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The radiocarbon dates from White Horse Stone, Aylesford, Kent

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1 INTRODUCTION

The radiocarbon programme had two specific aims: first to look at the contemporaniety and duration of the Neolithic house and Grooved Ware settlement and associated features, and the second to address contemporaniety and temporal variation within the early-mid Iron Age settlement. A number of undated features representing specific activities (burial, placed deposits) were also dated in order to ascribe them to a phase. Within both the Neolithic/earlier prehistoric and Iron Age programmes detailed questions were addressed to attempt to define the chronological relationship between the specific phases and types of activity. In addition other aims included examining the Allerød soil.

1.1 Taphonomy and selection

Strict selection and scrutiny of material was made in an attempt to ensure that all items dated specific events (cf. Allen and Bayliss 1995; Allen *et al.* 2004) and were not just datable items.

In order to even attempt to answer specific questions relating to events it was imperative that the material selected for dating was directly related to the event we wished to date, and was not just casually deposited or physically in close proximity to the resultant feature or deposit. Both charcoal and charred plant remains were carefully scrutinised for twiggy material and sap wood with little age offset. Postholes provided one of the most problematic feature types, as there were no burnt post-built structures. Where clear structures were present connecting a series of postholes, it was, therefore, rarely possible to find charcoal representing the burnt out timber post. In the rare instances where this did occur, often only heartwood charcoal survived. In many cases a number of species were present in the charcoal assemblage. Assumptions were made that these, and the accompanying other remains, represented material burnt within the structure that had been scattered across the floor, and ultimately worked its way into the posthole via the void created by the eroding post leaving a gap between soil and post at ground level (Reynolds 1995; Allen pers. obs; Reynolds pers. comm.). In some cases splinters of bone were considered to have followed the same depositional pattern. However, in all of these assumptions, we could not rule out the possibility of residual or later material entering the posthole. In an attempt to combat this problem with the longhouse submission (see below), duplicate samples of, if possible, differing material were submitted from the same posthole.

Placed and special deposits were scrutinised to ensure they were single-event deposits, and articulated faunal elements or clearly selected large faunal items were chosen which were unlikely to be residual. Simulations were performed to determine if the questions addressed of the data could be answered by radiocarbon dating prior to selection and submission.

1.2 The radiocarbon programme

A total of 56 submissions were made (including 7 from the assessment phase), one of which was amalgamated with a replicate, and one of which failed, providing 54 radiocarbon results. These are presented in Tables 1 and 2 and Figures 1-16; all have been calibrated with the atmospheric data presented by Stuiver *et al.* (1998) using OxCal ver 3.9 (Bronk Ramsey 1995; 2001) and are expressed at the 95% confidence level with the end points rounded outwards to 10 years following the form recommended by Mook (1986).

1.3 Bayesian approach

Alex Bayliss

The Bayesian approach to the interpretation of archaeological chronologies has been described by Buck *et al.* (1996). It is based on the principle that although the calibrated age ranges of radiocarbon measurements accurately estimate the calendar ages of the samples themselves, it is the dates of archaeological events associated with those samples that are important. Bayesian techniques can provide realistic estimates of the dates of such events by combining absolute dating evidence, such as radiocarbon results, with relative dating evidence, such as stratigraphic relationships between radiocarbon samples. These 'posterior density estimates' (which, by convention, are always expressed *in italics*) are not absolute. They are interpretative estimates, which will change as additional data become available or as the existing data are modelled from different perspectives.

The technique used here is a form of Markov Chain Monte Carlo sampling, which has been applied using the program OxCal v3.9 (Bronk Ramsey 1995; 1998; 2001). An OxCal model is constructed explicitly specifying the known or assumed relative ages of the radiocarbon samples. The model structure is typically defined by the site's Harris matrix. The program calculates the probability distributions of the individual calibrated radiocarbon results (Stuiver and Reimer 1993), and then attempts to reconcile these distributions with the relative ages of the samples, by repeatedly sampling each distribution (using the Metropolis-Hastings algorithm and the Gibbs sampler) to build up the set of solutions consistent with the model structure.

This process produces a posterior density estimate of each sample's calendar age, which occupies only part of the calibrated probability distribution (the prior distribution of the sample's calendar age). The posterior distribution is then compared to the prior distribution; an index of agreement is calculated that reflects the consistency of the two distributions. If the posterior distribution is situated in a high-probability region of the prior distribution, the index of agreement is high (sometimes 100% or more). If the index of agreement falls below 60% (a threshold value analogous to the 0.05 significance level in a χ^2 test), however, the radiocarbon result is regarded as inconsistent with the sample's calendar age, if the latter is consistent with the sample's age relative to the other dated samples. Sometimes this merely indicates that the radiocarbon result is a statistical outlier (more than 2 standard deviations from the sample's true radiocarbon age), but a very low index of agreement may mean that the sample is residual or intrusive (ie that its calendar age is different to that implied by its stratigraphic position).

An overall index of agreement is calculated from the individual agreement indices, providing a measure of the consistency between the archaeological phasing and the radiocarbon results. Again, this has a threshold value of 60%. The program is also able to calculate distributions for the dates of events that have not been dated directly, such as the beginning and end of a continuous phase of activity (which is represented by several radiocarbon results), and for the durations of phases of activity or hiatuses between such phases.

