Caesar in 44 BC, it would seem quite likely that the South, much of which was allied with Rome would have been involved in protecting or solidifying much of its position. Although there was undoubtably some trade still existing between south and central Britain, the primary focus of the South was likely on its relationship with Rome. This in turn led to an increase in direct trade between central Britain and the Continent as evidenced in the coin data and metalwork (i.e. the Stirling Torcs - see Chapter 2.2).

It is in this approximately 100 year period that a salt production industry around the mouth of the Tees, and possibly stretching as far north as the Tweed was hitting its stride (Morris 2007; Willis 1999). Although the Fens had long been a locus for prehistoric salt production along the eastern coast, with that area beginning to come under the influence of Rome, it seems quite likely that salt production was taken up further north in native settlements outside of this sphere, at sites such as Street House Farm and perhaps as far north as North Road, Berwick-upon-Tweed. Briquetage from Tees salt production sites is found in nearly all of the sites in the valley dating to this time. It appears in the Period 2 features at Stanwick (Haselgrove forthcoming-b), at Kilton Thorpe Farm, and in the open settlement at Thorpe Thewles. Local briquetage has been recovered at other sites in the region as well, such as Melsonby (Fitts et al. 1999), Rock Castle (Fitts et al. 1994), Catcote (Long 1988), Burradon (Jobey 1970), Quarry Farm (Heslop 1984), and Scotch Corner (Abramson 1995). The chronological understanding of these sites is much less precise, although Melsonby and Rock Castle have very rudimentary models presented in Haselgrove (forthcoming-b) using a handful of pre-existing dates, these suggest that this open and enclosed settlement, respectively, do form part of this same later prehistoric landscape.

The effect of salt production being taken up further north along the coast was that the enclosed farmstead that is household/family centred and probably indicative of a network of relatively equal relations across the landscape is abandoned in the Tees. It is replaced by more extensive open settlement forms, containing multiple households, and a new set of relations. While the people in these new settlements are still primarily mixed agriculturalists, they are participating in a new and extensive salt trade, along with other objects such as shale and jet found along the coast, setting the conditions for vertical mobility of not only individuals, but whole communities through controlling the means of production of commodities that were previously traded.

It is within this setting that Stanwick rises as a centre. Whether it is administrative, ceremonial, or both, is unknown. What is clear is that monumental building works are underway with two events occurring at Stanwick that post-date the arrival of Caesar and probably also post-date his death: the construction of the rampart around the Tofts and the palisade. As the excavation evidence was unclear whether the two could have stood at the same time, they were separated in the modelling. However, the rampart probably was constructed in *35–10 cal BC* (*68% probability*; Fig. 4.3.10; *OxA-20783: 016*), and the palisade probably was constructed in *30 cal BC–cal AD 5* (*68% probability*; Fig. 4.3.10; *build: Palisade*).

The construction of the first large structure (LS1) probably took place shortly after the death of Caesar in *45–25 cal BC* (*68% probability*; Fig. 4.3.10; *Period 3–4 soil*). The sheer size of this structure, and the subsequent LS2, at perhaps 20m diameter and with upright posts in excess of 0.5m diameter, suggests that it was no ordinary residence. It may have housed an elite family, or it may have been a location where ritual activity took place. In either case, the monumentality of both these structures and the earthwork enclosures at Stanwick are highly suggestive of a degree of social hierarchy. Furthermore, it is clear though that by the time the second of these buildings was erected substantial Roman imports were making their way to the settlement.

It was at this time, when Stanwick is emerging as an elite centre, that the open settlements at both Thorpe Thewles and Kilton Thorpe Lane were in decline, if not already abandoned. The degree to which people were being drawn to Stanwick after Caesar came to Britain will remain a mystery, although it was certainly pulling some people in from the surrounding region as it grew in size. Stanwick. however, is itself abandoned in the years leading up to, or at the time of, the Roman advance to put down the Brigantian revolt. What does seem clear is that by AD 70 native Britons are either not living in great numbers in sites with archaeological visibility in the Tees valley or are living in settlements that are no longer recognizable as native by their form.

While some form of depopulation in the area may have taken place when the Romans advanced, the evidence is clear that people were still living in the region. At Thorpe Thewles, the earlier settlements are replaced by stock enclosures that contained Roman pottery, but no associated settlement is yet known. At Catcote, near Hartlepool, an Iron Age enclosed settlement exists just upslope from a Romano-British settlement (Tees Archaeology 2003). Here, the Iron Age settlement is enclosed within a series of rectilinear enclosures, with enclosed trackways and other smaller internal enclosures. It is much more reminiscent of the form of Pegswood Moor Farm further north on the Northumberland coastal plain than anything else discussed so far in the Tees valley.

In spite of these possible changes in settlement form, Street House Farm appears to remain the same through the 1st century cal AD. Here the answer is likely related to economics. All the other sites thus far discussed in the Tees valley have been receivers of salt, whereas the inhabitants of Street House Farm were the producers. Whether other native sites were abandoned or recreated in new forms as a direct result of Roman contact or even coercion, will remain in question until more sites are dated in the region, especially including sites such as Catcote where the chronological, and also social, relationship between an Iron Age and Romano-British settlement in close proximity can be further investigated.

Cheviot Hills

At about the time when the dated Tees lowland sites were becoming open settlements, in the Cheviot Hills the curvilinear enclosure of Fawdon Dean was being constructed, probably in *65–5 cal BC* (*68% probability*; Fig. 5.2.9; *start: Fawdon Dean*). This enclosure was probably abandoned in *cal AD 50–95* (*68% probability*; Fig. 5.2.9; *end:*

CS 3). A rectilinear enclosure was constructed approximately 500m further downslope at Ingram South probably in *cal AD 70–95* (*68% probability*; Fig. 5.3.4; *build: Inner Ditch, Ingram South*).

The shift in this area from the use of a curvilinear to rectilinear enclosure appears to closely coincide with Roman contact in the area. Whether the contact was directly with Romans or other native groups that made rectilinear enclosures and were displaced into the area is unknown. At Fawdon Dean, however, the earlier curvilinear enclosure is supplanted by a rectilinear enclosure suggesting that either it was constructed by people living at, or closely associated with, Ingram South or that the rectilinear form was becoming adopted in the area.

Tweed-Forth region

As was seen in Chapter 7, settlement in the Tweed-Forth region was dynamic during the period of Roman occupation. Some settlements were re-inhabited at the time, such as Dryburn Bridge (*69% probability* re-inhabited after AD 43; Table 7.10.2; *start: Dryburn Bridge Roman*), while others, such as Phantassie Farm, were abandoned (*68% probability* abandoned after AD 80 and before AD 142; Table 7.10.2; *end: Phantassie Farm Phase 5*). The reoccupation of Eildon Hill North in this period may well have been in refuge at a time when the Roman army was in flux between the Tyne–Solway and Forth–Clyde lines (*72% probability* it was re-inhabited after AD 80; Table 7.10.2; *start: Eildon Hill North - later IA*). The Dunion appears to have been abandoned at this time *(85% probability* prior to the construction of the Antonine Wall; Table 7.10.2; *end: The Dunion*).

The two enclosures at Port Seton, Fishers Road East and West, share divergent settlement histories. The curvilinear structures within the kidney-shaped enclosure at Fishers Road East were probably constructed prior to the advances of Agricola in AD 80 (*93% probability*; Table 7.10.2; *start: Curvilinear Structures (Fishers Road East)*), and probably did not go out of use until the period following the Roman withdrawl to the Stanegate in AD 103 (*75% probability* after AD 103; Table 7.10.2; *end: Curvilinear Structures (Fishers Road East)*). Fishers Road West, on the other hand, was probably abandoned prior to Agricola's campaign (*91% probability*; Table 7.10.2; *end: Phase 4 Enclosure (Fishers Road West)*).

As noted in Chapter 7, these results are not nearly as robust as those from the sites across the border in England. Much more work needs to be undertaken in the region to date sites within an explicit Bayesian framework to better understand the nuanced historical interactions between natives and Romans.

8.1.4 Timber and stone

Although now it is probably well-recognized that prehistoric peoples in Britain were able to construct structures using dry-stone techniques, the identification of ‘Votadini’ houses – later prehistoric stone-built roundhouses in the Tyne-Forth region – has often included dating these sites to the Roman Iron Age. At Fawdon Dean, the stone-built structures were probably constructed in *cal AD 10–45* (*68% probability*; Fig. 5.2.9; *build: stone Roundhouses*). At Stanwick, the two stone-built roundhouses had probably been abandoned by *cal AD 25–50* (*68% probability*; Fig. 4.3.10; *end: Stanwick*). The dating here suggests that in upland and lowland environments alike, stone was used by Iron Age peoples to construct roundhouses in the region prior to the Roman conquest. This should perhaps came as no surprise as drystone architecture is widespread in Britain before this period, being used to construct such things as ramparts and broch towers.

8.2 Tempo: the rhythms of change

Moving outward to encompass the entire region of east-central Britain it is possible to begin to investigate and discuss the rhythms of change, the tempo at which physical changes are taking place within Iron Age settlements. With the sites that have been dated and modelled it is possible to begin developing a picture of the tempo of change by looking at how long an enclosure ditch is in use, or how often a roundhouse is rebuilt.

There are various social implications of either a quicker or slower tempo. Firstly, the construction of these settlements, the houses and ditches in particular of the homesteads (ie, Thorpe Thewles, East and West Brunton), would have been no easy task for most families, even larger extended familial groups. The second reconstruction of the Mesolithic hut at Howick, Northumberland took nearly a week and involved between 6 and 16 adult individuals (Waddington 2007). This, of course, was undertaken using modern tools and materials procured from outside sources, so that in the past gathering and preparing all the materials would likely have added a significant amount of time. Furthermore, the materials involved in the construction of these houses would have required many people to not only move onto site but to move into place during construction. The Pimperne house on the Butser experimental farm had roof rafters that weighed in at *c.* 740–985 kg each (Reynolds 1993, 98).

The construction of some of the ditches and palisades would likely have been even more labour intensive. Perhaps made more difficult in some areas by heavy, clayey soils, and also with procuring timber for palisades. The investment of labour in constructing the house and the enclosure is such that it would either need to take place over an extended period of time with the entire family doing all the work, organizing it around the work necessary to prepare or maintain the fields and manage the livestock, or else the construction of one or both of these monumental elements might take place over a few days with members of the surrounding community lending a hand – an Iron Age version of an Amish 'barn raising'. The former scenario is one that places the settlements in much more isolation in the landscape, while the latter acknowledges and reinforces the interconnectedness of the community.

Secondly, with regard to enclosure ditches, in two cases the full recut of an individual ditch has been dated (Fisher Road East and Knowes Farm). At the two other sites where there was ample data to model and discuss the enclosure ditches (Ingram South and Stanwick) what has been dated is the length of time that individual ditches were in use and so in some way physically structured the movements of the society living within the settlement. Furthermore, at Stanwick, the pace of change of the enclosure ditches is one that, with the exception of Enclosure 3 and the Palisade (and also the undated SS2) that form the same boundary line, is actually indicative of a reworking of the structure of the internal space in The Tofts.

The construction labour required and use-life of the roundhouse is dependent upon the material used, be it stone or timber. It probably goes without saying that stone is a more durable building material and that a structure constructed of timber and thatch or sod will likely need to be rebuilt sooner. What is less clear is how long a timber building given only minor repairs will remain standing. Although the Pimperne house was only in use for 15 years, when it was deconstructed it was still in very good condition. The outer porch upright posts had to be replaced at 7–8 year intervals, while some of the other internal posts still had their heartwood intact and worm free, although the outer sapwood was completely gone. However, some posts were rotted through so that there the post-pipe was completely void of material. The gradual backfilling of post-pipes is seen archaeologically where conditions exist for preservation of the stratigraphy. It is also apparent that as the post-pipe subsided stones were placed to raise the level and continue supporting the post. It seems clear that people in the past were well aware of the issue and had methods in place to mitigate the problems, so that a roundhouse, if weathertight, could had stood for a considerable amount of time. Furthermore, radiocarbon dating and Bayesian modelling of Late Bronze Age timber roundhouses at Bestwall Quarry in Dorset suggest that they may have stood for a couple of generations, perhaps around 70 years or so, before being rebuilt completely (Bayliss et al. 2009).

The use-life of some ditches and roundhouses was calculated where possible in the site models described in Chapters 4–7. The result of the calculations was a probability distribution from which the median point, the point at which one-half of the probability values are above and below, was extracted (NB: this is different from the mean which is the average of all the data values). The median is plotted in the figures for ditches and structures presented below as a vertical line through the posterior density estimate.

8.2.1 Ditches

The data for the ditches (Fig. 8.6) suggest that enclosure ditches are fully recut approximately every 30–40 years. Although the median interval measurements for the Phase 3 and 4 ditches at Fishers Road West are *66* and *102 years*, respectively, the models from which these data are derived have a low number of dates and the subsequent probabilities have low precision as shown by the spread of the probabilities. Furthermore, the low precision of the probabilities includes an extended tail toward a longer interval that thus can skew the median value toward a larger value.

The tempo intimated by these results does include the various ditch cleanings, many of which were likely lost (Chadwick 1999), and indicates the full time that a particular ditch was open and in use. The tempo here appears to be on the order of one or two generations. At Fishers Road West the Phase 3 ditch is the earliest to take the form of a rectilinear farmstead. Although this earlier ditch may have been open for more than two generations, the lack of precision may put the interval closer to two generations. The same is true of the Phase 4 enclosure ditch, which has an even longer tail as a result of the lack of later material to constrain the enclosure results. The initial Ditch 1 (*43 years*) at Knowes Farm and the recut (*27 years*) both span one or two generations.

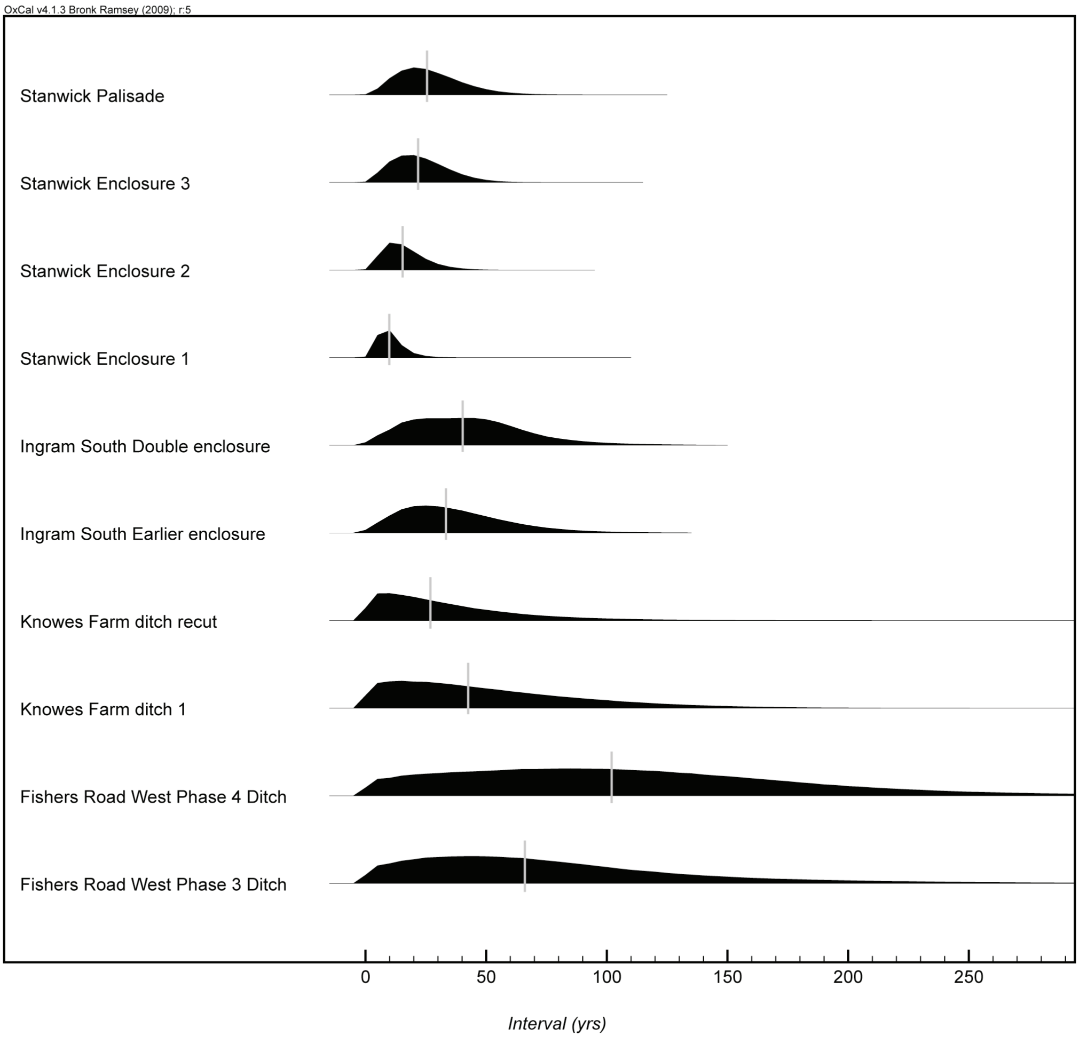

Figure 8.6: Probability density functions for the spans for the use of ditches at settlements included in this study and discussed in Chapters 4–7. The grey vertical line represents the median value for the probability

At Ingram South the development is slightly different, where we have an earlier enclosure that was in use for perhaps little more than a generation (*34 years*) before a second enclosure ditch was dug. The internal settlement was affected by this change and this second ditch was in use for perhaps *41 years* (median value; Fig. 8.6; Ingram South Double Enclosure). This is taken even further at Stanwick, not only in the revealed archaeological complexity, but in the actual pace of change. The earliest Enclosure 1 ditch was perhaps in use for *10 years* (median value; Fig. 8.6; Stanwick Enclosure 1). The second, horseshoe-shaped Enclosure 2 ditch, was in use for another *15 years* (median value; Fig. 8.6; Stanwick Enclosure 2) before the site is reorganized and the Enclosure 3 ditch is dug, which was perhaps in existence for *22 years* (median value; Fig. 8.6; Stanwick Enclosure 3) before the Palisade was constructed, and which survived for about *25 years* (median value; Fig. 8.6; Stanwick Palisade).

8.2.2 Roundhouses

The data for the roundhouses is on the one hand strikingly similar to that of the enclosure ditches and on the other hand decidedly different (Fig. 8.7). Firstly there appears to be a clear division between the use-life of the stone structures and the timber-built roundhouses. The data here may be slightly misleading and err on the side of overestimation for the stone-built structures. The two houses on The Dunion (6 and 8) suffer the same problem of the Fishers Road West enclosure ditches: 1) a model that is imprecise; and 2) probabilities that have tails that accentuate longer intervals. The two stone structures at Fawdon Dean that replaced earlier timber-built roundhouses (CS1 P3 and CS2 P2) have their upper limit constrained in the model by dates from a later enclosure ditch (Enclosure 2) that cuts them. Therefore, the intervals for these stone-built structures should be viewed as a maximum length of time that these structures were in use, and given Enclosure 2 is morphologically completely different – rectilinear and not curvilinear – from the preceding phase, it is probably not unreasonable to expect a gap, however slight, in use of the site. This is probably especially the case here given that the circular stone structures associated with the final phase of the earlier curvilinear enclosure had an associated abandonment layer and they were subsequently cut through by the later rectilinear enclosure ditch. The span for Fawdon Dean CS 3, a small ancillary building nestled between the other two, is calculated using the same starting probability as the other two stone-built phases, but using the evidence for the abandonment and destruction of that particular building for the end. This gives a median values of *46 years* for the use of this structure. Given that CS 1 and 2 are considered a unified build with CS 3 it seems quite plausible that the three structures were abandoned at the same time.