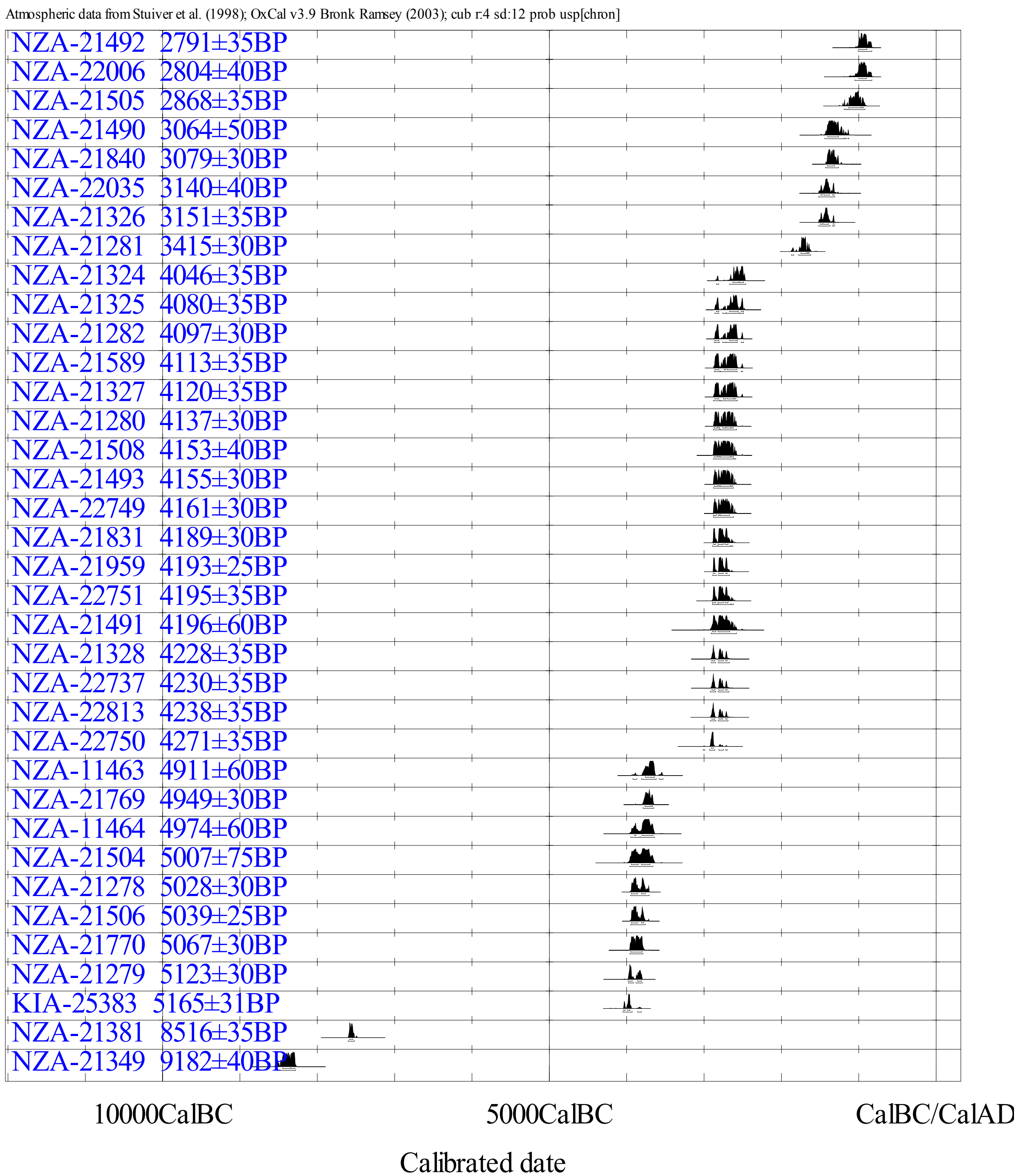

Figure 1. Radiocarbon distribution of the early prehistoric results (excluding late glacial)

2 EARLIER PREHISTORIC PROGRAMME

2.1 Allerød

The lateglacial interstadial 'Allerød' soil was exposed in section, and was recognised as such from its stratigraphic location, confirmed by environmental analysis (mollusca and soil micromorphology). The sequence of an organic soil sealed by cold stage calcareous deposits has been noted elsewhere in southern England, and is typical of other Lateglacial interstadial sequences such as Watcombe Bottom, Ventor, Isle of Wight (Preece *et al.* 1995); Brook (Kerney *et al.* 1964; 1980) and Holywell Coombe, Kent (Preece 1991; 1994; Preece & Bridgland 1998); Pitstone, Buckinghamshire (Evans 1966; 1986; Valentine and Dalrymple 1976; Green *et al.* 1984), Westhampnett, West Sussex (Allen and Powell forthcoming) and Burleston Down, Dorset (Allen 1999).

Unlike all other 'Allerød ' phase soils in Kent, the soil at White Horse Stone was excavated in part under archaeological conditions (like Westhampnett; Allen and Powell forthcoming). The 'Allerød' (context 4934) was reported to contain both flints and charred plant remains, indicating human activity rarely seen in such deposits. On examination, the flints were proven to be natural frost shatters (Gardiner pers. comm.), nevertheless dating the charcoal would facilitate its comparison with a number of other dated 'Allerød' soils in southern England (Figure 1; Table 3). Carefully scrutiny of the sample flots (sample 321) by Mark Robinson revealed no wood charcoal and he was only able to recover two fragments of charred uniseriate dicotyledenous material (in this case woody material, but it could be secondary thickening from the base of herbaceous plant rather than the wood of a shrub or tree). Although both fragments were submitted for AMS dating, they were too small, so were combined and a single result obtained.

The result of 11,130±48 BP (NZA-22046) from White Horse Stone falls comfortably within the expected date range (13,000-11,000 cal BC) calibrating to 11500-10700 cal BC; a range of 600 years, and compares well with other determinations for Allerød buried soils reviewed by Preece (1994), and with dates of Lateglacial human activity (Housley 1991; Housley *et al.* 1997). The radiocarbon results from other sites in southern England (listed below) are on short-lived material, or where they are on unidentified charcoal we can suggest that this is not long-lived material because of the limited duration and climatic/environmental conditions that prevailed during the Allerød (Windermere) Interstadial.

When those results for Kent are modelled (Figure 2a; excluding that from Pepper Hill which was not in a stratified context), we can see that the dated phase starts at *11800-11580 cal BC (95% probability; Allerød start;* Figure 2a) and ends at *11150-10750 cal BC* (*95% probability; Allerød end;* Figure 2a) with a duration of only *c* 500-700 years.

Despite the fact that these results are close to the radiocarbon 'plateau' effect in the curve at *c.* 10,000 BP (Amman and Lotter 1989) which gives results of near-constant age (Becker and Kromer 1991; Becker 1993), all the results here clearly fall before that plateau and are unaffected.

Nevertheless, atmospheric radiocarbon variation during the Lateglacial (Pilcher 1991), resulting from the rapid climatic change, may result in fluctuations in ^{14}C measurements of 1000 radiocarbon years during the 'Allerød' phase (Stuiver *et al.* 1991). These radiocarbon problems are beyond our control, but their implications must be borne in mind particularly when comparing determinations of 'Allerød' sequences in southern England. Changes in atmospheric radiocarbon could separate these dates and provide numerous and large 'wiggles' in the radiocarbon curve which would tend to result in a number of separated 'spikes'.

The single determination from White Horse Stone is younger than those from a number of other Allerød sites (Figure 2), and the chronological model provides a date of *11450-11020 cal BC (NZA-22046, 95% probability)*. This places the White Horse Stone sequence late in the Allerød phase of the Lateglacial Interstadial transition, when temperatures were cooling, and before the onset of severe colder conditions of the Loch Lomond re-advance (Younger Dryas). The dating is consistent with a later immature Allerød phase soil. That is, this soil belongs to the latter part of the Lateglacial Interstadial transition (*cf.* Lowe and Gray 1980).

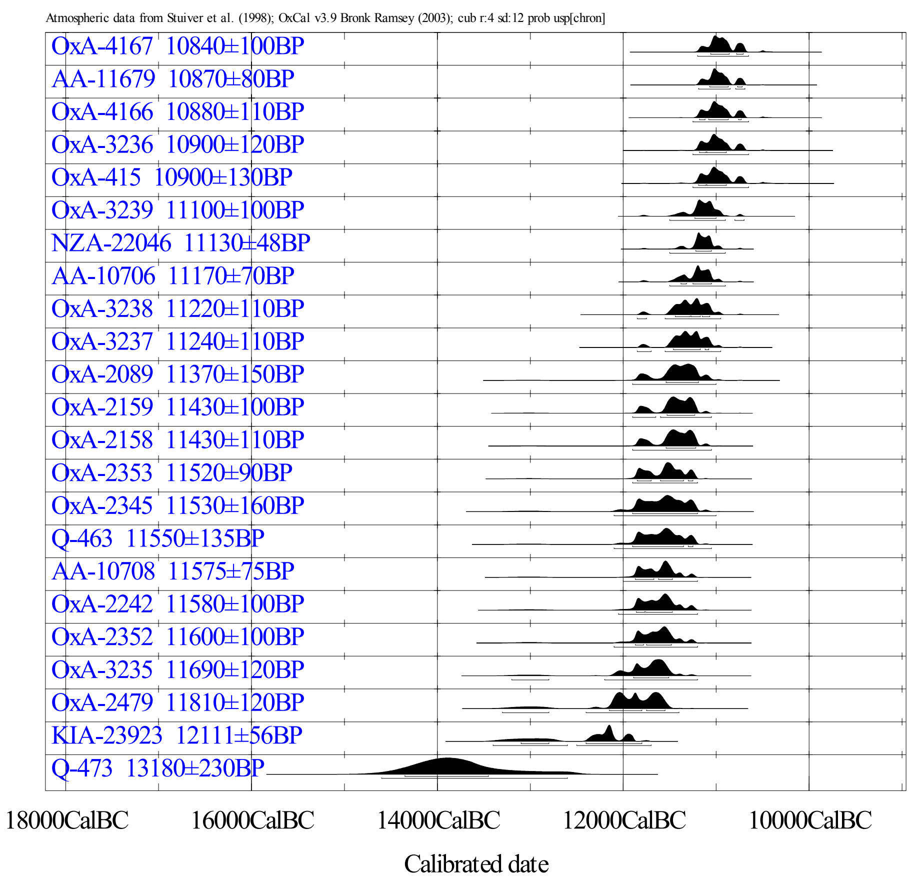

Figure 2. Radiocarbon distributions of other dated 'Allerød ' soils in southern England