The data from timber-built structures present a use-life interval that is very much in accord with the enclosure data of approximately one generation. The entire settlement at Kilton Thorpe Lane appears to have been inhabited for perhaps *28 years* (median value; Fig. 8.7; Kilton Thorpe Lane (1 phase of houses)) and there is no indication that the builds here were successive in any way. The large structures at Stanwick were in use for very short spans before being rebuilt with LS1 in use for *34 years* (median value; Fig. 8.7; Stanwick LS1) and LS2 having an even more abbreviated use-life of only *17 years* (median value; Fig. 8.7; Stanwick LS2). There could be many reasons

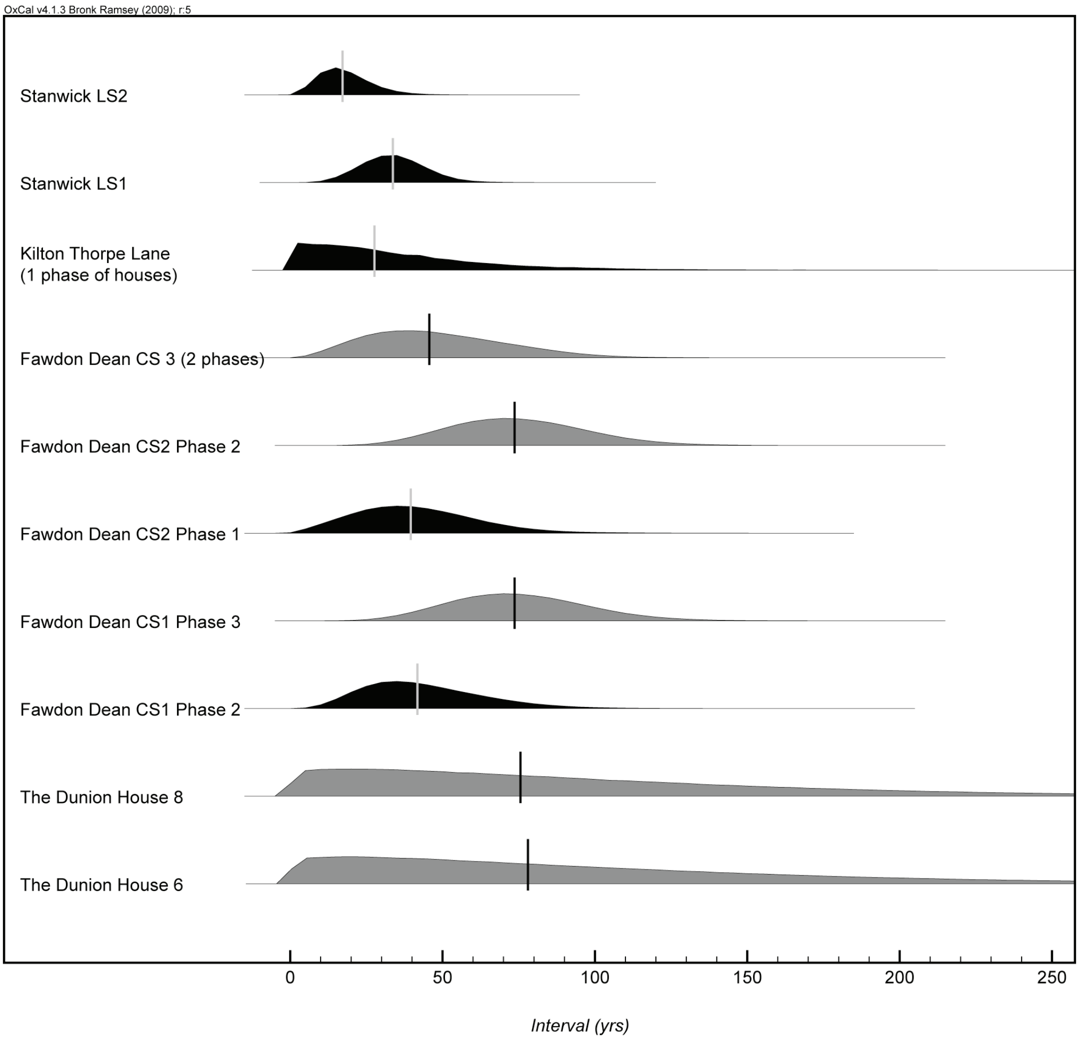

Figure 8.7: Probability density functions for the spans for the use of structures at settlements included in this study and discussed in Chapters 4–7. Probabilities shown in grey are from stone-built structures, while those in black are from timber-built ones. The vertical line represents the median value for the probability

for this shortened use of LS2, but perhaps developing ties with the Roman world played a part as the building was dismantled and used for fuel with the area that was once a religious/spiritual locus still retaining its significance within the penannular gully demarcated area of hearth activity.

Most striking is the evidence from Fawdon Dean for the timber-built phases of CS1 and 2. Here we have evidence of the two houses having burnt, or been burnt, to the ground prior to the construction of the stone-built settlement. The archaeology and the dating evidence both suggest that this was the same singular event. The interval for CS1 P2 is *41 years* (median value; Fig. 8.7; Fawdon Dean CS1 P2) and CS2 P1 is *39 years* (median value; Fig. 8.7; Fawdon Dean CS2 P1).

8.2.3 Discussion

The data from the dating and modelling both from the enclosure ditches and the houses strongly suggest that the tempo of change for these monumental settlement structures was on the scale of the generation, perhaps 30–40 years. I would suggest here that this modelled tempo may very well be real and, as such, would have had an important function in the negotiation of space and social relations in the past. I would also suggest that the tempo of reconstruction and renewal almost certainly is a reflection of social rituals associated with community building in the later Iron Age, rather than a physical or functional requirement.

Tempo as a product of function?

While the tempo of rebuilding a timber roundhouse at a site may have a functional explanation (e.g. the timber posts have rotted in the ground), it would seem a coincidence that timber and stone-built structures in the period for the most part enjoy the same longevity[15]. Furthermore, as Reynolds (1993) has pointed out, as the sapwood disintegrates a gap is left between the post and post-pit packing that could be filled and if the post rotted through or broke it would not be a difficult task to set the post on a pad of stones as often seen in medieval timber barns, and the archaeology, so that a rebuild only becomes a physical necessity when the structure is in a state of complete disrepair.

Is there a functional reason for recutting ditches? Perhaps it could be argued that there is, but most reasons are probably quite thin. Ditches appear to be in a constant state of flux, and level of being filled. If the purpose is to be 'a ditch' then it makes little sense why so many excavated ditches have evidence for episodes of deliberate infilling followed by cleaning. Furthermore, regular cleaning is likely to have simply made the ditch slightly deeper and wider as the edges could be either scraped clean or slightly over cut (Chadwick 1999). It has been argued that the act of recutting a ditch is a much more significant process (Chadwick 1997).

The enclosure ditches and houses are from all different site types and so the tempo of recutting cannot simply be attributed to 'what people do in a specific type of site or at a

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[15] This is if we are to adjust the two Fawdon Dean stone structures (CS 1 and 2) to be closer in agreement with the third (CS 3) that has dated abandonment debris and accept that the structures on The Dunion are likely to shorter-lived than the modelling suggests as a result of the low number of dates.

very specific time in the past'. The Knowes Farm and Fishers Road West ditches are well-dated examples from the typical Iron Age enclosed farmsteads that appear to crop up around 200 cal BC. At Stanwick, the ditches form features from the earliest phases up through to the palisade, when the site was also ramparted. Finally, at Ingram South, the enclosures are associated with late pre-Roman and early Roman Iron Age activity.

Changing social relations in the later Iron Age?

The mid-1st millennium cal BC appears to be a time when settlement along the North Sea coastal plain was nucleated and either palisaded or open, perhaps in a state of flux whereby sites are palisaded, and then open for a while before another palisade is constructed. Near the Forth at Dryburn Bridge, the previously palisaded site becomes an open settlement around the middle of the 1st millennium cal BC, probably in *530–415 cal BC* (*68% probability*; Fig. 8.8; *transition: palisade>open (Dryburn Bridge)*). East and West Brunton, along the Northumberland coast, were also either open or perhaps palisaded in their earliest forms around 400 cal BC (Fig. 8.8). Although there is no data to suggest how many structures were in use at one time in these settlements, the spatial arrangements of them all makes it possible that multiple households were actively living on these sites at the same time.

Around 200 cal BC all seems to change, at least in the eastern lowlands of central Britain and perhaps along the Northumberland coast, as a new settlement form begins spreading across the study region – the enclosed farmstead. This new settlement form likely held one extended family per household and existed in a dispersed pattern across the landscape. It should be noted that in the uplands, sites such as Wether Hill are still occupied at this time, but appear to be abandoned shortly after, while settlement on The Dunion persists into the period of Roman occupation.

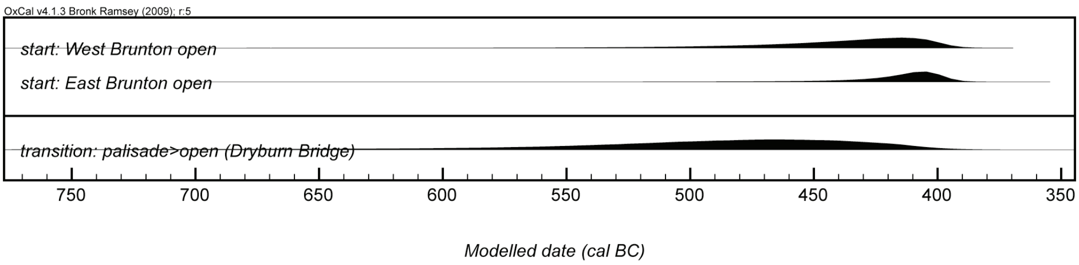

Figure 8.8: Probability density functions for the start of open settlement at Dryburn Bridge, East Brunton, and West Brunton. The probabilities are derived from the modelling in their respective sections

A settlement pattern changing from nucleated to dispersed settlement across much of the region would bring with it new challenges for the society. With the local community being spread out over a larger area, rituals and activities associated with building community would likely take on new forms. I will argue here that the new form of ritual may well have centred around the digging of the large rectilinear enclosure ditches around centrally located roundhouses. I suggested earlier that the construction of the roundhouse or the digging of the enclosure might be akin to an Amish ‘barn raising’. I make this analogy not only with the effect the event has on the community but will suggest that it may well take place for similar reasons.

Most Amish communities are composed of between 30 and 50 families. It is within these small community groups that the elders are able to promote values and pass down traditions (Wetmore 2007). The ‘barn raising’ involves the entire community and historically took place when settling into new areas, which can be seen as a necessity for a community of dispersed families with no access to hired help. These days it is primarily an event that brings the community together when a barn is damaged or destroyed.

For the Amish, the ‘barn raising’ acts in much the same way as other activities directed toward maintaining the community such as working fields for neighbours who are ill or have had a family member die unexpectedly, butchering animals, cutting and sawing wood, and erecting fences. It is through a system of mutual aid that the community insures itself against disaster while also maintaining a multibonded social unit. Furthermore, it is through these practices that they are able to integrate rituals and maintain traditions (Hostetler 1980, 246–47).

It is quite possible that the shift in settlement pattern around 200 cal BC laid the ground for a new settlement form. This form, the enclosed farmstead, also brought with it a change in social practice that focused the community rituals on the homestead with the construction of the homes and the digging of the ditches. These rituals would have brought the dispersed communities together from time to time strengthening old bonds while creating new ones.

What is most peculiar is that the two earliest dated forms of this new settlement type (Thorpe Thewles and West Brunton) are very similar, and in plan are representative of the typical later Iron Age farmstead for the region. East Brunton and Fishers Road

West are later in date and somewhat different in plan and overall character, and may well represent a re-imagining of this settlement type by an outside group. While the material culture in the region at this time is relatively homogenous, it is not entirely inconceivable that families were moving around the landscape, signifying their membership in a particular clan, community, or group, in part through the form of their settlement. They would likely have done so also with the clothes that they wore and the adornment on their structures, which is all lost to us archaeologically.

It is not possible to determine how many families/farmsteads might have made up an Iron Age 'community' in 200 cal BC. However, it is not difficult to imagine as many as 30 families involved in a close network. Activities such as the recutting of the ditches and the rebuilding of the roundhouses likely involved the entire community, and these activities would have been very important. Firstly, the bringing together of the families from across a region would reaffirm social ties, especially with sons or daughters that went to live with their partner's families. It would also provide a mechanism whereby community identity and traditions could be (re)solidified. Participation in the event would help in the creation of a social memory. It would also provide a functional means to negotiate or arrange marriages, further develop economic relations, and settle disputes.

The recutting and rebuilding may well both be part of a larger ritual of renewal. The renewal of the settlement at a 30–40 year pace might also suggest that it is associated with the handing over of the farm to the next generation. At Fawdon Dean the timber-built structures were burnt to the ground just prior to the construction of the stone roundhouses probably in *cal AD 10–45* (*68% probability*; Fig. 5.2.9; *build: stone Roundhouses*), and assuming this was purposeful and not accidental, it might signify the death and rebirth of the settlement.

A further peculiarity of West Brunton Farm is that two of these typical farmsteads were constructed within a stone's throw of one another at about 200 cal BC, their connectedness signified in their spatial and temporal proximity and yet independence by their bounded separateness. Here it has been argued by the excavator that an earlier structure existed within Enclosure A and so perhaps a dispute over inheritance, or extraordinary inheritance circumstances (i.e. twins) might have prompted the construction of the second enclosure. This is, and will remain, simply conjecture.

There is no data yet available to estimate the tempo of change for the period leading up to 200 cal BC. It would, thus, be foolish not to acknowledge that the social rituals in place at this time had their seeds sown in ritualized activities taking place deeper in antiquity. Perhaps these same patterns are discernible in the recutting and renewal of hilltop enclosures in the first half of the 1st millennium cal BC, or in the renewal of the palisaded enclosures of the mid-1st millennium cal BC. More data and modelling is needed on sites dating to the early-mid 1st millennium cal BC in order to realize fully the longevity of these practices or the timing of these changes.

8.3 Important considerations and lessons learned

The project has brought to light both technical and methodological considerations that are important lessons learned. Especially important are taphonomy, replicating dates, and dealing with outliers. These are summarized and discussed here so that they can be of utility to others aiming to develop regional settlement chronologies

8.3.1 Taphonomy

The single-entity sampling advocated by Ashmore (1999) has gone a long way to reduce earlier problems associated with mixed samples (Waterbolk 1971). This has been taken further so that preference is given to material on a site that is almost certainly of human origin: carbonized grains of domestic cereals and carbonized residues on pottery. This push for security in dating material that can be well-argued as having been anthropogenically produced has come at a price: the association of the sample and the context is often poorly thought out or understood.

Perhaps the single most important consideration when dating a settlement is the taphonomic processes that result in a specific sample being incorporated into a specific context. While most times the processes leading to the context being formed are well understood, how the radiocarbon sample in the context relates to the formation process is lost. Three types of deposits proved difficult at times despite a high degree of confidence in understanding the taphonomic processes at work. These deposits include: postholes, midden spreads, and fills of gullies and shallow ditches.

Postholes

As a result of the experimental work of Reynolds (1993; 1995) and the construction and dismantling of the Pimperne House, the taphonomic processes at work that result in material being in a posthole would appear to be fairly well understood. At the

Pimperne House the internal circuit of posts, which it had been assumed would remain dry and free of rot as they were well-protected from the elements under the roof, were in many cases actually rotted completely through so that the upright post appeared to be suspended in mid-air, although it actually rested on the post-pit packing material. What existed beneath one of these rotted posts was an empty void, empty of everything but some silting, two aluminium beer can pulls, a woman's hair tie, a plastic soldier, and a few fragments of local pottery made on the Butser experimental farm, and a marble (Reynolds 1995, 23). This rotting all occurred within 15 years of the structure's construction.

In prehistory, if this structure was taken down and rebuilt, then there should be expected to be three parts to the posthole fill: 1) the post-pit packing and any deposit at the base to stabilize the post in the hole; 2) the initial silting at the base of the posthole; and 3) the post-pipe fill. Chronologically, we would expect the material in the post-pit packing to provide a *terminus post quem* for the construction event; the material in the base would date to the early use of the structure; and the material in the post-pipe would date to the source of that material. However, as Reynolds points out, given that people in prehistory would have been aware of the posts rotting over time, they would have slowly filled in the gap with occupational debris and when the post was rotted through probably capped the subsiding posthole area with stones for further stabilization, and the result of this process is visible in carefully excavated examples (Reynolds 1995, 24).

The ideal posthole sample for radiocarbon dating would come from an *in situ* fragment of timber or from material recovered from the post-pipe, as these samples would date from the construction through the use of the structure. Material from the post-pit packing might date to anytime up to the point that the post was set. This has raised a question, discussed in Chapter 4, regarding the security of the dating of LS1 at Stanwick. Here a fragment of early South Gaulish samian Drag 15/17 was recovered from the post-pit packing fill. The dating and modelling of the feature appeared too early, if we were to accept that the sherd dates its deposit to some time after AD 15–20. Other postholes contained a total of three fragments of Roman pottery securely placed at the base of the pit, but these are all dated conventionally from *c.* 25–20 BC and are in keeping with material being deposited a few years after the structure was built as the posts decayed.

The radiocarbon dating of the LS1 postholes has provided seven results, six of which are in agreement. The seventh, from an upper fill, is more recent and in disagreement with a replicate date on other material from the same context. However, while this one date would appear too recent it is likely a statistical outlier as all seven of the radiocarbon measurements from the LS1 postholes are statistically indistinguishable (T'=9.9; v=6; T'(5%)=12.6). The modelling estimates that LS1 was constructed after *50–10 cal BC* (*95% probability*; Fig. 4.3.10; *Period 3–4 soil*) and probably in *45–25 cal BC* (*68% probability*), as the postholes for the feature cut through the Period 3–4 soil horizon. Furthermore, the structure was built prior to LS2 in *20 cal BC–cal AD 25* (*95% probability*; Fig. 4.3.10; *build: LS2*) and probably in *10 cal BC–cal AD 15* (*68% probability*). These data leave little doubt that there was ample time for the earlier Roman pottery to make its way to Stanwick and be deposited in the base of their respective postholes.

The sherd of South Gaulish samian Drag 15/17 recovered from the post-pit packing fill remains problematic. It is still slightly earlier than the context from which it derives, and by all reasoning should provide a *terminus ante quem* for that deposit. A separate model for Stanwick was constructed that included the fragment of early South Gaulish samian in a position equivalent to the other datable material in the post-pits and so indicative of being deposited during the use-life of the structure and not only does the model show good agreement when run but the modelled results show no appreciable difference to the model without the pottery dating included, except for a slight shift of the dating of these two structures to a more recent time, but even the shift is nearly imperceptible after the results are rounded to 5 years.

In an effort to provide a means to evaluate the security of posthole fills as part of the project, pairs of single-entity samples were submitted from time to time. In total, across the nine sites that received extra dating as part of the project, nine postholes had a second (or in one case even a third) sample submitted. Only in five of the nine cases did the measurements pass a chi-square test. However, five of the nine postholes were from Stanwick and it was here that four postholes passed chi-square tests. The one posthole to fail at 95%, the lower fill of LS1 posthole (3071), passed at 99%. So although the excavator has raised concerns over the dating, I am comfortable that the evidence supports the radiocarbon chronology and highlights a danger with typological dating of features from associated pottery alone.

Gullies and shallow ditches

A second type of deposit that can be problematic includes the drip gullies around roundhouses and shallow linear features. Every effort is made to sample material from organic-rich basal or lower fills as that material is thought to represent occupation debris purposefully or accidentally dumped into the cut feature. Unlike the larger ditches of many of the enclosures where these lower fills are generally safely out of reach of later ploughing activity, these features often experience some degree of truncation. While the sampled features may not be plough-disturbed, it is possible that the truncation might increase the chance that intrusive material will be incorporated into the deposit through natural processes simply because they are closer to the surface and less protected.

At Pegswood Moor this appears to have been the case. Multiple results were made on two separate species of plant material from the Droveway [900] and a fill in a ditch/ fence to the east of Enclosure 11 [331], and in each case the paired results were in statistical agreement. This would normally increase confidence in overall security of the material in the deposit being undisturbed. The radiocarbon dates, however, are post-medieval and not Iron Age and would appear on their values alone and the confidence in the deposits to date these two features to the post-medieval period. The archaeologist has made a strong case against their having a post-medieval date given their orientation and layout within the landscape fit with the Iron Age field system and not the post-medieval fields. These two features were highly truncated, a fact not overly clear at the time of sample selection, which raises the questions about context security.

Midden spreads

Spreads of occupation debris across a settlement are difficult to fully grasp from a taphonomic point of view. The material is rubbish and yet it can be found spread across specific areas of a site. In this project, two settlements had very similar deposits: Stanwick and Thorpe Thewles. Not only were the deposits similar but the associated settlement phases were similar. At Thorpe Thewles, what were referred to as “Masking Deposits” occurred as localized spreads across portions of the Phase III open settlement. The same type of deposit was called the Period 3–4 soil or the Period 4–5 infilling at Stanwick. The deposits in both cases were rich in organics and, at least at Thorpe Thewles, rich in sherds of Iron Age pottery. Although the deposits formed identifiable spreads across the site they often filled the slight subsidence depressions of previous ditches and gullies.

It is hard to imagine people, even in prehistory without our modern sense of hygiene, living amongst the detritus of everyday life. As such, we call into question from where these deposits originate. In all likelihood they were deposited fresh, as attested to by the relative lack of abraded edges on the Thorpe Thewles pottery recovered from the main late Phase III masking deposits and similar deposits near the cobbled entrance. In some cases the midden deposits may be build-up of a small garden or in an animal pen.