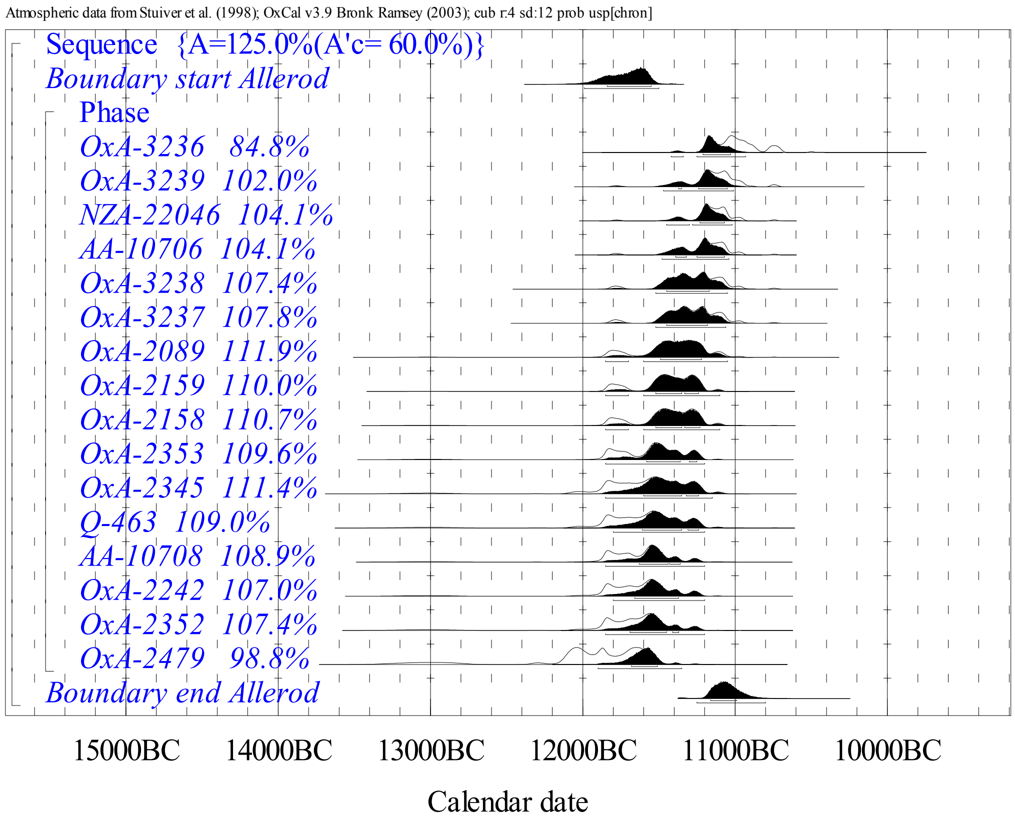

Figure 2a. The posterior density distributions of the modelled sequence of Allerød results for Kent.

Site	***material***	***lab no.***	***result BP***	***cal BC***	***range***
Westhampnett, W. Sx	*Pinus* + *Betula*	OxA-4167	10,840±100	11200-10650	550
Westhampnett, W. Sx	*Betula* + Rosacea	AA-11679	10,870±80	11190-10690	500
Westhampnett, W. Sx	cf. *Betula*	OxA-4166	10,880±110	11250-10650	600
Upper Halling, Kent	cf. *Betula*	OxA-3236	10,900±120	11250-10650	600
Pitstone, Bucks	charcoal	OxA-415	10,900±130	11250-10650	600
Dover Hill, Kent	*Betula*	OxA-3239	11,100±100	11500-10700	800
White Horse Stone, Kent	uniseriate dicotyledenous material	NZA-22046	11,130±48	11500-10900	600
Brook borehole III, Kent	charcoal	AA-10706	11,170±70	11500-10900	600
Dover Hill, Kent	*Betula*	OxA-3238	11,220±110	11850-10950	900
Upper Halling, Kent	cf. *Betula*	OxA-3237	11,240±110	11850-10950	900
Holywell Coombe, Kent	charcoal	OxA-2089	11,370±150	11900-11000	900
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2159	11,430±100	11900-11050	850
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2158	11,430±110	11900-11050	850
Holywell Coombe, Kent	'reduced carbon'	OxA-2353	11,520±90	11900-11200	700
Holywell Coombe, Kent	*Carex/Scirpus* fruits	OxA-2345	11,530±160	12100-11000	1100
Dover Hill, Kent	charcoal	Q-463	11,550±135	12100-11050	1050
Brook (Pit A), Kent	*Betula*	AA-10708	11,575±75	12000-11200	800
Holywell Coombe, Kent	charcoal	OxA-2242	11,580±100	12050-11200	850
Holywell Coombe, Kent	humic acids	OxA-2352	11,600±100	12100-11200	900
Watcombe Bottom, IoW	charcoal	OxA-3235	11,690±120	13200-11200	2000
Holywell Coombe, Kent	*Arianta* snail shell	OxA-2479	11,810±120	13300-11400	1900
Pepper Hill, Kent	charred parachyma	KIA-23923	12,111±56	13400-11700	1700
Holborough, Kent	charcoal	Q-473	13,180±230	14600-12600	2000

Table 3. Radiocarbon determinations for Allerød buried soils (data from Evans 1986; Kerney 1963; Preece 1991; 1994; Preece & Bridgland 1998; Preece et al. *1995; Allen & Powell forthcoming)*

2.2 Mesolithic events

Two of the postholes (4834 and 5113) from the Early Neolithic longhouse contained, among the poor charcoal assemblages, fragments of *Pinus* sp. charcoal This is a species (*Pinus sylvestris* – Scots Pine) that occurs in the pre-Boreal and Boreal climatic phases (Allen 2000, table 2), but is succeeded after the later Mesolithic (Atlantic phase), by deciduous woodland (*c* 6300 - 4000 cal BC). It is unknown, or very rare, in Neolithic chalkland environments. Further it has been argued that pine stands cannot survive on thin chalk rendzina soils (Allen 1988, 83), but has been demonstrated to exist on the chalkland in the Mesolithic at Stonehenge (pollen and charcoal evidence; Allen 1995a), in Sussex (Allen 1995b) and elsewhere (Allen and Gardiner 2002).

Neolithic postholes 4834 and 5514 of the longhouse (see Figure 4), contained six and five very small fragments of *Pinus* charcoal respectively with no other species identified. The questions here included, was pine used in activities related to the Early Neolithic structure (ie 3950-3700 cal BC) and, did pine survive in west Kent beyond the Boreal (ie 6300 cal BC)? If we were able to consider them a part of the structure on the basis of their date, then they could help model the date and longevity of the long house, although caution in their inclusion would need to be expressed as this is a circular, and non taphonomic, argument.

Both fragments of charcoal produced determinations that comfortably fall in to the pre-Boreal to Boreal phase. Pine charcoal in posthole 5113 gave a result of 9182±40 BP (NZA-21349) and that in posthole 4834 was 8516±35 BP (NZA-21381) which calibrate to 8530-8280 cal BC and 7600-7520 cal BC respectively. These results fall comfortably with other dated pine charcoal from southern England, excepting two later results which date to the Neolithic or Early Bronze Age, and into the phase of Boreal pine charcoal dates. However they are significantly different as they fail χ^2 (T'= 158; T'(5%)=3.8; ν=1; Ward and Wilson 1978) and therefore probably represent two separate burning events within the Boreal phase.

Location	*Material*	*Lab ref*	*Radiocarbon age (BC)*	*Calibrated date range (2δ) cal BC*
Toadeshole dry valley, Sussex				
hillwash/subsoil hollow	*Pinus* charcoal	OxA-3079	3550±90 BP	2140 - 1680
hillwash/subsoil hollow	*Pinus* charcoal	OxA-3078	3580±80 BP	2140 - 1680
Stonehenge carpark, Wiltshire				
Postpit B	*Pinus* charcoal	HAR-456	8090±140	7500 – 6650
Postpit 9580, tertiary	*Pinus* charcoal	OxA-4920	8400±100	7600 – 7170
Postpit 9850, secondary	*Pinus* charcoal	OxA-4919	8520±80	7750 – 7350
Postpit 9580, secondary	*Pinus* charcoal	GU-5109	8880±120	8300 – 7600
Postpit A	*Pinus* charcoal	HAR-455	9130±180	8800 – 7700
Hambledon Hill, Dorset				
post-hole F279	*Pinus sylvestris* charcoal	OxA-7845	8400±60	7580 – 7350
post-hole F279	*Pinus sylvestris* charcoal	OxA-7846	8480±55	7800 – 7370
post-hole WOWK82	*Pinus sylvestris* charcoal	OxA-7816	8725±55	8200 – 7600
Itford Bottom, East Sussex				
Treehollow	*Pinus* charcoal	BM-1544	8770±85	8250 – 7600
White Horse Stone, Kent				
posthole 4834	*Pinus* charcoal	NZA-21381	8516±35	7600 – 7520
posthole 5113	*Pinus* charcoal	NZA-21349	9182±40	8530 – 8280
Strawberry Hill, Wilts				
Ditch 15	*Pinus* charcoal	OxA-3040	9350±120	9150 – 8250

Table 4. Dated pine on the chalklands of southern England (sources Allen 1992; Allen 1994; Allen and Bayliss 1995; 1995a; Mercer and Healy forthcoming)

These radiocarbon results, therefore, do not relate to the Early Neolithic longhouse, but do indicate burning events in the earlier Mesolithic. They are presumably related to human activity, rather than natural forest fires like those at Ussello which produced large quantities of charcoal (Lanting and Mook 1977; Jacobi pers. comm.) The earlier burning event (posthole 5113) is approximately coeval with the dated event at Sandway Road at 8340-8030 cal BC (9318±50 BP, NZA-11934), but does not represent the same event as it too fails χ^2 (T'=4.5; T'(5%)= 3.8; ν =1; Ward and Wilson 1978) indicating that all three dated events are separate chronological incidences. Other Mesolithic pine dates (Table 4) have often been associated with dug features, charcoal, but no, or very few, flint artefacts (e.g. Stonehenge postpit, Strawberry Hill ditch, Hambledon Hill postholes).