At Phantassie Farm there was evidence of a rock-cut pit that was used to store midden material that was mixed according to multiple radiocarbon dates. Presumably this midden was being used as fertilizer in a nearby garden or on nearby fields. However, also at Phantassie there existed areas where there was midden material against and over disused walls. The material itself may well have been redeposited from somewhere else as midden material was also building up in a disused structure late in the sites habitation.

This all calls into question the security of these deposits. While at Thorpe Thewles and Stanwick the midden deposits appeared to be fairly well understood, it was still felt necessary to submit multiple samples to test the security of the deposits. The midden store and a second midden deposit at Phantassie Farm did have multiple measurements made, however, other spreads on midden and occupation surfaces had only single samples submitted. The value and necessity of multiple dates is discussed in further detail below.

8.3.2 Replicating dates

When choosing samples it is not always possible to have material that one might claim will “without a shadow of a doubt” provide the date the deposit was formed. Those types of samples, in fact, are very rare and include such things as *in situ* burned material in a hearth, grain stored in a pit, and articulated human or animal bone. For most archaeological deposits it is necessary to submit samples that are assumed to date to the formation of the context, or to the use of the feature over a period of some years. While we may not be absolutely certain that the result is accurate, it is possible to have a high degree of confidence that the association is secure and so it does date the deposit. The types of deposits that this might include are *in situ* structural posts, discrete dumps of rubbish material in ditches or pits, or charcoal and seeds that have worked their way into the fill of postholes. These are the two levels of confidence at which all of the dates submitted as part of this project were subjected. Despite the high degree of confidence in these deposits it is still necessary to replicate some of the measurements, with some of the cases and reasons already discussed above.

However, not only should context dates be replicated, and in the case of these models between 1 in 7–10 dates were replicated, to test for the security of the deposit, but the material should be different. At the very least the difference should be to the species level since two excavated fragments of hazel charcoal could have been the same twig in antiquity. So the idea is to date two fragments of different species charcoal, or a fragment of charcoal and a charred seed, or a fragment of charcoal and a carbonized residue.

There are numerous examples throughout the modelling in Chapters 4–7 where replicate measurements were not statistically consistent. In some cases, such as the Midden Store at Phantassie Farm, the combination of replicate measurements and a sampled sequence illuminated the archaeologists to the fact that the entire deposit was mixed, likely in antiquity as material was put in, the midden was mixed, and material was later removed. In other cases, the replicate measurements identified a likely statistical outlier, such as the two measurements on the same inhumation (Inhumation 3) at Stanwick. While at Kilton Thorpe Lane, the replicate measurements on conjoining sherds from Pot 6 were wildly different with one dating to the earlier Iron Age and the other to the Mesolithic period, indicating either a problem with the actual residue or with the sample processing and measurement. Most dates on carbonized residues that are inaccurate would appear to be noticeably wrong, but the modelling at Pegswood Moor has brought to light the possibility that they can also be slightly wrong.

The initial suite of ^{14}C dates for Pegswood was on five carbonized residues from Iron Age tradition pottery sherds. As a suite of dates they not only appeared acceptable but when placed into a Bayesian model all but one were in agreement with the prior information (phasing and stratigraphy), whilst the exception was felt likely to have been redeposited. It was from this first model and simulations derived from it that all of the samples were selected. The newer dates included some three from carbonized residues on pots. Of those, two are wildly inaccurate, dating to the Mesolithic and

Neolithic periods. Furthermore, most of the charcoal and charred cereal dates from Pegswood, when calibrated along with the carbonized residue dates, give the impression that many of the residue dates are slightly offset and older than expected. This is quite possible if minute amounts of old carbon were incorporated in the residue either through post-depositional processes in the ground, or from the body of the pot when it was sampled for dating. Without the replication of results and using multiple types of samples across the site, it is possible that such a potential error would not have been identified.

8.3.3 Outliers

The identification of outliers is the third important lesson learned. Bronk Ramsey (2009b) has covered the two primary ways that outliers can be identified and mitigated in the modelling process. Firstly, they can be rejected manually. In this case, the indices of agreement are used to identify potential outliers – these may be outliers in the statistical sense of radiocarbon measurement or in the physical sense of being residual or intrusive material – and the material and the contexts are further scrutinized. In the majority of the cases this method works. The production of a radiocarbon measurement is a statistical process and so the age has 95% probability of truly lying within the 2-sigma range, therefore 1 in 20 results should be expected to lie outside of the 95% probability range. In practice, most outliers are a product of contexts being sampled where the taphonomy is poorly-understood and the result is then either too young or too old because the sample is intrusive or residual.

At Phantassie Farm, over 20% of the radiocarbon results were excluded as outliers. These results were all manually rejected with most being demonstrably older or younger than any of the other material from the site. The site had quite a bit of stratigraphy, but much of this was related to layers sealed beneath stone walls, rubble fills of stone walls, and dumps of occupation debris within structures or against walls. With very little replication and the nature of the stoney fills making residual and intrusive material appear equally likely in many contexts 12 dates were removed. It should be stressed here once again that with the exception of two areas of midden deposit, no other contexts had dates replicated.

At Dryburn Bridge, the problem was that it was impossible to manually reject ^{14}C dates given the data available. Unlike Phantassie Farm where there were stratigraphic controls, at Dryburn Bridge the replicate measurements that were in disagreement came from the same bodies, but were sampled and measured at two or three different times and following two or three different methods. While Dunwell (2007) suggested that a single tranche of dates be removed, this blanket approach appeared unwarranted. All the dates were used here within a Bayesian outlier model. While it may be debated whether two of the bodies, in fact, date to the 7th–8th century cal AD – there was only one measurement available on each – the remaining model would appear to conform with the archaeological evidence.

The issues encountered at Pegswood Moor did raise the potential for including the pottery dating within an outlier model. However, in this case, the model did not work, and is likely attributed to not having securely dated material and the start and end of the settlement sequence. In this case, the earliest and latest dated material was pottery, from which the radiocarbon dates had been called into question. Without further dating, it was necessary to manually reject dates in this case, and I would suggest if further work is undertaken on Pegswood that issue be resolved.

8.4 Conclusion

The lessons learned in this project will be an invaluable point of reference for anyone undertaking similar constructions of settlement chronologies. However, the rewards of following a rigorous methodology with particular attention paid to understanding the taphonomy of every sample and ensuring an adequate level of replication are enormous. The individual site models in Chapters 4–7 already highlighted the potential for highly precise results, but this chapter has shown just how those results can be used to gain new insights into the processes of social change across a landscape. It is this possibility to extend the Bayesian method from the site to the region that is most exciting and relevant for archaeology in the 21st century.

CHAPTER 9: CONCLUSION

This thesis began with the statement that "chronological understanding is at the heart of archaeological interpretation". It was intimated that part of the failure of current Iron Age chronology was directly related to the failure of today's archaeologists to see past the limitations of radiocarbon calibration in the Iron Age and look to the future of statistical modelling. As this thesis has shown, the production of a robust site-based chronology is not a simple matter of dating some material simply because it can be dated. Firstly, in keeping with the advice of Ashmore (1999) it is necessary to to target short-lived, single-entity samples. These include pieces of short-lived charcoal, individual charred seeds, bones, and carbonized residues on pottery. But moving beyond that, it is equally important that there is a well-understood or argued taphonomic relationship between the sample and the context from which it was derived. This includes samples from *in situ* burnt deposits such as hearths and articulated or articulating bone, but also material from rubbish dumps or charred material that has worked its way into a posthole (Reynolds 1995).

There are two beliefs that regularly make their way into discussions regarding radiocarbon and chronology-building. These are best summarized by Sharples (forthcoming) when he claims that to develop a "decent radiocarbon chronology" the following criteria should be met:

- a large number of dates;
- belong to a demonstrable stratigraphic sequence which can be used to apply Bayesian statistics.

These claims were made in a review of three publications of later Iron Age sites in the Lothians. It went further to suggest that 30–40 dates was probably the right number of dates/contexts for settlements of the size and complexity of those published. It should be noted that four of the sites in those three books have been modelled and included in this project: Dryburn Bridge, Knowes Farm, Phantassie Farm, and Standingstone.

Looking back at these four sites, they do all have a large number of ^{14}C dates, ranging from 25 at Knowes Farm to 59 at Phantassie Farm. But none of the samples from these sites were selected explicitly within a Bayesian framework or even with the foresight of applying a Bayesian modelling approach to the results. At Fawdon Dean and Ingram South there were 24 and 27 samples dated and the results were very good and quite precise. At Kilton Thorpe Lane there was a total of 17 dates and the spans for the individual modelled results are perhaps within the span of two generations (<70 years at 95% probability), which is an achievement given most of the raw calibrated dates cover a span of over 150 years at 95% confidence. Many sites of varying levels of complexity have produced exceptional results with fewer than 30 results, so long as those sites were primarily dated using the Bayesian approach from the beginning.

Furthermore, the belief that a demonstrable stratigraphic sequence is a prerequisite for developing a robust and precise Bayesian chronology is not Sharples' belief alone as it is echoed in Cunliffe (2005, 652–54). This leads to the second myth, which is that without a stratigraphic sequence the Bayesian model will do little good. Firstly, the most basic Bayesian model is of an unordered phase of dates that has the prior assumption that they are distributed uniformly through time. That one prior assumption is enough, given a favourable portion of the radiocarbon calibration curve (i.e. non-plateau), to reduce the probabilities on the dates by accounting for the statistical scatter[16].

While there was some degree of stratigraphy in every site in this project in some cases it had very little effect. The sequence from the curvilinear structures in the Standingstone scoop had such a small effect to be visually nearly imperceptible[17], and completely obscured by the time the results were rounded to five years when compared to a model that disregard the sequencing. However, at Stanwick, where the settlement spans probably *80–120 years* (*68% probability*; Fig. 4.3.11; *span: Stanwick*) and there is an enormous depth to the layers of stratigraphy, the sequence has allowed for a considerable amount of precision in the modelled results.

[16] The Neolithic causewayed enclosure at Lodge Farm, St. Osyth, Essex is an excellent case-in-point whereby 20 radiocarbon results from 10 unstratified pits and enclosure fills produced modelled results that suggested all the activity spanned *1–40 years* (*95% probability*), however, the results were situated in an area of calibration curve with many wiggles in a plateau and the model was only able discern that the activity belonged to one of two possible centuries as a result of the bimodal distributions of all the results (Hamilton et al. 2007, fig. 62).

[17] Not only is the effect very small when visually comparing the calibrated probabilities in outline and the *posterior density estimates* in black, but a model that removes that stratigraphic relationship shows very little difference in the visual probabilities as well as the numeric ranges of those probabilities.

The key concern is that the samples undergo a rigorous selection process that not just takes into account the taphonomy, but keeps taphonomic confidence in the forefront of the selection criteria. Where the taphonomy of samples was in question and where replication of dates did not occur, there was a high incidence of excluded dates. Phantassie Farm, for instance, had 12 dates excluded from the model for these reasons.

While the size and complexity of a settlement is of concern, especially given that larger and more complex sites usually equate to a greater number and more intricate set of questions, the real date of the site is of particular interest as well. Thirty, forty, or even one hundred radiocarbon dates drawn from short-lived samples in clearly defined and taphonomically understood contexts might do very little to help construct a chronology if all of those samples date to a bad portion – plateau – of the radiocarbon calibration curve. This thesis has shown that it is possible in the second half of the first millennium BC to overcome much of the effect of the later plateau (400–200 BC). While it may not be possible to overcome the effects of the plateau at 800–400 BC with such dramatic results, it nevertheless is a task worthy of exploration. The Bayesian method would allow for some sites that are thought to hold the potential for good dating, both in the material available and the chronological questions, to be explored and simulated to see the effect of the calibration curve on those results.

9.1 Avenues for further research

The research presented here really does only scratch the surface of what Bayesian modelling and radiocarbon dating can do in developing settlement chronologies that have the potential for producing interpretative narratives about communities and society across a region. The Bayesian method, used here, illustrates perhaps the most important tool available to archaeologists to develop chronological frameworks in a manner that is both explicit and robust. Initially the method was used on a site-by-site basis to construct models that date the occurrence of identified archaeological phenomena. These phenomena are dated in this way independently and in such a manner that each date from each context in each model could be closely and rigorously scrutinized. The result of these models were then used to examine the occurrence of the phenomena across a wider landscape.

The results of the modelling have begun to shed light on social organization and change in east-central Britain not only in the period of direct Roman contact and conquest, but even 150 years prior to the arrival of Caesar. Some of the ideas and themes discussed and in need of further investigation include: 1) the rise in rectilinear enclosed farmsteads in the lowlands from the Tees to the Forth; 2) the shift from the dispersed enclosed farmsteads to open nucleated settlements at about the time of Caesar's 'visit' to Britain; 3) the timing of the rise in salt production in the Tees and up along the Northumberland coast; 4) the decline/absence of habitation evidence on decidedly 'native' settlements in the Tees after AD 70; and 5) the identified tempo of renewal for ditches and roundhouses at what is perhaps a 30–40 year interval.

The rise in rectilinear enclosed settlements along the coastal plain is likely an internal development and may well find its root in the earlier Iron Age. The implication that these probably single extended family farmsteads were, in some cases, preceded by more nucleated open or palisaded sites and, in the proven case of Thorpe Thewles, followed approximately 150 years later by nucleated open settlements suggests a major shift in social organization in east-central Britain at this time. More sites that fit this type exist (e.g. Burradon, West Brandon, Coxhoe, Belling Law[18], and Tower Knowe) and these should be investigated further to determine if they too date to the same period. Also, further analysis (re-evaluation) and comparison of the archaeological data from all the sites should prove to be highly informative. These rectilinear enclosed farmsteads perhaps should be viewed differently from such enclosures as Ingram South and Enclosure 2 at Fawdon Dean that were built at or near the time of Roman conquest and become the more prevalent enclosure type in the Cheviot Hills at this time, as there is far too much temporal separation, although their rise in popularity ultimately may have been for very similar reasons.

The rectilinear enclosed farmsteads appear to have been replaced around 55/4 BC by open nucleated settlements. At Thorpe Thewles the change was dramatic with the massive Main Enclosure Ditch being deliberately infilled. It is unclear why such changes would take place, but I have suggested that it may be the result of a disruption or fracturing of the internal social networks of the island. After the initial Roman arrival, the southern tribes appear to be giving and receiving more attention to Rome. This would have disrupted socio-economic networks within the island and resulted in old

[18] Belling Law has two associated ^{14}C dates that suggest the initial site could date to around 200 cal BC. HAR-1394 (2110 ±80BP) is from the wall of House I thought to be contemporary with Phase 1 and which calibrates to 390 cal BC–cal AD 60. The second date (HAR-1393; 1670 ±70BP) is from a posthole associated with the later stone roundhouse and dates to the later Roman–post-Roman period.

networks being reinvigorated and new ties formed. Perhaps to do so meant turning away from the old way of living dispersed across the land and coming together to provide more immediate aid and support.

I began to argue in the previous chapter that economics may have been the driving force, or one of them, behind the shift to open settlements and that this may have also created the perfect conditions for the development of a more hierarchical social structure at this time as seen in the rapid development of Stanwick. One new economy may have been salt production. If salt production in the Fens was becoming more focused on trade with Rome then it might leave a void in supply to central Britain and northward that could be filled by people living further along from the North Yorkshire to Northumberland coast. The settlement at Street House Farm is one such site with North Road, Berwick being a second. These sites should be examined further with particular attention paid to dating the time at which salt production begins to see if there is a correlation between the onset of the production and the shift to open nucleated settlements.

The fourth, and unexpected result, was the apparent depopulation of three of the four dated settlements in the Tees valley either prior to or at the time of the arrival of the Roman Army in AD 70. While it was probable that Kilton Thorpe Lane was abandoned early, given the lack of Roman material on the site, Thorpe Thewles and Stanwick had habitation phases with associated Roman material, and were thought to have been inhabited for at least a short time beyond AD 70. The hypothesis put forward in the previous chapter was that perhaps the native settlement form ceased to exist and at sites such as Thorpe Thewles where the settlement was turned over to stock enclosures the associated Roman iron Age settlement simply has not been identified. This could be investigated further by targeting sites, such as Catcote, where native Iron Age settlement is located in close proximity to a Romano-British settlement and examining the chronologies of the two settlements, with specific interest paid to questions of contemporaneity and continuity.

Finally, the data produced suggests ditches and roundhouses are being renewed every 30–40 years. This data is drawn from examples from across the study area and in the throughout the later Iron Age period. The identified tempo probably extends back into the earlier Iron Age. This question of the tempo of renewal, or perhaps restructuring as is the case at Stanwick with much of the ditch digging episodes, is one that can be examined on a site-by-site basis where the data exist.

Table 1: Radiocarbon dates from all 18 sites included for dating and Bayesian modelling for the project. The material is all single-entity samples unless otherwise noted as a “bulk” sample. Animal bone when articulated/articulating is noted in the table as well.