2.3 Early Prehistoric events

The early prehistoric events (ie pre-Iron Age), at a very general level, can be seen to fall into four quite distinct phases of dated events separated by periods containing no radiocarbon dated events. These broad phases are i) Mesolithic, pre 7500 cal BC; ii) Early Neolithic *c* 4000-3600 cal BC, iii) Later Neolithic *c* 2900-2500 cal BC; iv) Middle and Later Bronze Age *c* 1500-800 cal BC. These are plainly displayed in the radiocarbon distributions (Figure 1).

2.3.1 Early Neolithic Longhouse

One of the aims of the dating programme was to provide an absolute chronology for the date and duration of the longhouse, and providing this was a challenge. As discussed above, none of the postholes contained charred timbers, and the hearths, although within the structure, may have been coincidental in their location and relate to late Neolithic pits which lay in the same area, or indeed other activity. In order to attempt to date this structure, samples from both postholes and hearths within it were selected. Where postholes were sampled, both the context and the material were examined. Charcoal selected was identified and only young or round wood submitted, and charcoal that was assumed to have been a part of the burning and cultural activity within the structure (excepting *Pinus* charcoal – see above). Animal bone was selected on the same basis, that is, it was assumed to have been discarded during the use of the structure, and to have found its way into voids within the postholes, rather than having been placed in the posthole either before construction or after demolition. In order to identify wayward intrusive or residual items, multiple samples from three postholes, and single samples from a further two were submitted (4817 (x3), 4820 (x2), 4902, 5008 (x2), and 5280), see Table 1. Where possible, duplicate materials which was entirely different were selected (ie charred plant remains vs animal bone or charred cereal vs wood charcoal) in an attempt to date different (but coeval) events represented by non post material within the postholes. In addition to the nine samples from postholes, samples of charred plant remains were submitted from two hearths (4830 and 4874) (Figure 4).

The results

Included within this submission were three samples of calcined bone. One of these failed (from posthole 5008). However, eleven determinations were made (Table 1), and all, except one, fall in the earlier Neolithic, and most within a range of 3960-3640 cal BC (2 sigma) (Figure 3). Two results fall outside this range. A sample of young wood Maloideae charcoal from posthole 5008 gave a result of 4137±30 BP (NZA-21280) calibrating to 2880-2580 BC. This clearly falls into the Grooved Ware phase of activity on the site and must be intrusive and can be discounted. The other sample from this posthole failed. This posthole is shallower than most others and probably does not belong to the structure (Figure 4). Other than this, only one of the determinations falls outside the main grouping.

That is young wood Maloideae charcoal from heath 4830, near the centre of the structure, which produced a determination of 5165±31 BP (KIA-25383) which is 4050-3810 cal BC. Although this seems very early in the structure's use, or may even indicate fires at this location *prior* to the construction of the longhouse around it, the result, when placed in the chronological model, is consistent with others from the house (see below). Although the sampled feature contains one fragment of Grooved Ware (2g) this can be discounted as being intrusive on a site busy with other Grooved Ware activity.

A second hearth (4874) gave a date of 3950-3760 cal BC (5039±25 BP, NZA-21506) that falls comfortably amongst the other dated samples. Although the dated grain is undoubtedly a part of the longhouse phase, the hearth itself contained 49 sherds of Grooved Ware (178g). The hearth contained burnt soil and burning, but there was not a single discrete patch nor lens of charcoal, just specks that were assumed to be relict charcoal fragments from the hearth. Although the pottery itself is not burnt, the feature form and configuration is one found elsewhere on this site in the Grooved Ware phase. Thus we consider the feature to belong to the Grooved Ware phase, but the dated charcoal to be residual from the Early Neolithic longhouse.

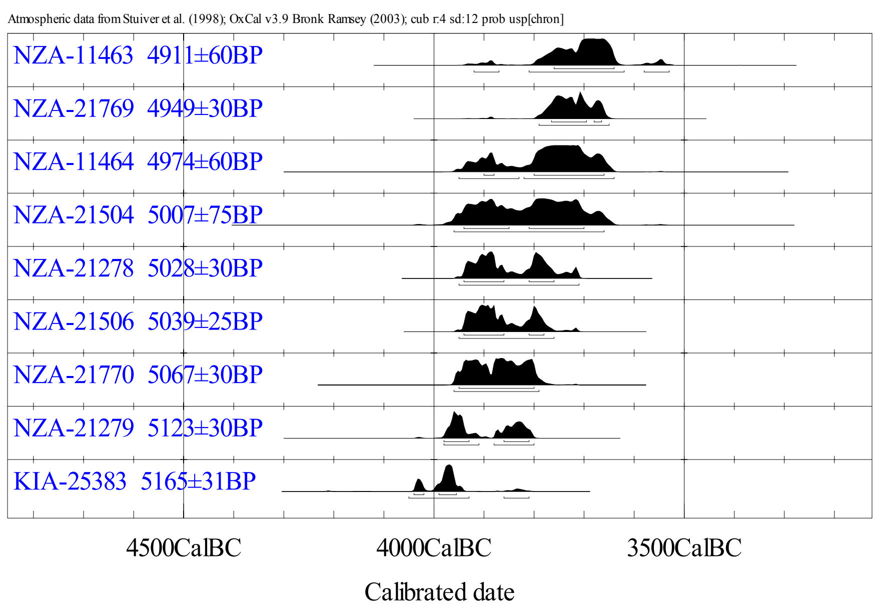

Figure 3. Radiocarbon determinations from the longhouse (excluding the late Neolithic result from feature 5008)

On the assumption that the remaining material derives from a single phase of activity related to the use of the longhouse, two sets of information can be used to model the date and use of the longhouse: that from the postholes, and that from the hearths. The dated items from the postholes are not structural timbers, but are discarded domestic material often originating from the hearths. On this basis material from both hearths and postholes can be included in the model, and nine results are applicable.