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
Dryburn Bridge							
AA-53706	Burial 1; burial on left side, flexed with head to N in an unlined pit; cuts palisade of original enclosed settlement	human bone: rib, long bone and cranium fragments	-20.0			2280 ±50	410–200 cal BC
SUERC-4068	replicate of AA-53706	human bone: cranium, rib and long bone	-20.4			2485 ±35	790–410 cal BC
GU-1149	replicate of AA-53706	human bone: unidentified fragments	-21.5			2210 ±70	410–50 cal BC
AA-53707	Burial 2; substantial but incomplete burial, on left side, flexed with head to N in an unlined pit	human bone: right humerus and left radius fragments	-21.2			2265 ±50	410–200 cal BC
SUERC-4069	replicate of AA-53707	human bone: right humerus and left radius fragments	-21.1			2435 ±35	760–400 cal BC
GU-1404	replicate of AA-53707	human bone: tibia	-21.8			2400 ±100	800–210 cal BC
AA-53708	Burial 3; partial remains, on left side, flexed at the base of an unlined pit	human bone: ulna, long bone and vertebra fragments	-21.1			2325 ±50	520–230 cal BC
SUERC-4070	replicate of SUERC-4070	human bone: ulna, long bone and vertebra	-20.6			2455 ±35	770–400 cal BC
GU-1405	replicate of SUERC-4070	human bone: unidentified fragments	-20.4			2665 ±165	1270–390 cal BC
AA-53709	Burial 4; Cist 1; disarticulated remains of mature adult male; most small bones were missing; overlying Burial 5	human bone: left ulna	-20.7			3755 ±55	2350–1980 cal BC
GU-1406	replicate of AA-53509	human bone: femur	-21.4			3850 ±160	2870–1880 cal BC
SUERC-4071	replicate of AA-53509	human bone: left ulna	-20.4			3765 ±35	2290–2040 cal BC
SUERC-4082	replicate of AA-53509	human bone: rib and scapula	-20.1			3760 ±40	2300–2030 cal BC
mean Burial 4	T’=0.3; v=3; T’(5%)=7.8					3763 ±24	2285–2055 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
AA-53710	Burial 5; Cist 1; complete remains of crouched burial on the floor beneath cover; articulated remains under disarticulated Burial 4	human bone: left humerus	-20.4			3340 ±75	1880–1440 cal BC
SUERC-4072	replicate of AA-53710	human bone: left humerus	-21.8			3615 ±40	2130–1880 cal BC
SUERC-4083	replicate of AA-53710	human bone: left radius	-21.0			3725 ±35	2280–2020 cal BC
AA-53711	Burial 6; flexed burial on right side at base of an unlined pit [DB78 SB/8]	human bone: femur fragment	-23.0			1880 ±45	cal AD 20–240
SUERC-4073	replicate of AA-53711	human bone: femur	-21.7			2380 ±35	710–390 cal BC
SUERC-4084	replicate of AA-53711	human bone: right femur	-21.2			2400 ±35	730–390 cal BC
GU-1410	replicate of AA-53711	human bone: femur	-20.9			2415 ±80	800–370 cal BC
mean Burial 6	T'=0.3; v=2; T'(5%)=6.0					2392 ±24	525–395 cal BC
AA-53712	Burial 7; partial remains of a burial at the base of an unlined pit	human bone: assorted long bone and cranium fragments	-23.0			1320 ±45	cal AD 640–770
AA-53713	Burial 8; partial remains of a burial at the base of an unlined pit	human bone: petrous temporal	-22.4			1685 ±50	cal AD 230–530
SUERC-4412	replicate of AA-53713	human bone: long bone and cranial fragments	-23.6			1705 ±40	cal AD 230–430
mean Burial 8	T'=0.1; v=1; T'(5%)=3.8					1697 ±32	cal AD 250–420
AA-53714	Burial 9; partial remains, flexed on the left side at the base of an unlined pit [DB79 SB/10]	human bone: pubis fragment	-20.8			2040 ±70	350 cal BC–cal AD 120
SUERC-4074	replicate of AA-53714	human bone: pubis	-21.0			2435 ±35	760–400 cal BC
GU-1412	replicate of AA-53714	human bone: femoral head	-21.6			2300 ±125	780–40 cal BC
AA-53715	Burial 10; Cist 2; articulated crouched burial an the floor of a stone-lined cist set within a grave pit 1m deep; remains under disarticulated Burial 11 [DB79 SB/6]	human bone: right ulna	-20.8			3660 ±55	2200–1890 cal BC
GU-1408	replicate of AA-53715	human bone: femur	-20.6			3620 ±85	2210–1740 cal BC
SUERC-4078	replicate of AA-53715	human bone: right ulna	-21.2			3755 ±35	2290–2030 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
mean Burial 10	T'=3.5; v=2; T'(5%)=6.0					3717 ±28	2200–2020 cal BC
AA-53716	Burial 11; Cist 2; disarticulated remains deposited in stone-lined cist set within the base of a large pit; overlies articulated Burial 10 [DB79 SB/7]	human bone: thoracic vertebra	-21.0			3765 ±60	2440–1980 cal BC
GU-1409	replicate of AA-53716	human bone: tibia	-23.1			3550 ±80	2140–1680 cal BC
SUERC-4079	replicate of AA-53716	human bone: thoracic vertebra	-21.7			3720 ±35	2270–2020 cal BC
mean Burial 11	T'=4.8; v=2; T'(5%)=6.0					3709 ±29	2200–2020 cal BC
AA-53717	Burial 12; partial remains in the base of an unlined pit	human bone: cranium fragments	-23.4			1405 ±45	cal AD 560–680
AA-53718	Burial 13; partial remains of flexed burial, on right side with its head facing S in the base of an unlined pit [DB79 SB/12]	human bone: long bone and ribs	-20.7			2300 ±45	410–210 cal BC
SUERC-4088	replicate of AA-53718	human bone: petrous femoral	-20.8			2450 ±35	770–400 cal BC
GU-1414	replicate of AA-53718	human bone: leg fragments	-20.8			2040 ±180	420 cal BC–cal AD 390
AA-53719	Burial 14; partial remains of burial at the base of an unlined pit with a stony fill; cuts the palisade trench foundation of the original enclosed settlement	human bone: femur fragment	-20.3			2365 ±55	750–370 cal BC
AA-53720	antler fragment (OBH/1) from putative pick found in the base of a large pit	animal bone: deer antler fragment	-22.2			2290 ±55	410–200 cal BC
SUERC-4938	replicate of AA-53720	animal bone: deer antler fragment	-22.0			2320 ±40	420–260 cal BC
mean antler	T'=0.2; v=1; T'(5%)=3.8					2310 ±33	410–260 cal BC
AA-53721	Dog burial (MCX/1) within a stone-floored pit that cut an earlier souterrain-related feature containing Roman glass	animal bone: dog vertebra	-21.3			1830 ±45	cal AD 70–330
SUERC-4939	replicate of AA-53721	animal bone: dog	-17.5			1830 ±40	cal AD 70–320
mean dog	T'=0.0; v=1; T'(5%)=3.8					1830 ±29	cal AD 80–250
GU-1285	Fence/shallow gully associated with H7 [DB79 SC/3]	charcoal: alder, willow, birch, hazel	-25.0			1730 ±55	cal AD 130–430
GU-1257	House 2 (H2); part of the charred stump of a post set within the outer ring-groove and relating to the secondary enlarged roundhouse layout [DB78 SC/2]	charcoal: *Quercus* spp.	-25.0			2450 ±50	780–400 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
AA-53705	House 2 (H2); part of the charred stump of a post set within the outer ring-groove and relating to the secondary enlarged roundhouse layout [SC/2-2]	charcoal: *Quercus* spp.	-25.8			2500 ±40	800–410 cal BC
GU-1283	House 2 (H2); oak timber, split in terminal post setting; outer ring-groove beneath abandonment layer [DB79 SC/1]	wood: *Quercus* spp.	-25.0			2280 ±55	410–200 cal BC
GU-1284	House 2 (H2); oak timber, split in terminal post setting; outer ring-groove beneath abandonment layer [DB79 SC/2]	wood: *Quercus* spp.	-25.0			2615 ±55	900–590 cal BC
GU-1286	House 9 (H9); pit/posthole [DB79 SC/5]	charcoal: *Quercus* spp.	-25.0			2400 ±55	760–380 cal BC
AA-53704	House 9 (H9); part of a charred stump of structural post L112, possibly a door post of the timber roundhouse [SC/5-1]	charcoal: *Quercus* spp.	-24.2			2475 ±40	790–400 cal BC
GU-1287	House 2 (H2); terminal post setting of inner-ring groove beneath abandonment layer [DB79 SC/6]	charcoal: *Quercus* spp.	-25.0			2550 ±55	820–510 cal BC
AA-53703	House 2 (H2); part of a charred stump of a post, possibly a door post set in the S terminal of the inner ring-groove; possibly relates to the original construction [SC/6-1]	charcoal: *Quercus* spp.	-25.1			2455 ±40	770–400 cal BC
The Dunion							
GU-1271	soil (F1065) under a hearth of House 2 [G2079]	bulk charcoal: *Corylus avellana*; small diameter	-24.6			1970 ±80	180 cal BC–cal AD 230
GU-1272	drainage ditch (F1531) around south side of House 1 [G4253]	bulk charcoal: *Corylus avellana* and *Salix* sp.; small diameter	-24.6			2080 ±50	350 cal BC–cal AD 30
GU-1273	drip gully or drainage ditch (F1710) to south of House 8 (cuts House 1) [G2074]	bulk charcoal: *Corylus avellana*; small diameter	-24.5			1910 ±120	200 cal BC–cal AD 400
GU-1274	occupation layer (F3051) of House 4 [B4763]	bulk charcoal: *Corylus avellana*, *Quercus* spp., and *Prunus avium*; small diameter	-24.2			2090 ±150	410 cal BC–cal AD 240
GU-1275	accumulation of occupation debris (F6031) behind Rampart 1 [B1381]	bulk charcoal: *Corylus avellana* and *Betula* sp.; small diameter	-25.0			2120 ±50	360–1 cal BC
GU-1276	pit (F9017) under wall and paving of House 6 [B1380]	bulk charcoal: *Corylus avellana*, *Alnus* sp., and *Betula* sp.; small diameter	-24.7			2120 ±110	400 cal BC–cal AD 90

Lab ID	Context Information [Sample ID]	Material	δ^{13}C (‰)	δ^{15}N (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
GU-1277	House 7, post-hole	bulk charcoal: *Quercus* spp.; large diameter	-26.0			5550 ±100	4600–4230 cal BC
GU-1278	pit (F1059) in House 2, quern pit [G/2065/B4754]	bulk charcoal: *Corylus avellana* and *Salix* sp.; small diameter	-24.8			2000 ±55	170 cal BC–cal AD 130
East Brunton							
OxA-22485	fill 112 of Wall slot 113 in House F [112A]	charcoal: *Betula* sp.	-26.4			2137 ±27	350–60 cal BC
OxA-22486	fill 112 of Wall slot 113 in House F [112B]	charcoal: *Populus* sp.	-26.2			2183 ±27	370–170 cal BC
OxA-22487	fill 117 of Gully 118 surrounding House G [117A]	charcoal: *Acer campestre*	-27.9			2084 ±27	200–40 cal BC
OxA-22488	fill 117 of Gully 118 surrounding House G [117B]	charcoal: *Alnus/Corylus* sp.	-28.0			2087 ±26	200–40 cal BC
OxA-22489	fill 119 of pit/posthole 120 at north side of House G entrance [119]	charcoal: *Quercus* spp.; roundwood	-26.3			2064 ±25	170–1 cal BC
OxA-22490	fill 151 of Wall slot 152 in House Va [151]	charcoal: unidentified tuber	-27.0			2060 ±26	170 cal BC–cal AD 10
OxA-22491	fill 219 of posthole 220 in internal post ring of House B [219]	charcoal: *Alnus/Corylus* sp.	-26.8			2308 ±28	410–360 cal BC
OxA-22492	fill 247 of posthole 248 of House C [247B]	charcoal: *Alnus/Corylus* sp.	-26.9			2338 ±27	410–380 cal BC
OxA-22493	fill 247 of posthole 248 of House C [247C]	charcoal: Betulaceae	-25.7			2284 ±25	400–230 cal BC
OxA-22628	fill 247 of posthole 248 of House C [247A]	charcoal: *Quercus* spp., roundwood	-25.6			2428 ±27	750–400 cal BC
SUERC-1398	fill 121 of pit/posthole 122 at south side of House G entrance [NGP03 121]	charcoal: unidentified	-27.8			2140 ±45	360–40 cal BC
UBA-7818	upper fill 143 of pit 144 in House O [NGP03 143/42]	bulk: carbonized grain; barley	-20.2			2361 ±32	520–380 cal BC
UBA-7819	fill 460 of third recut of Enclosure 2 [NGP03 460/82]	bulk: 2 carbonized grains; wheat	-27.6			2088 ±31	200–1 cal BC
UBA-7820	fill 131 of palisade slot [NGP02 131/56]	charcoal: *Quercus* spp.	-33.0			2445 ±39	770–400 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
Eildon Hill North							
GU-2190	hearth under Defensive System A at Entrance 2	bulk charcoal: alder, birch, hazel, Pomoideae, *Prunus*, oak, willow and elm; roundwood	-24.9			2760 ±50	1020–810 cal BC
GU-2370	replicate of GU-2190	bulk charcoal: alder, birch, hazel, Pomoideae, *Prunus*, oak, willow, and elm; roundwood	-25.2			2870 ±50	1260–910 cal BC
mean pre-Rampart hearth	T'=2.4; v=1; T'(5%)=3.8					2816 ±36	1060–890 cal BC
GU-2197	pit under Defensive System A	bulk charcoal: alder, birch, hazel, ash, and willow; roundwood	-25.1			2680 ±130	1190–410 cal BC
GU-2194	dispersed hearth of House Platform 1, Episode 1	bulk charcoal: birch, ash, oak, and willow	-24.9			3020 ±60	1430–1050 cal BC
GU-2373	replicate of GU-2194	bulk charcoal: birch, ash, and willow	-25.2			2600 ±50	840–590 cal BC
GU-2195	floor surface of House Platform 1, Episode 1	bulk charcoal: alder, birch, hazel, *Prunus*, and willow; roundwood	-25.2			2750 ±50	1010–800 cal BC
GU-2193	abandonment level of House Platform 1, Episode 1	bulk charcoal: alder, birch, hazel, and willow	-23.8			2650 ±60	920–670 cal BC
GU-2191	floor surface (Area II) of House Platform 1, Episode 2	bulk charcoal: alder, birch, hazel, willow, and heather	-25.8			1760 ±50	cal AD 130–410
GU-2192	replicate of GU-2191	bulk charcoal: alder, birch, hazel, Pomoideae, willow, and heather	-24.8			2200 ±60	400–60 cal BC
GU-2371	floor surface (Area II) of House Platform 1, Episode 2	bulk charcoal: alder, birch, hazel, Pomoideae, willow, and heather	-25.0			2000 ±130	390–320 cal BC
mean HP1, E2 i	T'=1.9; v=1; T'(5%)=3.8					2166 ±55	390–40 cal BC
GU-2372	dispersed hearth of House Platform 2	bulk charcoal: alder, hazel, birch, ash, cherry, and willow; roundwood	-26.1			1780 ±50	cal AD 120–390
GU-2196	floor surface (Area III) of House Platform 2	bulk charcoal: alder, hazel, and willow; roundwood	-24.9			1820 ±60	cal AD 60–380

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
GU-2198	floor level (mostly fire-base area) House 3	bulk charcoal: alder, birch, hazel, ash, *Prunus*, oak, willow, and elm; roundwood	-25.2			2620 ±60	900–590 cal BC
Fawdon Dean							
OxA-20801	fill 118 (F106); a charcoal-rich deposit that lies on the cobbling in CS1 (Ph3) [BVA02 118B]	charcoal: *Quercus* spp.; roundwood	-24.0			1909 ±24	cal AD 30–140
OxA-20814	fill 252 of posthole (F252) in CS2 Phase 1 [BVA02 252A]	charcoal: indeterminate; twig	-26.8			2170 ±28	360–170 cal BC
OxA-20815	fill 239 of posthole (F239) beneath stone roundhouse wall. (CS1 Ph2) [BVA02 239A]	Poaceae fragment	-21.3			1979 ±29	50 cal BC–cal AD 80
OxA-20872	184; an 'abandonment' layer over pit F216 (CS3) [BVA02 184B]	charcoal: Maloideae; roundwood	-26.5			2061 ±31	180 cal BC–cal AD 10
OxA-20873	187 (F156); *in situ* burned material on the floor of CS2 (Ph2) [BVA02 187A]	charcoal: Maloideae; twig	-23.6			2147 ±32	360–60 cal BC
OxA-20874	202 (F106); a charcoal concentration from within the paving slabs in the entrance of CS1 (Ph3) [BVA02 202A]	charcoal: *Alnus glutinosa*	-24.8			1933 ±30	cal AD 1–130
SUERC-24282	fill 171 (F171) of wooden roundhouse gully cut (CS1 Ph1) [BVA02 171A]	charcoal: *Alnus glutinosa*; roundwood	-27.8			2150 ±30	360–90 cal BC
SUERC-24281	209 (F156); *in situ* burned material on the floor of CS2 (Ph2) [BVA02 209A]	charcoal: *Corylus* avellana; roundwood	-25.1			1920 ±30	cal AD 20–140
SUERC-24280	184 (F216); an 'abandonment' layer over pit F216 (CS3) [BVA02 184A]	charcoal: *Alnus glutinosa*; roundwood	-28.4			1940 ±30	cal AD 1–130
SUERC-24279	224 (F106); a charcoal-rich deposit with many cereal grains, overlying wooden features and beneath the later stone roundhouse. Possibly reflects *in situ* burning (CS1 Ph2) [BVA02 224A]	carbonized grain: *Hordeum* sp.	-23.2			1990 ±30	50 cal BC–cal AD 80
SUERC-24277	118 (F106); a charcoal-rich deposit that lies on the cobbling in CS1 (Ph3) [BVA02 118A]	charcoal; *Corylus avellana*	-25.0			1965 ±30	50 cal BC–cal AD 120
SUERC-24278	fill 252 of posthole (F252) in CS2 Ph1 [BVA02 252B]	carbonized grain; Ceralia indeterminate	-23.0			1990 ±30	50 cal BC–cal AD 80
AA-40753	soil layer sealed beneath CS 1 wall [BVA00 120]	charcoal; *Salix/Populus* sp.	-27.3			2110 ±60	360 cal BC–cal AD 20
AA-54967	CS 1 Ph 2: fill of pit sealed beneath RH wall [BVA00 233 (F232)]	bulk: charcoal, barley, cereal grain	-25.7			1995 ±40	100 cal BC–cal AD 80

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
AA-54965	CS 1 Ph 3: upper fill of clay-lined pit [BVA00 210 (F219)]	bulk: charcoal, barley, wheat	-22.9			1980 ±45	90 cal BC–cal AD 130
AA-54968	CS2 Ph 1: fill of pit in RH platform [BVA02 251 (F250)]	bulk: barley grain and rachis, cereal grain, dock	-25.7			2020 ±40	170 cal BC–cal AD 70
AA-40755	burnt material sealed under Encl. 2 RH wall [BVA00 079]	charcoal: *Corylus avellana*	-26.4			1910 ±45	cal AD 1–230
AA-40754	abandonment debris sealed by tumble of Encl. 2 RH wall over RH floor [BVA00 073]	charcoal: *Salix* sp.	-26.5			1770 ±40	cal AD 130–390
AA-40752	basal fill of pit cut through terminus of Encl. 1 ditch [BVA00 90 (F89)]	charcoal: Alder	-26.9			1845 ±40	cal AD 70–260
AA-54963	CS 3 Ph 1: stone wall of structure [BVA02 F155]	bulk: cereal seed, dock, hazelnut, charcoal	-25.3			2005 ±70	200 cal BC–cal AD 130
AA-54964	CS 3 Ph 2: inner facing wall [BVA02 160 (F147)]	bulk: wheat grain, charcoal	-24.4			2010 ±45	170 cal BC–cal AD 80
AA-54966	CS3 Ph 2: clay lining of pit [BVA02 225 (F216)]	bulk: charcoal, cereal grain, plantain	-26.4			2005 ±40	110 cal BC–cal AD 80
AA-44597	fill of pit within extrapolated circumference of Encl. 2 RH [BVA00 45 (F46)]	charcoal: *Salix/Corylus* sp.	-26.6			1860 ±45	cal AD 50–250
AA-44595	posthole fill from RH in Encl. 2 [BVA00 43 (F44)]	charcoal: *Corylus avellana*	-25.4			1755 ±45	cal AD 130–410
Fishers Road East							
OxA-7399	89: fill of ditch [3] episode 3	carbonized grain: barley; hulled	-24.4			2210 ±40	390–170 cal BC
OxA-7400	89: fill of ditch [3] episode 3	carbonized grain: barley; naked	-24.8			2110 ±40	350–40 cal BC
OxA-7401	103: fill of ditch [3] episode 3	bulk carbonized glume bases: spelt	-24.2			2235 ±35	400–200 cal BC
OxA-7402	103: fill of ditch [3] episode 3	bulk carbonized glume bases: emmer	-23.8			2230 ±35	400–190 cal BC
OxA-7518	101: fill of ditch [3] episode 3	carbonized grain: barley; hulled	-23.4			2030 ±50	180 cal BC–cal AD 80
OxA-7519	101: fill of ditch [3] episode 3	carbonized grain: barley; naked	-22.9			2075 ±50	350 cal BC–cal AD 50
OxA-7520	105: fill of ditch [3] episode 3	bulk carbonized glume bases: spelt	-25.6			2045 ±55	200 cal BC–cal AD 70

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
OxA-7521	105: fill of ditch [3] episode 3	bulk carbonized glume bases: spelt	-25.2			2075 ±55	350 cal BC–cal AD 60
OxA-7522	105: fill of ditch [3] episode 3	bulk carbonized glume bases: emmer	-24.9			2030 ±50	180 cal BC–cal AD 80
OxA-7523	67: a middle fill of ditch [65]	carbonized grain: barley; hulled	-23.2			1970 ±50	90 cal BC–cal AD 130
OxA-7524	67: a middle fill of ditch [65]	carbonized grain: barley; naked	-23.0			1910 ±65	50 cal BC–cal AD 250
OxA-7525	815: an upper fill of ditch [806]	bulk carbonized glume bases: spelt	-23.4			1955 ±50	50 cal BC–cal AD 140
OxA-7526	815: an upper fill of ditch [806]	bulk carbonized glume bases: emmer	-25.4			1955 ±50	50 cal BC–cal AD 140
OxA-7527	822: a middle fill of ditch [806]	bulk carbonized glume bases: spelt	-25.3			2055 ±55	210 cal BC–cal AD 70
OxA-7528	822: a middle fill of ditch [806]	bulk carbonized glume bases: emmer	-25.5			1945 ±55	50 cal BC–cal AD 220
OxA-7529	413: soil layer above stones [522/524]	carbonized grain: bread wheat	-23.3			1130 ±50	cal AD 770–1020
AA-25715	473: fill of CS4 outer gully [501]	carbonized grain: barley	-25.5			1960 ±45	50 cal BC–cal AD 130
AA-25716	683: the fill of post hole [685] (post structure [1190])	carbonized grain: barley; hulled	-23.6			1920 ±45	40 cal BC–cal AD 220
AA-25717	1018: the fill of post hole [700]	carbonized grain: barley	-24.9			1950 ±45	50 cal BC–cal AD 140
AA-25718	1010: the fill of CS1 entrance post	carbonized grain: barley	-23.1			1810 ±45	cal AD 80–340
AA-25719	111: a middle fill of ditch [35]	bulk carbonized glume bases: spelt	-24.1			1905 ±45	cal AD 1–230
AA-25720	111: a middle fill of ditch [35]	bulk carbonized glume bases: emmer	-25.8			1840 ±45	cal AD 60–320
AA-25721	368: secondary fill of ditch [367]	charcoal: *Calluna*	-25.4			2015 ±45	170 cal BC–cal AD 80
AA-25722	907: a middle fill of ditch [901]	carbonized seeds: *Potamogeton* sp.	-24.3			1845 ±55	cal AD 50–330
AA-25723	809: a middle fill of ditch [806]	carbonized grain: barley	-21.8			1825 ±50	cal AD 70–340
AA-25724	824: basal fill of ditch [806]	carbonized grain: barley	-23.6			23,680 ±230	
AA-25725	66: uppermost fill of ditch [65]	carbonized grain: barley; naked	-25.0			1215 ±45	cal AD 670–950

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AA-25726	66: uppermost fill of ditch [65]	carbonized grain: barley; hulled	-24.1			1785 ±55	cal AD 80–400
AA-25727	125: middle fill of ditch [12]	carbonized grain: barley	-23.2			1610 ±45	cal AD 340–560
AA-25728	476: fill of CS4 ring gully [500]	carbonized grain: barley	-24.2			1985 ±45	cal AD 90–130
AA-25729	149: lower fill of ditch [189]	carbonized grain: barley	-23.2			1875 ±60	cal AD 1–320
AA-25730	386: secondary fill of ditch [213]	carbonized seeds: *Ranunculus scel.*	-22.2			2590 ±45	830–590 cal BC
AA-25731	370: middle fill of ditch [369]	carbonized seeds: *Ranunculus scel.*	-25.8			1975 ±45	90 cal BC–cal AD 130
AA-25732	147: secondary fill of palisade [131]	carbonized grain: barley	-26.0			265 ±50	cal AD 1480–1950
AA-25733	747: fill of entrance post hole [743] of CS3	carbonized grain: barley	-24.9			1960 ±45	50 cal BC–cal AD 130
AA-25734	770: fill of CS3 ring gully [741]	charcoal: *Calluna*	-29.4			1895 ±45	cal AD 10–240
AA-25735	429: fill of post hole [428] in CS4 post ring [485]	carbonized grain: barley	-23.9			125 ±45	cal AD 1660–post1950
AA-25736	110: basal fill of ditch [65]	carbonized grain: barley	-23.2			2000 ±55	170 cal BC–cal AD 130
AA-25737	105: fill of ditch [3] episode 3	carbonized grain: barley	-23.5			1880 ±45	cal AD 20–240
AA-25738	168: fill of ditch [3] upper fill, terminal, episode 4	carbonized grain: barley	-24.3			1870 ±45	cal AD 30–250
AA-30363	386: secondary fill of ditch [213]	carbonized seeds: *Ranunculus scel.*	-25.6			2410 ±45	760–390 cal BC
Fishers Road West							
AA-19636	primary fill of SE terminal of Ph 3 ditch [3] (section 11)	carbonized grain: *Hordeum vulgare*	-23.5			2330 ±80	750–200 cal BC
AA-19641	primary fill from Ph 4 ditch (section 12)	bulk charcoal: *Salix* sp. and *Corylus avellana*	-33.9			2204 ±75	410–40 cal BC
AA-19635	latest fill of Ph 3 ditch [3] (section 6)	carbonized grain: *Hordeum vulgare*	-23.5			2135 ±55	370–40 cal BC
AA-19637	upper fill, NE terminal of Ph 3 ditch [3] (section 20)	carbonized grain: *Hordeum vulgare*	-23.2			2120 ±55	360–1 cal BC

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AA-19643	putative rampart with Ph 4 ditch sealing ditch [3] fills (section 20)	carbonized grain: *Hordeum vulgare*	-22.1			2110 ±80	390 cal BC–cal AD 60
AA-19639	western entrance of Ph 4 ditch (section 17)	carbonized grain: *Triticum aestivo-compactum*	-24.5			2110 ±70	380 cal BC–cal AD 50
AA-19638	primary fill NE terminal of Ph 3 ditch [3] (section 20)	carbonized grain: *Hordeum vulgare*	-23.4			2105 ±55	360 cal BC–cal AD 20
AA-19640	TPQ for wind blown sand deposit in Ph 4 ditch (section 13)	carbonized grain: *Hordeum vulgare*	-22.3			2035 ±80	350 cal BC–cal AD 130
AA-25713	base of Ph 4 ditch (section 13)	carbonized seeds: *Hyoscamus niger*	-26.4			1985 ±45	100 cal BC–cal AD 130
AA-19642	primary fill, N terminal of E entrance, Ph 4 ditch [4] (section 7)	carbonized grain: *Hordeum vulgare*	-22.7			1975 ±55	110 cal BC–cal AD 130
AA-26224	Pit 1019, adjacent to Structure 1	carbonized grain: *Hordeum vulgare*	-25.6			1905 ±55	40 cal BC–cal AD 240
AA-19644	unfinished terminal of Ph 3 ditch (section 11)	carbonized grain: *Hordeum vulgare*	-25.0			1900 ±55	40 cal BC–cal AD 240
AA-19646	Structure 7, stake hole	carbonized grain: *Hordeum* indeterminate	-23.9			1670 ±50	cal AD 240–540
AA-19645	pit in Structure 4 (roundhouse)	carbonized grain: indeterminate	-24.1			1130 ±50	cal AD 770–1020
AA-19647	Structure 7, ring gully	carbonized grain: indeterminate	-23.9			945 ±95	cal AD 890–1270
AA-19634	upper fill of Ph 2 ditch [3] (section 19)	carbonized grain: *Avena* sp.	-26.5			245 ±95	cal AD 1440–post1950
AA-19633	lower fill of Ph 2 ditch [3] (section 16)	carbonized grain: *Hordeum vulgare*	-26.2			215 ±70	cal AD 1490–post1950
AA-25714	isolated pit near W entrance, truncated and capped by topsoil	carbonized seed: *Vitis vinifera*	-22.3			modern	post1950
Ingram South							
OxA-20945	40; a fill in a large pit F39. The feature is located within the bounds of the Phase 3 rectilinear enclosure [BVA03 40B]	carbonized grain: cf. *Hordeum* sp.	-22.8			1872 ±28	cal AD 60–230
OxA-21849	143; the make-up of the clay-floor F19 and lies over 431 [BVA04 143D]	charcoal: *Alnus glutinosa*	-24.8			2024 ±25	100 cal BC–cal AD 50
OxA-20802	99; the upper fill of the inner ditch F96 and overlies 183 (middle fill) [BVA03 99B]	carbonized grain: *Hordeum* sp.; hulled	-23.4			1912 ±24	cal AD 25–135

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OxA-20803	431; the fill of pit F430 that is cut by Phase 3 enclosure and is overlain by F19 [143] [BVA04 431B]	carbonized grain: *Triticum* cf. *dicoccum*	-22.5			1928 ±27	cal AD 20–130
OxA-20816	143; the make-up of the clay-floor F19 and lies over 431 [BVA04 143B]	carbonized grain: *Triticum spelta/dicoccum*	-21.4			1942 ±29	cal AD 1–130
OxA-20817	183; the middle fill of the inner ditch F96. It is overlain by 99 (upper fill) and overlies 184 (primary fill) [BVA03 183B]	carbonized grain: *Hordeum* sp.	-23.5			1917 ±28	cal AD 20–140
SUERC-24270	431; the fill of pit F430 that is cut by Phase 3 enclosure and is overlain by F19 [143] [BVA04 431A]	carbonized grain: *Hordeum* sp.; hulled	-23.1			1870 ±30	cal AD 60–240
SUERC-24271	183; the middle fill of the inner ditch F96. It is overlain by 99 (upper fill) and overlies 184 (primary fill) [BVA03 183A]	carbonized grain: *Hordeum* sp.	-23.7			1860 ±30	cal AD 70–240
SUERC-24272	99; the upper fill of the inner ditch F96; overlies 183 (middle fill) [BVA03 99A]	carbonized grain: *Hordeum* sp.; hulled	-22.9			1835 ±30	cal AD 80–250
SUERC-24276	40; a fill in a large pit F39. The feature is located within the bounds of the Phase 3 rectilinear enclosure [BVA03 40A]	carbonized grain: *Hordeum* sp.; hulled	-22.2			1900 ±30	cal AD 20–210
SUERC-26469	143; the make-up of the clay-floor F19. It lies over 431 [BVA04 143C]	carbonized grain: *Hordeum* sp.	-20.1			1945 ±35	40 cal BC–cal AD 130
Beta-105609	inner ditch fill (late recut) [BIF96.1 52]	?bulk barley seed	---			1840 ±40	cal AD 70–320
SUERC-2404	fill of post hole F275 [BVA03 276]	bulk: 25 carbonized grains; barley	-22.9			1930 ±50	50 cal BC–cal AD 220
SUERC-2405	lower fill of inner ditch F96 [BVA03 184]	bulk: 25 carbonized grains; barley	-24.1			1875 ±40	cal AD 50–240
SUERC-2406	fill of post hole F258 [BVA03 258]	bulk: 2 barley, 1 wheat, and 2 indeterminate cereal	-22.4			310 ±35	cal AD 1460–1660
SUERC-2410	fill of gully F176 cut by inner ditch [BVA03 177]	charcoal: cf. Alder	-26.3			2305 ±40	410–230 cal BC
SUERC-2411	fill of post pipe F166 [BVA03 167]	charcoal: cf. Alder	-27.3			1920 ±35	cal AD 1–140
SUERC-2412	fill of post hole F27 [BVA03 26]	bulk: 20 carbonized grains; barley	-23.5			1905 ±35	cal AD 20–220
Beta-184070	F19, 301; southern edge under clay floor [BVA03 301 #2]	unknown	-24.5			2040 ±40	180 cal BC–cal AD 60
Beta-182413	northern edge of clay floor [BVA03 F19 #1]	nutshell	-24.6			1850 ±40	cal AD 60–250
SUERC-4494	primary silt of gully F592 [BVA04 543 <173>]	charcoal: oak; small roundwood (>15 years)	-26.9			2015 ±40	160 cal BC–cal AD 80

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SUERC-4495	early cobbled surface [BVA04 537 (118)]	bulk: charcoal, 2 wheat, 1 barley, and 2 indeterminate grains	-24.9			2825 ±40	1120–890 cal BC
SUERC-4496	fill of daub wall line [BVA04 520]	bulk: charcoal and 2 barley seeds	-25.6			1970 ±40	50 cal BC–cal AD 130
SUERC-4497	fill of gully under floor [BVA04 544 <129>]	bulk: charred seeds and small roundwood charcoal	-23.9			1975 ±35	50 cal BC–cal AD 120
SUERC-4501	fill of outer boundary gully F561 [BVA04 562 <121>]	bulk: charred seeds and twigs	-22.0			2000 ±35	90 cal BC–cal AD 80
SUERC-4502	charcoal deposit in butt end of ditch/recut (Area 2) [BVA04 721]	bulk charcoal: unidentified	-25.5			1885 ±40	cal AD 20–240
SUERC-4503	fill of ditch to second enclosure (Area 2) [BVA04 731]	bulk charcoal: unidentified	-27.5			1855 ±40	cal AD 60–250
Kilton Thorpe Lane							
SUERC-19213	secondary fill, ditch [4] [Pot 6A]	carbonized residue	-26.3			6235 ±30	5310–5070 cal BC
OxA-18758	replicate of SUERC-19213	carbonized residue	-24.1			2480 ±40	790–400 cal BC
OxA-18756	fill of ditch [31] near Structure 1 [Pot 31]	carbonized residue	-25.5			2154 ±29	360–100 cal BC
SUERC-18812	shallow depression near ditch [14] [Pot 15]	carbonized residue	-25.5			2015 ±30	100 cal BC–cal AD 60
SUERC-18813	(49) upper fill, ditch [4] [Pot 49A]	carbonized residue	-24.9			2015 ±30	100 cal BC–cal AD 60
OxA-18743	replicate of SUERC-18743	carbonized residue	-25.9			2092 ±27	200–40 cal BC
OxA-18744	replicate of SUERC-18743	carbonized residue	-25.6			2037 ±27	160 cal BC–cal AD 30
mean Pot 49	T'=4.0; v=2; T'(5%)=6.0					2050 ±17	110–1 cal BC
SUERC-18814	secondary fill, ditch [66] [Pot 66]	carbonized residue	-27.3			2010 ±30	90 cal BC–cal AD 70
SUERC-18815	single fill, ditch [75] nr Structures 2 & 5 [Pot 76 segment iv]	carbonized residue	-26.1			2005 ±30	90 cal BC–cal AD 70
OxA-18745	single fill, ditch [119], merges with western edge ditch [4] [Pot 122 segment vi (A)]	carbonized residue	-26.2			2044 ±26	170 cal BC–cal AD 30

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OxA-18759	primary fill, ditch [251] surrounding Structure 1 [Pot 256 segment vii]	carbonized residue	-26.4			2010 ±27	90 cal BC–cal AD 60
OxA-18760	replicate of OxA-18760	carbonized residue	-26.5			1985 ±26	50 cal BC–cal AD 80
mean Pot 256	T'=0.4; v=1; T'(5%)=3.8					1997 ±19	45 cal BC–cal AD 60
OxA-10653	primary fill, ditch [4] [12AA]	bulk carbonized grain: Cerealia	-22.8			1955 ±50	50 cal BC–cal AD 140
OxA-10655	(252), habitation level Structure 1 [252AB]	bulk carbonized grain: Cerealia	-24.4			1950 ±45	50 cal BC–cal AD 140
OxA-11186	(500) homogenous fill of post holes, removed from main site [500]	bulk carbonized grain: Cerealia	-21.9			1788 ±35	cal AD 130–340
OxA-10518	(250) secondary fill, ring gully [251], Structure 1 [250AA]	bulk charcoal: unidentified; roundwood	-26.0			2230 ±55	400–160 cal BC
OxA-10654	(76) single fill, ditch [75] [76AA]	bulk charcoal: unidentified; roundwood	-26.1			1955 ±45	50 cal BC–cal AD 130
Knowes Farm							
SUERC-10565	trilobate pit complex outside enclosure to N [TKN03 7]	carbonized grain: wheat	-22.8			1960 ±35	50 cal BC–cal AD 130
SUERC-10566	silt accumulating in W scoop F128 [TKN04 124]	carbonized hazel nutshell	-25.0			1915 ±35	cal AD 10–140
SUERC-10567	W ditch F103; higher fill of 2nd recut F243 [TKN04 132]	carbonized grain: wheat	-22.8			1990 ±35	60 cal BC–cal AD 80
SUERC-10568	isolated W scoop F129, fill of base of scoop [TKN04 135]	carbonized grain: barley	-21.0			2000 ±35	90 cal BC–cal AD 80
SUERC-10569	W ditch F103; primary fill of 2nd recut F243 [TKN04 146]	carbonized grain: wheat	-22.6			2055 ±35	180 cal BC–cal AD 30
SUERC-10570	W scoop F232; behind revetment wall [TKN04 147]	carbonized grain: barley	-22.4			1925 ±35	cal AD 1–140
SUERC-10571	Cist; upper fill [TKN04 149]	cremated human bone	-17.9			2405 ±35	750–390 cal BC
SUERC-10575	W ditch F103; primary fill of 1st recut F142 [TKN04 162A]	carbonized grain: barley	-23.7			2050 ±35	180 cal BC–cal AD 50
SUERC-10576	W ditch F103; primary fill of 1st recut F142 [TKN04 162B]	carbonized grain: wheat	-23.1			2060 ±35	180 cal BC–cal AD 30
SUERC-10577	Cist; middle fill [TKN04 163A]	carbonized grain: barley	-22.1			1965 ±35	50 cal BC–cal AD 130

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SUERC-10578	Cist; middle fill [TKN04 163B]	charcoal: birch	-25.9			1825 ±35	cal AD 80–320
SUERC-10579	Cist; lower fill [TKN04 187]	cremated human bone	-21.8			2305 ±35	410–250 cal BC
SUERC-10580	W ditch F103; primary fill of 1st recut F142 [TKN04 189]	carbonized grain: wheat	-22.6			2045 ±35	170 cal BC–cal AD 50
SUERC-10581	W scoop F128; presumably blew in [TKN04 197]	carbonized grain: barley	-24.8			1.3140 ±0.0055	post1950
SUERC-10585	W scoop F284; matrix of revetment [TKN04 229]	carbonized grain: barley	-22.6			1960 ±35	50 cal BC–cal AD 130
SUERC-10586	W scoop F128; fill of oven [TKN04 261]	carbonized grain: barley	-23.5			1915 ±35	cal AD 10–140
SUERC-10587	NE ditch term; lowest fill of recut F405 [TKN04 271A]	carbonized grain: barley	-22.8			2095 ±35	210–1 cal BC
SUERC-10588	NE ditch term; lowest fill of recut F405 [TKN04 271B]	wood: hazel; waterlogged	-27.1			2110 ±35	350–40 cal BC
SUERC-10589	NE ditch term; sand over 271 [TKN04 272A]	carbonized grain: barley	-23.0			2100 ±35	340–40 cal BC
SUERC-10590	NE ditch term, sand over 271 [TKN04 272B]	carbonized grain: barley	-23.8			2185 ±35	380–120 cal BC
SUERC-10591	W scoop F273, sand below stone paving [TKN04 296]	carbonized grain: barley	-23.0			2090 ±35	210–1 cal BC
SUERC-10595	E scoop F404; levelling above 2nd cobbles F329 [TKN04 330]	carbonized grain: barley	-24.1			2090 ±35	210–1 cal BC
SUERC-10596	E scoop F404; bedding of 4th cobbles F130 [TKN04 331]	carbonized grain: barley	-22.3			2075 ±35	200 cal BC–cal AD 10
SUERC-10597	W scoop F128; gully at start of sequence F378 [TKN04 364a]	carbonized grain: barley	-21.3			1935 ±35	20 cal BC–cal AD 130
SUERC-10598	W scoop F128; gully at start of sequence F378 [TKN04 364b]	charcoal: onion couch	-27.2			2860 ±35	1130–920 cal BC
Pegswood Moor							
Beta-230302	fill 1108 of pit 1111 in Structure 4	carbonized residue	-24.7			2200 ±40	390–160 cal BC
OxA-22853	primary fill 173 of ditch 174 in Enclosure 10	carbonized grain: cf. *Hordeum* sp.	-22.1			1947 ±23	cal AD 1–125
OxA-22892	fill 546 of pit 547 in Structure 12	charcoal: *Corylus avellana*; roundwood	-25.3			2010 ±26	90 cal BC–cal AD 60

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OxA-22353	fill 546 of pit 547 in Structure 12	charcoal: *Acer campestre*	-24.0			1964 ±24	40 cal BC–cal AD 85
OxA-22894	fill 1011 of gully 1012 surrounding features 8–15	charcoal: Rowan type	-25.6			2065 ±27	180 cal BC–cal AD 10
Beta-230299	fill 582 in ditch 614 (backfill of Phase 4 ditch)	carbonized residue	-26.5			2140 ±40	360–50 cal BC
OxA-22833	fill 1060 of a posthole in ditch 1205 of Enclosure 2	carbonized residue	-23.4			1956 ±24	20 cal BC–cal AD 120
OxA-22396	fill 1224 of hearth 1225 in Structure 5	charcoal: *Sorbus* sp.; twig	-26.5			1983 ±24	45 cal BC–cal AD 75
OxA-22895	fill 1224 of hearth 1225 in Structure 5	charcoal: *Corylus avellana;* roundwood	-27.4			1961 ±26	40 cal BC–cal AD 90
OxA-22893	fill 900 in ditch 923 of the Droveway	charcoal: *Prunus* sp.; roundwood	-25.7			209 ±24	cal AD 1645–1950
Beta-230298	fill 482 in ditch 182 of Enclosure 7	carbonized residue	-27.5			2100 ±40	350–1 cal BC
Beta-230301	fill 680 in ditch 681 of Enclosure 7	carbonized residue	-26.6			2210 ±40	390–170 cal BC
OxA-22783	fill 723 in ditch 724 of Enclosure 7	charcoal: *Corylus avellana;* roundwood	-27.0			2010 ±28	90 cal BC–cal AD 60
AA-43432	upper fill 1151 in ditch 182 of Enclosure 7 [sample 66]	charcoal: *Betulaceae* (*cf. Corylus*)	-27.6			1960 ±50	60 cal BC–cal AD 140
OxA-22852	fill 134 in hearth 135	charcoal: *Sorbus* sp.	-28.2			5049 ±29	3960–3770 cal BC
OxA-22782	fill 657 in hearth 658	carbonized residue	-26.7			4084 ±32	2860–2490 cal BC
Beta-230300	fill 659 in hearth 660	carbonized residue	-26.3			2370 ±40	710–380 cal BC
OxA-22781	fill 612 in ditch 613 of Enclosure 9	carbonized residue	-25.8			8905 ±50	8250–7830 cal BC
OxA-22891	fill 331 in ditch 334 east of Enclosure 11	charcoal: *Acer campestre*; roundwood	-25.1			249 ±24	cal AD 1640–1800
SUERC-28601	fill 659 in hearth 660	carbonized grain: cf. *Hordeum* sp.	-22.3			1965 ±30	50 cal BC–cal AD 120
SUERC-26800	fill 900 in ditch 923 of the Droveway	charcoal: *Rhamnus cathartica* (purging buckthorn)	-25.9			270 ±30	cal AD 1520–1950
SUERC-26805	fill 331 in ditch 334 east of Enclosure 11	charcoal: *Rhamnus cathartica* (purging buckthorn)	-25.1			235 ±30	cal AD 1640–1950