The chronological model (Figure 5) indicate a build date of *4100-3820 cal BC* (*build*: Figure 5) and end date of *3780-3550 cal BC* (*disuse*; Figure 5) with an agreement of over 85% give the use of the house of between 70-500 years (95%) and 160-370 years (68%); ie a span of around 300 years. It is therefore likely to belong to the first quarter of the fourth millennium BC (3950-3700 cal BC) and is unlikely to have been built before 4000 cal BC (Figure 5). Excludnhg the result from hearth 4830 (Maloideae charcoal, KIA-25383) on the basis that it may predate the structure (Figure 3) makes little difference to the results.

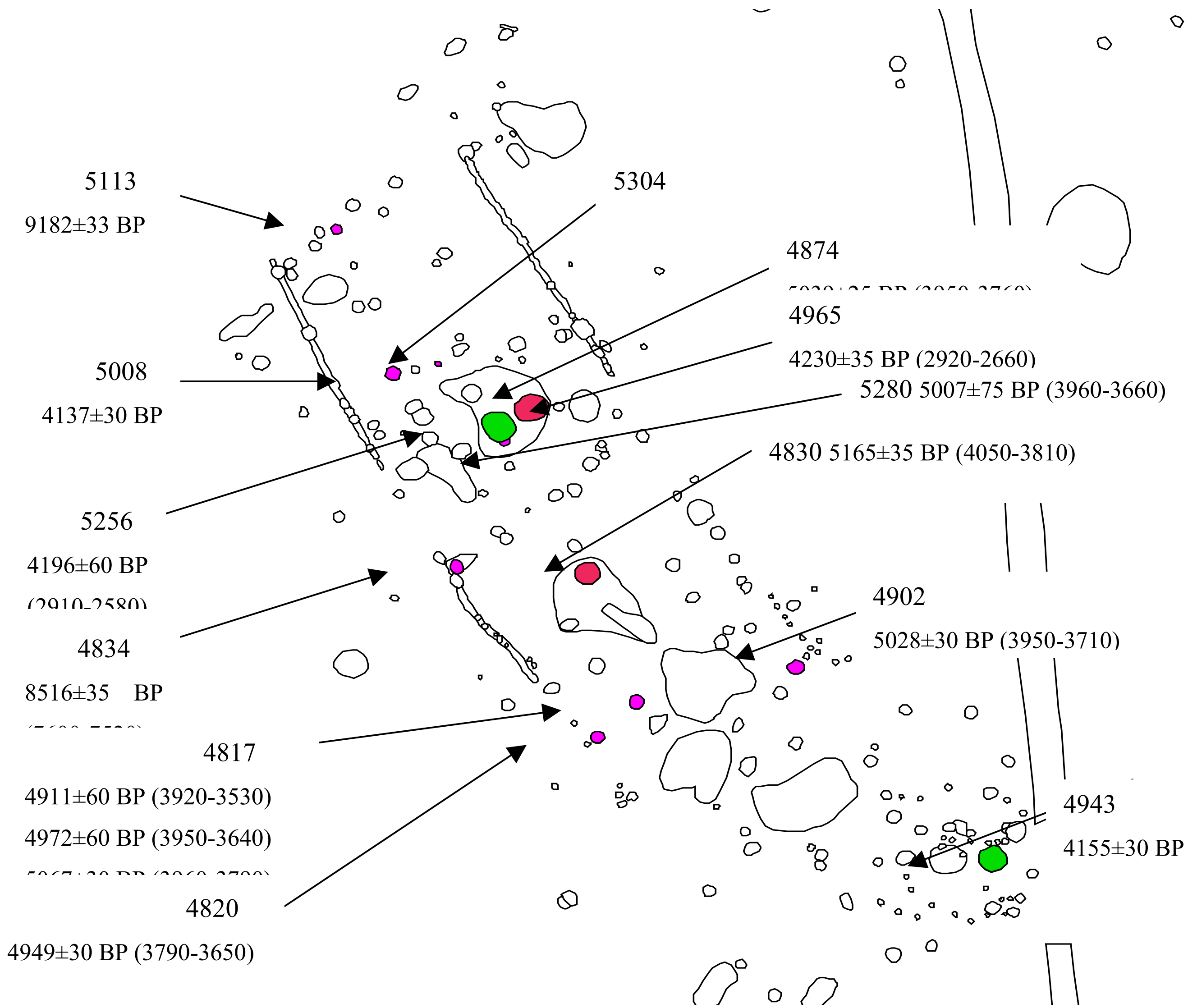

Figure 4. Radiocarbon determinations from the longhouse, and features in the same area. Purple = longhouse postholes; Red = hearths - LN?; Green = GW pits