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Phantassie Farm							
SUERC-5620	silty clay spread (388): under structure [8] paving (067)	carbonized grain: *Hordeum vulgare* var. *vulgare*	-26.4			2100 ±40	350–1 cal BC
SUERC-5518	lower fill (308) of scooped hollow (132)	charcoal: *Betula* sp.	-25.7			2070 ±35	200 cal BC–cal AD 10
SUERC-5490	structure [1]: fill of cut (477)	charcoal: *Corylus avellana*	-26.4			2015 ±35	110 cal BC–cal AD 70
SUERC-5638	structure [1]: occupation deposit	charcoal: *Alnus* sp.	-26.1			1965 ±40	50 cal BC–cal AD 130
SUERC-5636	structure [1]: east fill (438) of 'yard' ditch (399)/(439) ?ditch (436)	carbonized grain: *Hordeum vulgare* var. *vulgare*	-23.3			2075 ±40	200 cal BC–cal AD 20
SUERC-5637	structure [1]: west fill (150) of 'yard' ditch (399)/(439)	charcoal: *Corylus avellana*	-28.4			1930 ±35	cal AD 1–140
SUERC-5634	structure [1]: hard standing, clay silt layer (431); old ground surface	carbonized grain: *Hordeum vulgare* sl.	-21.2			2015 ±40	160 cal BC–cal AD 80
SUERC-5627	structure [1]: hard standing, silt layer (326)	charcoal: *Betula* sp.	-26.1			1920 ±35	cal AD 1–140
SUERC-5502	structure [2]: scorched deposit (110)	carbonized grain: *Hordeum vulgare* sl.	-23.0			2010 ±35	100 cal BC–cal AD 70
SUERC-5501	structure [2]: post-pipe (163) in post-pit (111)	charcoal: *Betula* sp.	-26.2			2025 ±35	160 cal BC–cal AD 60
SUERC-5629	structure [2]: fill of post-hole (426), below structure [14]	charcoal: *Betula* sp.	-26.4			2010 ±40	160 cal BC–cal AD 80
SUERC-8196	structure [3]: deposit (061) beneath wall	charcoal: *Corylus avellana*	-26.8			1995 ±40	100 cal BC–cal AD 80
SUERC-5531	structure [5]: fill (267) of post-pit (268)	carbonized grain: *Hordeum vulgare* sl.	-22.0			2000 ±35	90 cal BC–cal AD 80
SUERC-5530	structure [5]: fill (256) of pit (257)	charcoal: *Corylus avellana*	-27.3			2050 ±40	180 cal BC–cal AD 50
SUERC-5506	cell [6]: deposit (234) – TPQ for rebuilding wall	charcoal: *Corylus avellana*	-25.3			2050 ±35	180 cal BC–cal AD 50
SUERC-5529	cell [7]: upper fill (335) beneath paving of large scoop (368)	charcoal: Prunoideae	-26.4			1950 ±35	40 cal BC–cal AD 130

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SUERC-5639	house [9]: (189) sealed beneath wall (056)	charcoal: Prunoideae	-25.4			1930 ±35	cal AD 1–140
SUERC-5488	house [9]: fill (057) of large post-hole (158)	carbonized hazel nutshell	-24.3			1980 ±30	50 cal BC–cal AD 80
SUERC-5508	midden (120) seals structure [1]	charcoal: *Betula* sp.	-26.0			2005 ±35	100 cal BC–cal AD 80
SUERC-5616	midden (120) seals structure [1]	charcoal: *Alnus glutinosa*	-27.1			1965 ±40	50 cal BC–cal AD 130
SUERC-5618	midden (020) south of structure [1]	charcoal: *Corylus avellana*	-26.8			1960 ±40	50 cal BC–cal AD 130
SUERC-5497	midden (128) west of structure [1]	carbonized grain: *Hordeum vulgare* var. *vulgare*	-22.4			1940 ±35	40 cal BC–cal AD 130
SUERC-5522	midden (170) below floor (093) east of structure [1]	charcoal: *Corylus avellana*	-28.4			1965 ±35	50 cal BC–cal AD 130
SUERC-7345	structure [13]: fill of post-hole (366)	charcoal: *Betula* sp.	-26.8			2480 ±40	790–400 cal BC
SUERC-5520	structure [9]: lower fill (197) of hearth pit (331)	charcoal: *Corylus avellana*	-25.0			1895 ±35	cal AD 20–230
SUERC-5510	structure [9]: ashes (049) of later fire	charcoal: *Salix* sp.	-26.9			2060 ±40	200 cal BC–cal AD 30
SUERC-5496	structure [7]: occupation deposit (055)	carbonized grain: *Hordeum vulgare* var. *vulgare*	-22.3			1915 ±35	cal AD 10-140
SUERC-5486	structure [8]: rake-out dump (070) on paving (067)	carbonized grain: *Hordeum vulgare* var. *vulgare*	-23.6			1960 ±35	50 cal BC–cal AD 130
SUERC-5645	structure [8]: matrix (069) of south wall - deposit between stones (068) that make up rubble track	carbonized grain: *Hordeum vulgare* var. *vulgare*	-21.9			1935 ±35	20 cal BC–cal AD 130
SUERC-5492	structure [8]: floor deposit (066)	carbonized grain: *Hordeum vulgare* var. *vulgare*	-23.4			1935 ±35	20 cal BC–cal AD 130
SUERC-5500	structure [14]: spread (024)	carbonized grain: *Hordeum vulgare* sl.	-22.6			1985 ±35	50 cal BC–cal AD 90
SUERC-5498	midden store (structure [15]): upper deposit (224)	charcoal: *Corylus avellana*	-26.0			2110 ±35	350–40 cal BC
SUERC-5528	midden store (structure [15]): lower deposit (245)	charcoal: Maloideae	-25.0			2025 ±35	160–50 cal BC
SUERC-5499	midden store (structure [15]): upper deposit (224)	charcoal: *Prunus spinosa*	-23.2			1895 ±35	cal AD 20–230
SUERC-5700	midden store (structure [15]): lower deposit (245)	carbonized grain: *Hordeum vulgare* sl.	-23.3			1910 ±35	cal AD 20–210

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SUERC-5507	midden store (structure [15]): matrix (235) of burnt wall (arc of stones (246))	charcoal: *Corylus avellana*	-29.5			1905 ±35	cal AD 20–220
SUERC-5512	structure [16]: deposit (239) sealed by wall (205)	charcoal: *Corylus avellana*	-25.5			1980 ±35	50 cal BC–cal AD 90
SUERC-5511	structure [9]: rake-out deposit (49)	carbonized grain: *Triticum* sp.	-23.3			1865 ±35	cal AD 60–240
SUERC-9040	structure [11]: scorched dump (013) next to wall (100) of structure [11] and post-dates when [11] fell down	cremated human bone	-20.7			2150 ±40	360–50 cal BC
SUERC-5614	structure [10]: deposit (033) built-up against wall (035) and post-dates building use	carbonized grain: *Hordeum vulgare* var. *vulgare*	-24.4			1805 ±40	cal AD 90–340
SUERC-5487	lower fill of post-hole (108)	carbonized grain: *Hordeum vulgare* sl	-23.1			1965 ±35	50 cal BC–cal AD 130
SUERC-5509	fill of post-hole (177), sealed by later floor deposit (092) in structure [11]	charcoal: *Corylus avellana*	-28.8			1935 ±35	20 cal BC–cal AD 130
SUERC-5516	structure [10]: occupation deposit (006)	charcoal: *Corylus avellana*	-26.3			1930 ±35	cal AD 1–140
SUERC-5626	fill of post-hole (413)	carbonized grain: *Hordeum vulgare* sl.	-25.4			1920 ±40	cal AD 1–210
SUERC-5527	fill of post-hole (349)	carbonized grain: *Hordeum vulgare* sl.	-23.1			1920 ±35	cal AD 1–140
SUERC-5526	ground surface (171) sealed by floor deposit (093) of structure [11]	carbonized grain: *Hordeum vulgare* sl.	-23.4			1920 ±35	cal AD 1–140
SUERC-5628	fill (409) of ditch (439)	charcoal: *Corylus avellana*	-26.9			1915 ±35	cal AD 10–140
SUERC-5635	structure [1]: occupation deposit (435)	charcoal: *Corylus avellana*	-25.5			1910 ±40	cal AD 1–220
SUERC-5625	structure [1]: occupation deposit (361)	charcoal: *Salix* sp.	-25.2			1715 ±40	cal AD 230–420
SUERC-5519	structure [1]: fill (173) of wall cut (366)	carbonized grain: *Hordeum vulgare* sl.	-26.1			1860 ±35	cal AD 60–240
SUERC-5640	ground surface beneath structure [9]	carbonized grain: *Hordeum vulgare* sl.	-23.3			1860 ±40	cal AD 60–250
SUERC-5617	midden deposit (016) under structure [10]	charcoal: *Corylus avellana*	-25.9			1865 ±35	cal AD 60–240
SUERC-5521	midden deposit (020) south of structure [1]	charcoal: *Corylus avellana*	-26.4			1895 ±35	cal AD 20–230
SUERC-5644	occupation deposit (466) under structure [1]	carbonized grain: *Hordeum vulgare* var. *vulgare*	-22.3			1895 ±40	cal AD 20–230

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SUERC-5517	midden store (structure [15]): upper fill (242)	charcoal: *Prunus spinosa*	-26.5			1900 ±40	cal AD 20–230
SUERC-5630	upper fill of hollow (132)	charcoal: *Betula* sp.	-24.3			2070 ±40	200 cal BC–cal AD 30
SUERC-5491	post-abandonment deposit (223) over structure [6]	charcoal: *Corylus avellana*	-27.1			3610 ±40	2130–1880 cal BC
SUERC-5624	fill (305) of pit (368)	charcoal: *Corylus avellana*	-24.2			4790 ±40	3660–3380 cal BC
SUERC-5489	structure [14]: fill (042) of post-hole 121	charcoal: *Betula* sp.	-25.5			5230 ±40	4230–3960 cal BC
Standingstone							
SUERC-10528	fill [8] of post-hole F7 cut into outer (1st) palisade [TST03 8]	carbonized grain: hulled barley	-23.5			2735 ±35	980–810 cal BC
SUERC-10529	upper fill [10] of Palisade F13 [TST03 10]	carbonized grain: hulled barley	-27.0			1.2383 ±0.0052	post1950
SUERC-10530	fill [12] of post-hole F11, inner stretch, in Palisade F13 [TST03 12]	carbonized grain: *Triticum* sp.	-22.9			2770 ±35	1010–830 cal BC
SUERC-10531	upper fill [14] of Palisade F13 [TST03 14]	charcoal: birch	-25.5			2780 ±35	1020–830 cal BC
SUERC-10535	fill [21] of Pit F56, contains much burnt stone and charcoal [TST03 21a]	carbonized grain: naked barley	-25.4			4120 ±35	2880–2570 cal BC
SUERC-10536	fill [21] of Pit F56, contains much burnt stone and charcoal [TST03 21b]	carbonized grain: hulled barley	-24.8			4085 ±35	2860–2490 cal BC
SUERC-10537	grain cache [46] in circular pit F45, foundation deposit? [TST03 46b]	carbonized grain: emmer type	-21.6			2770 ±35	1010–830 cal BC
SUERC-10538	third fill [49] from top of NW ditch terminal F3 [TST03 49]	animal bone: cattle tooth; charred	-20.0*			2900 ±75	1380–900 cal BC
SUERC-10539	fill [60] of post-hole F61 (structure next to palisade) [TST03 60]	carbonized hazel nutshell	-26.4			2790 ±35	1020–840 cal BC
SUERC-10540	fill [82] with charcoal over cobbled surface of sunken floor feature F79 [TST03 82]	charcoal: birch	-24.9			2215 ±35	390–180 cal BC
SUERC-10541	fill [94] of section of Gully F106 [TST03 94]	charcoal: hazel	-27.8			2270 ±35	400–200 cal BC
SUERC-10545	upper fill [104] Palisade F103 [TST03 104]	carbonized hazel nutshell	-23.6			2215 ±35	390–180 cal BC
SUERC-10546	fill [110] of second cut of CS2 gully (F360) [TST03 110]	charcoal: hazel	-25.5			2170 ±35	370–110 cal BC

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SUERC-10547	fill [130] in central hollow/sunken floor feature F451 [TST03 130]	carbonized grain: emmer type	-23.0			2145 ±35	360–50 cal BC
SUERC-10548	fill [132] of post-hole F131, just inside 2nd palisade, pair to F125? [TST03 132]	charcoal: birch	-25.6			2815 ±35	1060–890 cal BC
SUERC-10549	fill [140] of post-hole/elongated pit F139 [TST03 140]	carbonized grain: hulled barley	-26.5			1.4418 ±0.0061	post1950
SUERC-10550	fill [146] of shallow post-hole F145 [TST03 146]	carbonized grain: hulled barley	-26.2			1.4420 ±0.0057	post1950
SUERC-10551	fill [197] of post-hole F196, outside enclosure, pair to F200 [TST03 197]	charcoal: hazel	-25.6			2850 ±35	1130–910 cal BC
SUERC-10555	fill [228] of pit F227, cut by enclosure ditch [TST03 228]	charcoal: birch	-25.3			2985 ±35	1380–1110 cal BC
SUERC-10556	fill [231] of pit F230; at end of palisade [TST03 231]	charcoal: hazel	-25.2			2780 ±35	1020–830 cal BC
SUERC-10557	upper fill [253] of enclosure ditch F252 [TST03 253]	carbonized hazel nutshell	-22.3			2555 ±35	810–550 cal BC
SUERC-10558	fill [298] of sunken floor feature F297 [TST03 298a]	carbonized grain: emmer type	-24.4			2165 ±35	370–100 cal BC
SUERC-10559	fill [329] of post-hole F328 at the end of Gully F106 [TST03 329]	charcoal: birch	-24.9			2225 ±35	400–190 cal BC
SUERC-10560	lower fill [345] of first cut of CS2 gully (F359) [TST03 345]	carbonized hazel nutshell	-24.5			3815 ±35	2440–2140 cal BC
SUERC-10561	fill [462] of second cut of CS2 gully (F360) [TST03 462]	carbonized hazel nutshell	-23.6			2835 ±35	1120–900 cal BC
SUERC-11893	fill [233] of cinerary urn (SMF35) F232 [TST03 233b]	cremated human bone	-24.4			3300 ±35	1690–1490 cal BC
Stanwick							
SUERC-24037	Inhumation 1 cutting rear of Rampart [Inhumation 1 (a)]	human bone: femur	-20.8	10.2	3.4	2010 ±35	100 cal BC–cal AD 70
OxA-20776	replicate of SUERC-24037	human bone: femur	-20.4	10.1	3.3	2051 ±25	170 cal BC–cal AD 10
mean Inhumation 1	T'=0.9; ν=1; T'(5%)=3.8					2037 ±21	105 cal BC–cal AD 20
SUERC-24038	Inhumation 2a inside rampart and cutting (10) [Inhumation 2a]	human bone: left femur	-20.5	9.4	3.5	2040 ±35	170 cal BC–cal AD 60
SUERC-24039	Inhumation 3 cut into back of Rampart [Inhumation 3 (a)]	human bone: humerus	-21.0	9.7	3.8	1925 ±35	cal AD 1–140

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OxA-20777	replicate of SUERC-24039	human bone: humerus	-20.5	9.9	3.3	2030 ±25	110 cal BC–cal AD 50
SUERC-24040	Inhumation 4 cutting Encl 1 ditch [Inhumation 4 (a)]	human bone: unidentified	-20.8	10.1	3.4	2075 ±35	200 cal BC–cal AD 10
OxA-20778	replicate of SUERC-24040	human bone: unidentified	-20.8	10.3	3.3	2075 ±27	180–1 cal BC
mean Inhumation 4	T'=0.0; ν=1; T'(5%)=3.8					2075 ±22	175–40 cal BC
SUERC-24041	Inhumation 5 cutting Encl 3 ditch [Inhumation 5 (a)]	human bone: right femur	-20.7	10.3	3.4	2060 ±35	180 cal BC–cal AD 30
OxA-20779	replicate of SUERC-24041	human bone: right femur	-20.3	10.3	3.2	2051 ±27	170 cal BC–cal AD 20
mean Inhumation 5	T'=0.0; ν=1; T'(5%)=3.8					2054 ±22	165 cal BC–cal AD 5
OxA-20783	dump of charcoally material within rampart and above Ditch 1 [016]	animal bone: sheep/goat vertebra; articulating	-21.8			1995 ±25	50 cal BC–cal AD 70
SUERC-24049	horse skull placed inverted over capstones over Inhumation 1 [49]	animal bone: horse skull	-21.9			2000 ±35	90 cal BC–cal AD 80
OxA-20780	pre-rampart occupation layer [215 (a)]	animal bone: pig; articulating	-21.9			2057 ±27	170 cal BC–cal AD 10
SUERC-24048	pre-rampart occupation layer [215 (b)]	animal bone: sheep/goat calcaneum; articulating	-22.2			2050 ±35	180 cal BC–cal AD 50
GrN-15666	extensive spread of midden beneath 1007 [1005] [Stanwick 3]	bulk charcoal: unidentified	-26.0			1990 ±20	45 cal BC–cal AD 65
GrN-15667	fill of "hearth" 1006 [1013] [Stanwick 4]	bulk charcoal: unidentified	-27.1			1995 ±35	90 cal BC–cal AD 80
SUERC-24052	spread of burnt material above LS1 pit [2174] [1022 (a)]	charcoal: *Alnus glutinosa*	-26.5			1925 ±35	cal AD 1–140
OxA-20789	spread of burnt material above LS1 pit [2174] [1022 (b)]	charcoal: *Quercus* sp.; roundwood	-24.9			1936 ±26	cal AD 1–130
SUERC-24053	fill of post pipe [1069] in LS2 post pit [2218] [1067 (a)]	charcoal: *Alnus glutinosa*	-26.7			1910 ±35	cal AD 20–210
OxA-20790	fill of post pipe [1069] in LS2 post pit [2218] [1067 (b)]	carbonized grain: *Hordeum* sp.	-22.0			1898 ±26	cal AD 50–210
OxA-3379	part of early midden south of gully [1100] [1085] [SW91 (03)]	bulk carbonized glume bases: *Triticum spelta*	-26.0			2090 ±70	360 cal BC–cal AD 60

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SUERC-24050	undifferentiated fills of pits [1113], [1114], & [1119] [1090]	charcoal: *Corylus avellana*; roundwood	-24.9			2005 ±35	100 cal BC–cal AD 80
GrN-15665	a fill of LS2 post pit [1117=2104] [1095] [Stanwick 2]	bulk charcoal: unidentified	-25.9			1990 ±35	60 cal BC–cal AD 80
SUERC-24042	layer above Encl 2 ditch fills and below SS1 wall [2007 (a)]	animal bone: cattle vertebra; articulating	-22.2			2010 ±35	100 cal BC–cal AD 70
OxA-20785	layer above Encl 2 ditch fills and below SS1 wall [2007 (b)]	carbonized residue	-26.4			1991 ±26	50 cal BC–cal AD 70
OxA-3381	upper fill of Encl 2 ditch [2072] [2045] [SW91 (05)]	bulk carbonized glume bases: *Triticum spelta*	-23.1			2140 ±65	390–1 cal BC
SUERC-26467	fill of LS1 post pit [2174] [2124 (a)]	charcoal: *Alnus glutinosa*	-25.8			2005 ±35	100 cal BC–cal AD 80
OxA-21847	fill of LS1 post pit [2174] [2124 (b)]	carbonized grain: *Hordeum* sp.	-23.1			2012 ±24	55 cal BC–cal AD 55
SUERC-24057	bottom fill of post pipe 2174, LS 1 [2126 (a)]	carbonized grain: *Hordeum* sp.	-23.5			2015 ±35	110 cal BC–cal AD 70
OxA-20791	bottom fill of post pipe 2174, LS 1 [2126 (b)]	charcoal: *Alnus glutinosa*	-27.3			1976 ±26	50 cal BC–cal AD 80
SUERC-24051	bottom fill post pipe [2152] = [1106]. In LS2 [2150 (a)]	charred bark	-26.9			1995 ±35	90 cal BC–cal AD 80
OxA-21388	bottom fill post pipe [2152] = [1106]. In LS2 [2150 (b)]	charred bark	-26.1			1997 ±28	50 cal BC–cal AD 70
OxA-3380	layer/spread SW corner, SW Quad [2167] [SW91 (04)]	bulk carbonized glume bases: *Triticum spelta*	-24.1			2050 ±65	350 cal BC–cal AD 80
OxA-21848	fill of post pipe [2199], in pit [2185/3201] [2179]	charcoal: *Alnus glutinosa*	-26.0			2043 ±25	160 cal BC–cal AD 30
OxA-20792	base of Hearth 3 [2195 (a)]	charcoal: *Corylus avellana*	-26.4			1977 ±27	50 cal BC–cal AD 80
SUERC-24058	base of Hearth 3 [2195 (b)]	charcoal: cf. Maloideae	-23.3			1985 ±35	50 cal BC–cal AD 90
GrN-15664	bottom fill of LS2 post pit [2191] [2209] [Stanwick 1]	bulk charcoal: unidentified	-25.6			2320 ±35	410–360 cal BC
OxA-20794	3/4 soil horizon [3010 (a)]	carbonized grain: *Hordeum* sp.	-22.2			2033 ±27	110 cal BC–cal AD 50
SUERC-24033	3/4 soil horizon [3010 (b)]	carbonized residue	-24.7			1995 ±35	90 cal BC–cal AD 80
SUERC-24043	soil matrix of SS 1 wall (3003) [3022]	animal bone: cattle tarsal; articulating	-22.2			1920 ±35	cal AD 1–140
OxA-21389	fill of cut [3037] [3036 (a)]	charcoal: *Alnus glutinosa*	-26.5			1975 ±28	50 cal BC–cal AD 80

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SUERC-26417	fill of cut [3037] [3036 (b)]	charcoal: *Betula* sp.	-24.7			2055 ±35	180 cal BC–cal AD 30
SUERC-24061	lower fill of post pipe [3071] in LS1 pit [3143] [3144 (a)]	charcoal: *Alnus/Corylus*	-28.8			1920 ±35	cal AD 1–140
SUERC-26468	lower fill of post pipe [3071] in LS1 pit [3143] [3144 (b)]	carbonized grain: indeterminate	-22.7			2025 ±35	160 cal BC–cal AD 60
OxA-3378	fill of Enc 1a/2 ditch [3184] [3183 (a)] [SW91 (02)]	bulk carbonized glume bases: *Triticum spelta*	-26.4			2080 ±65	360 cal BC–cal AD 60
OxA-3377	replicate of OxA-3378	bulk carbonized glume bases: *Triticum spelta*	-24.6			2060 ±65	350 cal BC–cal AD 80
mean 3183	T'=0.0, ν=1; T'(5%)=3.8					2070 ±46	210 cal BC–cal AD 50
SUERC-24047	fill of Enc 1a/2 ditch [3184] [3183]	animal bone: cattle ulna; articulating	-21.9			1965 ±35	50 cal BC–cal AD 130
OxA-20782	stony spread above wall 3512 [3507]	animal bone: sheep/goat femur; articulating	-20.5			1985 ±25	50 cal BC–cal AD 80
OxA-20781	stone spread around (4010) [4009]	animal bone: cattle vertebra; articulating	-21.2			1988 ±25	50 cal BC–cal AD 80
SUERC-26418	upper fill of Enc 3 W ditch [4074] [4111]	carbonized grain: *Triticum* sp.	-25.6			2065 ±35	190 cal BC–cal AD 20
OxA-20793	a lower fill of Enc 2 main ditch [3545]/[4170] [4168 (a)]	charcoal: *Alnus glutinosa*	-25.4			2072 ±27	180–1 cal BC
SUERC-24059	a lower fill of Enc 2 main ditch [3545]/[4170] [4168 (b)]	charcoal: *Corylus avellana*; roundwood	-25.1			2050 ±35	180 cal BC–cal AD 50
OxA-20557	fill of Palisade [5034] [5017 (a)]	carbonized grain: *Hordeum* sp.	-23.5			2030 ±28	110 cal BC–cal AD 50
SUERC-24060	fill of Palisade [5034] [5017 (b)]	charcoal: Maloideae	-25.9			1970 ±35	50 cal BC–cal AD 130
OxA-20784	a fill of linear gully B [5155]. Cuts CS 5 & 6 [5154]	animal bone: cattle calcaneum; articulating	-21.9			1954 ±27	40 cal BC–cal AD 130
OxA-3382	fill of CS2 ring gully [5141] [5136] [SW91 (06)]	?bulk carbonized grain: *Hordeum vulgare*	-22.1			1720 ±60	cal AD 130–430
OxA-20788	fill of posthole 5339, CS 6 [5338]	carbonized grain: *Avena* sp.	-21.4			2012 ±26	90 cal BC–cal AD 60
OxA-20787	fill of post pipe [5575] in PS4 post pit [5331] [5357]	charcoal: Maloideae	-25.4			2060 ±26	170 cal BC–cal AD 10
OxA-20786	primary fill of PS3 post pit [5211] [5364]	charcoal: *Salix/Populus* sp.	-28.0			2057 ±26	170 cal BC–cal AD 10

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Street House Farm							
OxA-18727	fill (312) of hearth [32]; Roundhouse 6 [SHF 05,06,07 Context 312A]	carbonized grain: *Triticum* sp.	-21.9			1933 ±25	cal AD 10–130
SUERC-18790	fill (312) of hearth [32]; Roundhouse 6 [SHF 05,06,07 Context 312B]	carbonized grain: *Triticum* sp.	-22.1			1960 ±30	40 cal BC–cal AD 130
OxA-18728	fill (389) of hearth [397]; Roundhouse 6 [SHF 05,06,07 Context 389A]	carbonized grain: *Triticum* sp.	-22.4			1885 ±26	cal AD 60–220
SUERC-18791	fill (389) of hearth [397]; Roundhouse 6 [SHF 05,06,07 Context 389B]	carbonized grain: *Triticum* sp.	-24.4			1890 ±30	cal AD 50–220
OxA-18729	linear gully (234) [SHF04 S1]	carbonized residue	-25.9			1980 ±25	50 cal BC–cal AD 80
SUERC-18792	entrance posthole; Roundhouse 2 [SHF04 S2A]	carbonized residue	-25.0			2050 ±30	170 cal BC–cal AD 30
OxA-18730	fill (239) of ringditch of Roundhouse 5 [SHF04 S3]	carbonized residue	-26.7			1952 ±26	20 cal BC–cal AD 130
SUERC-18793	Anglo-Saxon grave [234] [SHF04 S4A]	carbonized residue	-25.9			1985 ±30	50 cal BC–cal AD 80
OxA-18731	fill (317) in *Grubenhaus* [344] [SHF04 S5A]	carbonized residue	-26.6			1888 ±26	cal AD 60–220
SUERC-18794	linear boundary [321] [SHF04 S6]	carbonized residue	-25.8			2035 ±30	160 cal BC–cal AD 50
OxA-18732	linear boundary [375] [SHF04 S7]	carbonized residue	-27.0			2048 ±27	170 cal BC–cal AD 20
SUERC-18795	fill (388) of ring gully of Roundhouse 6 [SHF04 S8]	carbonized residue	-25.7			2055 ±30	170 cal BC–cal AD 20
OxA-18733	fill (417) of gully of structure [418] [SHF04 S9A]	carbonized residue	-26.7			1930 ±26	cal AD 10–130
SUERC-18796	replicate of OxA-18733	carbonized residue	-25.4			2010 ±30	90 cal BC–cal AD 70
SUERC-18800	narrow gully near cemetery [SHF04 S10A]	carbonized residue	-26.0			2030 ±30	160 cal BC–cal AD 60
OxA-18734	replicate of SUERC-18800	carbonized residue	-27.3			1944 ±26	cal AD 1–130
SUERC-11125	fill (141) of ring ditch of Structure 3 [SHF05 Context 141]	carbonized grain: *Hordeum* sp.	-23.0			2115 ±35	350–40 cal BC
SUERC-13793	fill (242) of briquetage pit [SHF05 Context 242]	charcoal: *Corylus avellana*; roundwood	-27.6			1935 ±40	40 cal BC–cal AD 140
Beta-200337	primary fill of SW enclosure ditch [SW enclosure ditch]	carbonized grain: *Hordeum* sp.	-24.5			2200 ±40	390–160 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
Thorpe Thewles							
OxA-18736	A102; a spread of highly concentrated charcoal/carbonized material in the middle fills of the Main Enclosure Ditch [JS 3, A102 sample B]	charcoal: *Prunus spinosa*	-25.5			1956 ±27	40 cal BC–cal AD 130
SUERC-18806	A102; a spread of highly concentrated charcoal/carbonized material in the middle fills of the Main Enclosure Ditch [JS 3, A102 sample A]	charcoal: *Corylus avellana*	-25.6			2035 ±30	160 cal BC–cal AD 50
OxA-1733	A135; the charcoal and grain rich second layer in the Main Enclosure Ditch [JS 7, A135] [A135, M.E.D. J.S. 7]	carbonized grain: spelt	-26.0			2040 ±70	350 cal BC–cal AD 120
OxA-18735	A99; a hearth in the middle fills of the Main Enclosure Ditch [JS 2, A99 sample A]	charcoal: *Betula* sp.	-26.4			1936 ±24	cal AD 15–130
SUERC-18810	A99; a hearth in the middle fills of the Main Enclosure Ditch [JS 2, A99 sample B]	charcoal: Pomoideae	-25.2			2005 ±30	90 cal BC–cal AD 70
SUERC-21761	B1285; a generic layer in the Main Enclosure Ditch [B1285]	carbonized residue	-27.2			2030 ±30	160 cal BC–cal AD 60
SUERC-21762	B1342; the primary fill of the Main Enclosure Ditch [S.F. 311, B1342]	carbonized residue	-27.0			2050 ±30	170 cal BC–cal AD 30
OxA-20004	B160; a layer in the Curvilinear Enclosure Ditch that cuts the Main Enclosure Ditch & Subrectilinear Enclosure I [B160]	carbonized residue	-26.7			2044 ±27	170 cal BC–cal AD 30
OxA-19894	B44; an “occupation layer” stratigraphically over the Curvilinear Enclosure Ditch [S.F. 31, B44]	carbonized residue	-28.3			1968 ±28	50 cal BC–cal AD 90
OxA-18685	B457: SF 122; one of several large conjoining sherds, including about 1/10 of the total rim; and was from the upper layer of Circular Structure B, directly under topsoil [S.F. 122, B457]	carbonized residue	-26.3			2022 ±24	90 cal BC–cal AD 50
GrN-15658	C1118; a layer in the Main Structure Ditch [LS 120, C1118] [Thorpe Thewles 1]	bulk charcoal: unidentified	-25.6			2205 ±35	390–170 cal BC
SUERC-21766	C1471; the primary silting of the Main Structure Ditch [C1471]	carbonized residue	-25.5			2040 ±30	170 cal BC–cal AD 50
GrN-15660	C1504; a layer of fill in Circular Structure K [LS 178, C1504] [Thorpe Thewles 3]	bulk charcoal: unidentified	-25.9			2130 ±60	380–1 cal BC
SUERC-21767	C1636; the primary silting of the Circular Structure K ring gully. The gully lies under deposits spread over the cobbled entrance [C1636]	carbonized residue	-25.6			2125 ±30	350–50 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
OxA-1745	C1823; the secondary fill in LS 265 which is cut by both Circular Structure K and the Late Rectilinear Enclosure Ditch II [LS 239, C1823]	carbonized grain: bread wheat	-26.0			720 ±70	cal AD 1180–1400
GrN-15659	C1836; a fill in an early linear feature [LS 268, C1836] [Thorpe Thewles 2]	bulk charcoal: unidentified	-25.8			2200 ±50	400–110 cal BC
OxA-1731	C1836; a fill in an early linear feature [LS 268, C1836] 2148, f2155]	bulk carbonized chaff: spelt	-26.0			2305 ±70	540–200 cal BC
GrN-15661	C2001; a layer in the ring ditch of Circular Structure M [JS 15, C2001] [Thorpe Thewles 4]	bulk charcoal: unidentified	-25.8			2720 ±80	1050–780 cal BC
OxA-18741	C2018/2025; two middle fills of the ring ditch for Circular Structure M. These fills contained high concentrations of carbonized material, which was interpreted as occupational debris dumps [JS 26, C2018/2025 sample B]	charcoal: Pomoideae	-24.6			2079 ±26	180–1 cal BC
SUERC-18803	C2018/2025; two middle fills of the ring ditch for Circular Structure M. These fills contained high concentrations of carbonized material, which was interpreted as occupational debris dumps [JS 26, C2018/2025 sample A]	charcoal: *Prunus spinosa*	-26.1			2155 ±30	360–100 cal BC
OxA-18738	C2251; an entrance posthole deposit of the Main Structure [JS 17, C2251 sample B]	charcoal: *Corylus avellana*	-24.8			2057 ±24	170 cal BC–cal AD 5
SUERC-18804	C2251; an entrance posthole deposit of the Main Structure [JS 17, C2251 sample A]	charcoal: *Salix*/*Populus* sp.	-25.7			2140 ±30	360–50 cal BC
OxA-1732	C2254; a secondary fill in the Main Structure Ditch [LS 121, C2254] [C2254, C2367]	bulk carbonized chaff: spelt	-26.0			2190 ±70	400–40 cal BC
OxA-19895	C31: 28NW; a pottery sherd from a layer of stratigraphy mixed dark stratigraphy overlying IA features but with no Romano-British pottery [C31, 28NW]	carbonized residue	-25.9			2024 ±29	110 cal BC–cal AD 60
OxA-20005	C32: 8NE; a pottery sherd from a layer of stratigraphy mixed dark stratigraphy overlying IA features but with no Romano-British pottery [C32, 8NE]	carbonized residue	-26.6			2064 ±29	180 cal BC–cal AD 10
GrN-15662	C407; a layer in the upper fills of the third recut of LS52 [LS52, C407] [Thorpe Thewles 5]	bulk charcoal: unidentified	-26.7			2410 ±80	790–360 cal BC
SUERC-21763	C486: 6NW; a pottery sherd from layer of stratigraphy overlying cobbling of a probable entranceway to the site that overlies Main Enclosure Ditch; fairly rapid accumulation; =465 [C486, 6NW]	carbonized residue	-28.2			2085 ±30	200–1 cal BC
OxA-19896	C486: C486, S.F. 125; a pottery sherd from layer of stratigraphy overlying cobbling of a probable entranceway to the site that overlies Main Enclosure Ditch; fairly rapid accumulation; =465 [S.F. 125, C486]	carbonized residue	-26.5			2012 ±24	55 cal BC–cal AD 55

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
OxA-20006	C486: S.F. 129; a pottery sherd from layer of stratigraphy overlying cobbling of a probable entranceway to the site that overlies Main Enclosure Ditch; fairly rapid accumulation; =465 [S.F. 129, C486]	carbonized residue	-28.3			2061 ±28	170 cal BC–cal AD 10
GrN-15663	C488; a fill in the Late Rectilinear Enclosure Ditch [LS 58, C488] [Thorpe Thewles 6]	bulk charcoal: unidentified	-25.3			2300 ±35	410–230 cal BC
SUERC-21764	C492; a layer of stratigraphy occupying a depression probably caused by erosion of the approach to an entrance. It overlies the cobbling over the Main Enclosure Ditch and signifies a fairly rapid accumulation [C492]	carbonized residue	-26.7			2105 ±30	210–40 cal BC
OxA-18739	C679; a deep fill of the Main Structure Ditch (associated with House 1) [JS 18, C679 sample B]	charcoal: *Betula* sp.	-25.5			2007 ±24	55 cal BC–cal AD 60
SUERC-18805	C679; a deep fill of the Main Structure Ditch (associated with House 1) [JS 18, C679 sample A]	charcoal: *Prunus spinosa*	-25.7			2150 ±30	360–90 cal BC
OxA-19897	C698; a pottery sherd from one of two large refitting sherds of a vessel. These were found in the debris on the floor of the Main Structure [C698b]	carbonized residue	-27.1			2145 ±30	360–60 cal BC
SUERC-21765	C698; a pottery sherd from one of two large refitting sherds of a vessel. These were found in the debris on the floor of the Main Structure [C698a]	carbonized residue	-26.7			2100 ±30	210–40 cal BC
OxA-18737	C730; a spread of highly concentrated charcoal/carbonized material that comprise a floor deposit of the Main Structure [JS 9, CS730 sample B]	charcoal: *Prunus spinosa*	-26.5			2079 ±24	180–40 cal BC
SUERC-18802	C730; a spread of highly concentrated charcoal/carbonized material that comprise a floor deposit of the Main Structure [JS 9, CS730 sample A]	charcoal: Pomoideae	-27.4			2080 ±30	200–1 cal BC
SUERC-18811	C888: SF 186; a floor level just inside the door of the Main House [S.F. 186, C888]	carbonized residue	-26.2			2215 ±30	390–190 cal BC
OxA-18740	D76; a layer of highly concentrated carbonized material, interpreted as an occupational debris dump in the Late Rectilinear Enclosure Ditch I [JS 21, D76 sample B]	charcoal: *Fraxinus excelsior*	-25.2			1995 ±25	50 cal BC–cal AD 70
SUERC-18801	D76; a layer of highly concentrated carbonized material, interpreted as an occupational debris dump in the Late Rectilinear Enclosure Ditch I [JS 21, D76 sample A]	charcoal: *Quercus* sp.; roundwood	-25.5			2010 ±30	90 cal BC–cal AD 70

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
West Brunton							
UBA-7809	fill 1202 in gully of Structure 4	animal bone: unknown calcined sheep	-23.3			2390 ±42	750–390 cal BC
UBA-7808	fill 1280 in gully of Structure 6	carbonized grain: barley	-24.3			2289 ±36	410–210 cal BC
UBA-7807	fill 1279 in gully of Structure 6	carbonized grain: wheat	-15.5			2088 ±44	350 cal BC–cal AD 10
UBA-7812	fill 1661 in terminal of Enclosure A ditch	wood: cherry	-35.5			1865 ±36	cal AD 60–240
UBA-7813	fill 1661 in terminal of Enclosure A ditch	wood: hazel	-30.8			1892 ±31	cal AD 50–220
UBA-7806	fill 1309 of slot in Structure 1a	wood: hazel	-26.8			2303 ±32	410–260 cal BC
OxA-22354	fill 1309 of slot in Structure 1a	charcoal: *Corylus avellana*	-24.6			2333 ±26	410–380 cal BC
UBA-7811	fill 1058 in gully of Structure 1	carbonized grain: barley	-9.1			2405 ±59	770–380 cal BC
UBA-7810	fill 1018 in gully of Structure 1	carbonized grain: wheat	-24.2			1962 ±32	50 cal BC–cal AD 130
OxA-22397	fill 1057 in pit/hearth 1060 in Structure 1	charcoal: *Corylus avellana*	-26.1			2177 ±25	360–160 cal BC
OxA-22847	fill 1057 in pit/hearth 1060 in Structure 1	charcoal: *Sorbus* sp.	-26.0			2228 ±24	385—200 cal BC
OxA-22780	fill 1069 in posthole 1068 in Structure 1	charcoal: Rowan type	-27.9			2244 ±27	400–200 cal BC
OxA-22846	fill 1015 in the last recut of gully of Structure 1	charcoal: *Prunus spinosa*	-26.3			2108 ±24	200–45 cal BC
UBA-7815	upper fill 1133 in enclosure Ditch C	carbonized grain: wheat	-18.3			1880 ±30	cal AD 60–230
UBA-7816	upper fill 1133 in enclosure Ditch C	carbonized grain: wheat	-24.0			1926 ±43	40 cal BC–cal AD 210
SUERC-28599	fill 1193 in last recut of enclosure Ditch C	charcoal: *Populus/Salix* sp.	-25.2			1960 ±30	40 cal BC–cal AD 130
OxA-22848	fill 1193 in last recut of enclosure Ditch C	charcoal: *Acer* sp.; roundwood	-24.8			1991 ±24	50 cal BC–cal AD 70
OxA-22849	fill 1530 in gully terminal segment 1533 of Structure 12	charcoal: *Sorbus* sp.	-24.7			2173 ±25	360–160 cal BC
OxA-22850	replicate of OxA-22849	as OxA-22849	-25.7			2064 ±25	170–1 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
SUERC-28598	fill 1530 in gully terminal segment 1533 of Structure 12	charcoal: *Alnus/Corylus* sp.	-25.4			2065 ±30	180 cal BC–cal AD 10
OxA-X-2386-33	fill 1602 in gully of Structure 29 [associated with Enclosure B]	charcoal: *Corylus avellana*; roundwood	-26.2			2287 ±22	400–260 cal BC
UBA-7814	fill 1602 in gully of Structure 29 [associated with Enclosure B]	charcoal: identified as non-Oak	-10.4			2404 ±37	750–390 cal BC
OxA-22398	fill 1626 of posthole 1627 at entrance of Structure 29 [assoc. with Enclosure B]	charcoal: *Corylus avellana*	-25.4			1991 ±25	50 cal BC–cal AD 70
OxA-22851	fill 1626 of posthole 1627 at entrance of Structure 29 [assoc. with Enclosure B]	charcoal: *Acer* sp.; roundwood	-24.6			2020 ±25	90 cal BC–cal AD 60
OxA-22789	fill 1817 of gully of Structure 35	charcoal: *Corylus avellana*; roundwood	-29.1			2110 ±28	210–40 cal BC
OxA-23067	lowest fill 1684 of ditch 1685 [Enclosure A]	charcoal: *Acer* sp.; roundwood	-25.5			2070 ±31	180 cal BC–cal AD 10
Wether Hill							
AA-54973	interface layer of late stone houses and Inner Rampart	charcoal: *Corylus avellana*; roundwood	-24.7			2190 ±40	390–110 cal BC
AA-54972	posthole beneath stone house	charcoal: *Corylus avellana*	-25.3			2195 ±50	390–100 cal BC
AA-40759	layer sealed beneath stone house wall	charcoal: *Alnus glutinosa*	-23.8			2175 ±45	390–90 cal BC
AA-40758	matrix of a stone house wall core	charcoal: *Betula* sp.	-26.6			1985 ±45	100 cal BC–cal AD 130
AA-35526	core Inner Rampart	charcoal: *Corylus avellana*	-26.2			2070 ±45	200 cal BC–cal AD 30
AA-35525	core Outer Rampart	charcoal: *Betula* sp.	-26.1			2145 ±45	370–40 cal BC
SUERC-2415	fill of the palisade trench cutting ring-groove House XIII	charcoal: *Alnus/Corylus* sp.	-24.4			2195 ±40	390–120 cal BC
SUERC-2416	fill of the palisade trench cutting ring-groove House XIII	charcoal: *Alnus/Corylus* sp.	-26.0			2245 ±25	400–200 cal BC
AA-54970	fill of a ditch truncated by later defenses	charcoal: *Salix/Populus* sp.; roundwood	-27.3			2150 ±40	360–50 cal BC
AA-54969	fill of a ditch truncated by later defenses	charcoal: *Corylus avellana*; 7-8 yr roundwood	-23.7			2260 ±40	400–200 cal BC
AA-54971	fill of a ditch truncated by later defenses	charcoal: *Corylus avellana*; roundwood	-26.1			2150 ±40	360–50 cal BC

Lab ID	Context Information [Sample ID]	Material	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	Radiocarbon Age (BP or FM)	Calibrated date (95% confidence)
SUERC-2420	ring-groove House XIII	charcoal: *Alnus/Corylus* sp.	-26.4			2170 ±35	370–110 cal BC
SUERC-2421	ring-groove House XIII	charcoal: *Quercus* spp.	-25.9			2295 ±35	410–230 cal BC
SUERC-2414	ring-groove House VI	charcoal: *Alnus/Corylus* sp.	-25.5			2220 ±40	400–170 cal BC
SUERC-2413	ring-groove House XIII	charcoal: cf. Alder	-24.8			2140 ±35	360–50 cal BC
AA-54974	early ring-groove House	charcoal: *Corylus avellana*; 3yr outer growth of small stem	-26.0			2190 ±40	390–110 cal BC
AA-40756	upper fill of Palisade trench	charcoal: *Quercus* spp.	-27.1			2000 ±45	110 cal BC–cal AD 90
AA-40757	unknown	charcoal: *Alnus glutinosa*	-23.6			1985 ±45	
Beta-101731	fill of Palisade trench	charcoal: unknown				2180 ±80	400–1 cal BC
Beta-89361	fill of Palisade trench	charcoal: unknown				2220 ±90	410–40 cal BC

Table 2: Thermoluminescence dates from Thorpe Thewles

Lab ID	Sample ID	Context	TL Result (BC/AD)
DurTL TT1	B457	Upper fill layer of Circular Structure B	145 BC ±165 (±210)
DurTL TT2	B13	Mask layer over Main Enclosure Ditch	515 BC ±220 (±275)
DurTL TT3	B341	Layer of fill in Late Rectilinear Enclosure Ditch II (under B392)	AD 40 ±220 (±270)
DurTL TT6	A109	Main Enclosure Ditch occupation debris	570 BC ±200 (±260)
DurTL TT7	C876	Upper fill of Main Structure Ditch	550 BC ±220 (±280)
DurTL TT8	C679	Primary fill of Main Structure Ditch	490 BC ±220 (±270)
DurTL TT13	C1632	Layer in Circular Structure K	AD 40 ±100 (±160)
DurTL TT14	B44	Occupation horizon over Main Enclosure Ditch (over B160)	400 BC ±140 (±220)
DurTL TT15	D118	Layer in Period III partition Double Ditch	240 BC ±210 (±260)
DurTL TT16	B392	Layer of fill in Late Rectilinear Enclosure Ditch II (over B341)	590 BC ±195 (±260)
DurTL TT17	B390	Layer of fill in Late Rectilinear Enclosure Ditch II	700 BC ±200 (±270)
DurTL TT18	C407	Upper fill layer of 3rd recut of Late Rectilinear Enclosure Ditch II (over C488)	AD 110 ±145 (±175)

Table 3: Thermoluminescence dates from The Dunion

House; Context	Date (BC/AD)
2; F1031	70 BC ±190 (±210)
6; F9014	AD 60 ±220 (±220)
7; F12003	AD 180 ±170 (±180)

APPENDIX II: SAMPLE PREPARATION, MEASURING, AND RESULTS

Sample Preparation and Measuring

Dryburn Bridge

All 50 samples were submitted to either the Scottish Universities Research and Reactor Centre (SURRC), or the Scottish Universities Environmental Research Centre (SUERC), East Kilbride.

There were nine samples of human bone and six samples of charcoal and charred wood submitted, processed for radiocarbon dating, and measured by liquid scintillation counting at the Scottish Universities Research and Reactor Centre (SURRC). The human bone was pretreated with a modified Longin (1971) method while the charcoal was pretreated as described in Stenhouse and Baxter (1983). The samples were further processed and measured as described by Noakes et al. (1965). The results are identified by GU- numbers.

Nineteen samples were submitted to SURRC, where they were pretreated and turned into a graphic targets that were subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). Fourteen samples of human bone and two samples of animal bone were processed with a modified Longin (1971) method while three samples of charcoal were processed following pretreatment methods detailed in Stenhouse and Baxter (1983). All the samples were graphitized following the method described in Slota et al. (1987) and measured by AMS following Donahue et al. (1997). The results are identified by AA- numbers.

A final sixteen samples were submitted to SUERC. Fourteen samples of human bone were pretreated following a modified Longin (1971) method and the two samples of animal bone were pretreated following Stenhouse and Baxter (1983). All the samples were graphitized as described in Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

The Dunion

Eight samples of bulk identified charcoal were processed for radiocarbon dating and measured by liquid scintillation counting at the Scottish Universities Research and Reactor Centre (SURRC), East Kilbride following procedures described by Noakes et al. (1965) and Stenhouse and Baxter (1983). The results are identified by GU-numbers.

The luminescence dating (Appendix I, Table 4) was undertaken by David Sanderson of the Scottish Universities Research and Reactor Centre, East Kilbride. The samples and measurements are described in further detail in Rideout et al. (1992, 106–08).

East Brunton Farm

One sample of charcoal was submitted to SUERC. The sample was pretreated following Stenhouse and Baxter (1983), graphitized as described in Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The result is identified by a SUERC- number.

Three samples (2 charred grain, 1 charcoal) were submitted to Queen's University, Belfast (UBA). The charcoal sample was processed using an acid-alkali-acid pretreatment, while the charred grain samples were only pretreated with the initial acid step, that is first described by de Vries and Barendsen (1952). The pretreated and dried samples were placed in quartz tubes with a strip of silver ribbon to remove nitrates, chlorides, and CuO. The samples were then sealed under vacuum and combusted to CO_2 overnight at 850°C. The CO_2 was converted to graphite on an iron catalyst using the zinc reduction method (Vogel et al. 1984). The graphite samples were analysed with an 0.5MeV NEC pelletron compact accelerator, with the $^{14}C/^{12}C$ ratios corrected for fractionation using the on-line measured $^{13}C/^{12}C$ ratio and in accordance with Stuiver and Polach (1977). The results are identified by UBA-numbers.

Nine samples of charcoal and one charred tuber were submitted to ORAU. All of these samples were prepared following the methods described in Hedges et al. (1989) and measured by AMS following Bronk Ramsey et al. (2004a). The results are identified by OxA- numbers.

Eildon Hill North

Thirteen samples of bulk identified charcoal were processed for radiocarbon dating and measured by liquid scintillation counting at the Scottish Universities Research and Reactor Centre (SURRC), East Kilbride following procedures described by Noakes et al. (1965) and Stenhouse and Baxter (1983). The results are identified by GU-numbers.

Fawdon Dean

Twelve samples of charcoal and carbonized grains were submitted to the then Scottish Universities Research and Reactor Centre (SURRC), East Kilbride, where they were pretreated and turned into graphite targets that were subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). The samples were processed following pretreatment methods detailed in Stenhouse and Baxter (1983) and graphitized following the method described in Slota et al. (1987). The samples were measured by AMS following Donahue et al. (1997). The results are identified by AA- numbers.

Twelve samples of charcoal and carbonized grain were submitted, six each, to the ORAU and SUERC. The sample submitted to Oxford were processed following Hedges et al. (1989) and measured by AMS as described in Bronk Ramsey et al. (2004). Samples submitted to SUERC were processed as detailed in Stenhouse and Baxter (1983) and graphitized following the method described in Slota et al. (1987). The samples were measured in East Kilbride by AMS (Xu et al. 2004). The Oxford results are identified by OxA- numbers and the East Kilbride results by SUERC-numbers.

Fishers Road East

A total of 16 carbonized plant macrofossils were submitted to ORAU. The samples were processed following Hedges et al. (1989) and measured by AMS as described in Bronk Ramsey and Hedges (1997). The results are identified by OxA- numbers.

A further 25 carbonized plant macrofossil samples were submitted to the then Scottish Universities Reactor and Research Centre (SURRC), East Kilbride, where they were pretreated and turned into graphic targets that were subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). The samples were processed following pretreatment methods detailed in Stenhouse and Baxter (1983) and graphitized following the method described in Slota et al. (1987). The samples were measured by AMS following Donahue et al. (1997). The results are identified by AA- numbers.

Fishers Road West

All 18 samples were submitted to the Scottish Universities Reactor and Research Centre (SURRC), East Kilbride, where they were pretreated and turned into graphic targets that were subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). The samples were processed following pretreatment methods detailed in Stenhouse and Baxter (1983) and graphitized following the method described in Slota et al. (1987). The samples were measured by AMS following Donahue et al. (1997). The results are identified by AA- numbers.

Ingram South

Three samples of carbonized seed and nutshell were submitted to Beta Analytic (Beta-) and were measured and processed by AMS as described on their website (http://www.radiocarbon.com/). The results are identified by their Beta- numbers.

Six samples of carbonized grain were submitted to ORAU and were processed following Hedges et al. (1989) and measured by AMS as described in Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Eighteen samples of charcoal and carbonized grain were submitted to SUERC and were processed following the methods on Stenhouse and Baxter (1983), graphitized following the method described in Slota et al. (1987), and measured by AMS (Xu et al. 2004). The results are identified by SUERC- numbers.

Kilton Thorpe Lane

A total of five Accelerator Mass Spectrometry (AMS) measurements were made in 2008 on carbonized residues submitted to the Scottish Universities Environment Research Centre, East Kilbride (SUERC). These samples were pretreated following procedures outlined in Stenhouse and Baxter (1983), graphitized following Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

A total of five samples of carbonized plant remains (seeds and charcoal) were submitted in 2001 and a further seven samples of carbonized organic residue were submitted to and measured in 2008 at the Oxford Radiocarbon Accelerator Unit (ORAU). All of these samples were prepared following the methods described in Hedges et al. (1989). The samples submitted in 2001 were measured by AMS following Bronk Ramsey and Hedges (1997), while those submitted in 2008 were measured by AMS following Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Knowes Farm

All 25 samples were submitted to SUERC. The 23 samples of charred grain and charcoal were processed following pretreatment methods detailed in Stenhouse and Baxter (1983), while the two samples of cremated bone were processed following Lanting et al. (2001). All the samples were graphitized following the method described in Slota et al. (1987) and measured by AMS, as described by Xu et al. (2004). The results are identified by SUERC- numbers.

Pegswood Moor

Five samples of carbonized food residue scraped from pottery sherd using a scalpel with the aid of a microscope were submitted to Beta Analytic (Beta-) and were measured and processed by AMS as described on their website (http://www.radiocarbon.com/). The results are identified by their Beta- numbers.

One sample of unidentified charcoal was submitted to SURRC, where it was pretreated and turned into a graphic target that was subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). The sample was processed following pretreatment methods detailed in Stenhouse and Baxter (1983) and graphitized following the method described in Slota et al. (1987). The sample was measured by AMS following Donahue et al. (1997). The result is identified by an AA-number.

Two short-lived charcoal and one charred seed were submitted to SUERC. The samples were pretreated following Stenhouse and Baxter (1983), graphitized as described in Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

A total of 15 samples, including 12 samples of short-lived charred plant remains and the carbonized residues from three pottery sherds, were submitted to ORAU. All of these samples were prepared following the methods described in Hedges et al. (1989) and measured by AMS following Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Phantassie Farm

All 59 samples were submitted for radiocarbon dating at SUERC. The 58 samples of charcoal and carbonized grain were pretreated as described in Stenhouse and Baxter (1987). The one sample of cremated bone was processed following the procedures detailed in Lanting et al. (2001). All samples were graphitized following Slota et al. (1987) and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

Standingstone

All 26 samples were submitted to SUERC for radiocarbon dating. The 25 samples of carbonized plant remains and animal bone were processed following pretreatment methods detailed in Stenhouse and Baxter (1983), with one sample cremated bone having been processed by methods described in Lanting et al. (2001). All of the samples were graphitized following the method described in Slota et al. (1987) and measured by AMS as described by Xu et al. (2004). The results are identified by SUERC- numbers.

Stanwick

Four samples of bulked unidentified charcoal were processed and measured by gas proportional counting at the University of Groningen, The Netherlands. The samples were pretreated following Mook and Waterbolk (1985) and were converted to carbon dioxide for measurement by gas proportional counting (Mook and Streurman 1983). The results are identified by GrN- numbers.

Thirteen samples of individual seeds of carbonized grain and short-lived charcoal, along with a carbonized residue on a pottery sherd were submitted to SUERC. All 14 of these samples were pretreated following procedures in Stenhouse and Baxter (1983), graphitized following Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

A total of 20 samples of charred macrofossils, including seeds and short-lived charcoal, and one carbonized residue on a pottery sherd were submitted to ORAU. All of these samples were prepared following the methods described in Hedges et al. (1989). All the samples were measured by AMS, with the six OxA measurements in the 3000s following Gillespie et al. (1983) and Hedges (1981), and the remaining following Bronk Ramsey et al. (2004). All the Oxford results are identified by OxA- numbers.

Five samples of human bone and five samples of animal bone were submitted to SUERC. The human bone was processed following a modified Longin (1971) method, while the animal bone was processed following details in Stenhouse and Baxter (1983). All 10 samples were measured by AMS following Xu et al. (2004). The results are identified by SUERC- numbers.

Four samples of human bone and five samples of animal bone were submitted to ORAU. All the samples were processed using a collagen extraction (Hedges et al. 1989; Law and Hedges 1989) followed by the revised gelatinization and filtration protocol described in Bronk Ramsey et al. (2004b). The samples were combusted and converted to graphite and dated by AMS as described by Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Street House Farm

One measurement is available from bulk carbonized barley grains submitted to Beta Analytic in 2005. The sample was pretreated using an acid-base-acid protocol and measured by AMS (see http://www.radiocarbon.com for further details). The result is identified by its Beta- number.

Two measurements were made in 2006–7 on a carbonized barley grain and a fragment of hazel charcoal, with a further eight measurements made in 2008 on carbonized residues (6) and individual carbonized wheat grains (2) submitted to SUERC. All these samples were pretreated following procedures in Stenhouse and Baxter (1983), graphitized following Slota (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

A total of two samples of individual carbonized wheat grains and six samples of carbonized organic residue were submitted and measured in 2008 to ORAU. All of these samples were prepared following the methods described in Hedges et al. (1989) and measured by AMS following Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Thorpe Thewles

Six samples of bulked unidentified charcoal were processed and measured by gas proportional counting at the University of Groningen, The Netherlands. The samples were pretreated following Mook and Waterbolk (1985) and were converted to carbon dioxide for measurement by gas proportional counting (Mook and Streurman 1983). The results are identified by GrN- numbers.

Two samples of single carbonized seeds, two samples of bulk spelt chaff, and seven samples of short-lived identified charcoal were submitted along with the carbonized residues from eight pottery sherds were submitted to ORAU. These samples were prepared following the methods described in Hedges et al. (1989). All the samples were measured by AMS, with the six OxA measurements in the 3000s following Gillespie et al. (1983) and Hedges (1981), and the remaining following Bronk Ramsey et al. (2004). All the Oxford results are identified by OxA- numbers.

Eight carbonized residues on pottery sherds and seven samples of short-lived identified charcoal were submitted to SUERC and were processed following Stenhouse and Baxter (1983), graphitized as described by Slota et al (1987) and measured by AMS (Xu et al. 2004). The results are identified by SUERC- numbers.

The thermoluminescence (TL) dating was all undertaken on Iron Age pottery sherds and the procedures are described in Bailiff (1988) with the results presented in Heslop (1987, 71–72) and Appendix I, Table 3.

West Brunton Farm

Two samples of charcoal were submitted to SUERC. The samples were pretreated following Stenhouse and Baxter (1983), graphitized as described in Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

Eleven samples were submitted to Queen's University, Belfast (UBA). Samples of charred plant material were processed using an acid-alkali-acid pretreatment (with the exception of UBA-7812, -7815, and -7816 which underwent only the initial acid step) that is first described by de Vries and Barendsen (1952), while the hazel wood (UBA-7813) underwent Soxhelet extraction (Hoper et al. 1998) followed by the acid-alkali-acid procedure. These pretreated and dried samples were placed in quartz tubes with a strip of silver ribbon to remove nitrates, chlorides, and CuO. The samples were then sealed under vacuum and combusted to CO_2 overnight at 850°C. The calcined sheep bone was pretreated and hydrolyzed to CO_2 as reported in Lanting and van der Plicht (1998) and Lanting et al. (2001).

The samples of CO_2 were converted to graphite on an iron catalyst using the zinc reduction method (Vogel et al. 1984). The graphite samples were analysed with an 0.5 MeV NEC pelletron compact accelerator, with the $^{14}C/^{12}C$ ratios corrected for fractionation using the on-line measured $^{13}C/^{12}C$ ratio and in accordance with Stuiver and Polach (1977). The results are identified by UBA- numbers.

Fourteen samples of short-lived charcoal were submitted to ORAU. All of these samples were prepared following the methods described in Hedges et al. (1989) and measured by AMS following Bronk Ramsey et al. (2004). The results are identified by OxA- numbers.

Wether Hill

Two samples of charcoal were submitted to Beta Analytic (Beta-) and were measured and processed by AMS as described on their website (http://www.radiocarbon.com/). The results are identified by their Beta- numbers.

Twelve samples were submitted to SURRC, where they were pretreated and turned into graphic targets that were subsequently measured at the University of Arizona Radiocarbon Accelerator, Tucson, U.S.A. (AA-). All the samples were charcoal and were processed following pretreatment methods detailed in Stenhouse and Baxter (1983), graphitized following the method described in Slota et al. (1987) and measured by AMS following Donahue et al. (1997). The results are identified by AA- numbers.

A final six samples were submitted to SUERC. All the samples were charcoal and were processed following pretreatment methods detailed in Stenhouse and Baxter (1983), graphitized following the method described in Slota et al. (1987), and measured by AMS as described in Xu et al. (2004). The results are identified by SUERC- numbers.

Presentation and Calibration of Results

The radiocarbon results are given in the table in Appendix I, and are quoted in accordance with the international standard known as the Trondheim convention (Stuiver and Kra 1986). They are conventional radiocarbon ages (Stuiver and Polach 1977).

The calibrations of the results, relating the radiocarbon measurements directly to calendar dates, are also given in the table in Appendix I. All have been calculated using the calibration curve of Reimer et al. (2009) and the computer program OxCal v4.1 (Bronk Ramsey 1995; 1998; 2001; 2009a). The calibrated date ranges cited in the text are those for 95% confidence. They are quoted in the form recommended by Mook (1986), with the end points rounded outwards to 10 years if the error term is greater than or equal to 25 radiocarbon years or to 5 years if it is less. The ranges quoted in italics are posterior density estimates derived from mathematical modelling. The ranges in plain type in the table in Appendix I have been calculated according to the maximum intercept method (Stuiver and Reimer 1986). All other ranges are derived from the probability method (Stuiver and Reimer 1993).

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