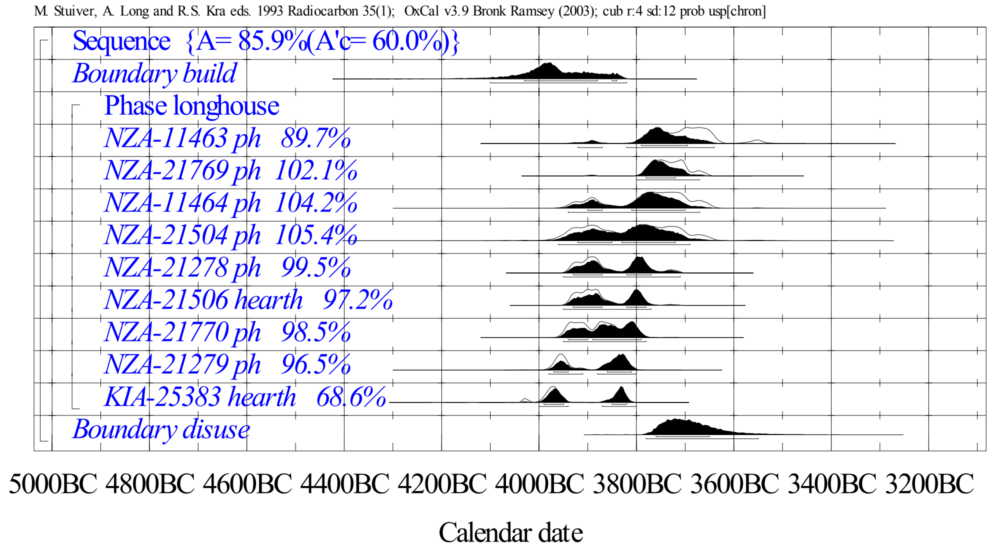

Figure 5. Chronological model showing the posterior density results of accepted results from the long house

2.3.2 Decorated bowl related features and Peterborough Ware related pits

Two samples of charred remains (one charred hulled barley *Hordeum* grain, and charred *Prunus* charcoal) were submitted from the postpipe (5417) of posthole 5415, associated with a large deposit (22 sherds) of Early Neolithic pottery including Decorated Bowl and fragments of fired clay resembling a cylindrical loomweight, a type usually found in later Bronze Age contexts. The pottery was anticipated to date to *c* 3600-3300 cal BC, and the purpose of the result was to establish whether the pottery was of this date or if it, and the feature, were contemporaneous with, rather than later than, the longhouse.

The results clearly demonstrate that the charred remains from the sample (sample 891) did not belong to a single event. The hulled barley (3064±50 BP, NZA-21490) produced a Middle Bronze Age date of 1440-1130 cal BC while the *Prunus* charcoal (3415±30 BP, NZA-21281) gave an Early Bronze Age date of 1870-1620 cal BC. It is likely that neither of these charred remains nor the pottery were functionally associated with each other or the posthole. The dated events in the posthole are nearly two millennia later than the longhouse. The stratigraphic and taphonomic assumptions concerning the association of the pottery and charred remains with the feature were incorrect. The later result (NZA-21490) is, however, consistent with the date of the loomweight, which would support the assumption that the Early Neolithic pottery was residual or redeposited. The Middle Bronze Age date for hulled barley is useful and is discussed later.

Features containing Peterborough Ware were isolated at Pilgrims Way. Pit 711 contained a clearly deliberate deposit with a large portion of a Peterborough Ware vessel and worked flint. Unfortunately, although charred remains existed in this feature and the context containing the deliberate deposit (context 709), these were isolated hazelnuts which we could not be sure belonged to, or with, the placed deposit. No submission was seen to be feasible.

2.3.3 Grooved Ware phase features

A series of Grooved Ware related features were selected for dating. Aims included dating i) the Clacton style Grooved Ware to determine date and duration, 2) deliberate deposited packages to confirm that they were a part of the Grooved Ware activity phase, and 3) other undated features and structures. Further Grooved Ware results were provided as a result of dating other structures (eg posthole 5009 of the Neolithic longhouse) and, when combined, these data may provide some indication of the duration of the Grooved Ware phase (Figure 6) and determine if i) these features constituted a discrete phase of distinct activity in relation to other dated events, and ii) if that activity was broadly contemporaneous and short-lived (ie within 200 years), or was spread throughout the currency of Grooved Ware. In particular, as features were present at both Pilgrims Way and White Horse Stone (see Figure 6) did they represent contemporaneous or different-age activity? Many of these features were characterised by the deliberate placement of assemblages of animal bone (Table 1), and these were selected for dating, as the association of the dated material with the pottery was clear and represented a single depositional event. Samples from ten pits (904, 911, 913, 958, 4943, 4965, 4994, 5072, 5125, and 5256) were submitted, with two pits providing multiple submissions (pit 958 x 2, and pit 5072 x 3).

A series of other pits and three hollows contained assemblages of finds similar to those in the Grooved Ware pits but lacking pottery (pit 952, treehole 861). These were dated to see if they were a part of this same phase and activity.

A round structure to the south of the longhouse was considered to belong to this phase on the basis of a few sherds of Grooved Ware pottery, but some Early Neolithic pottery was also present. Not only was the pottery sparse, but nothing suitable was recovered from any of the postholes, and so this structure is dated purely on association and assumption.

Two further features are included with this group on the basis of their results: charcoal from posthole 5009 of the longhouse, and bone from pit 5125 (associated with Food Vessel pottery). Seventeen results were obtained from 14 features (Table 1; Figure 6).

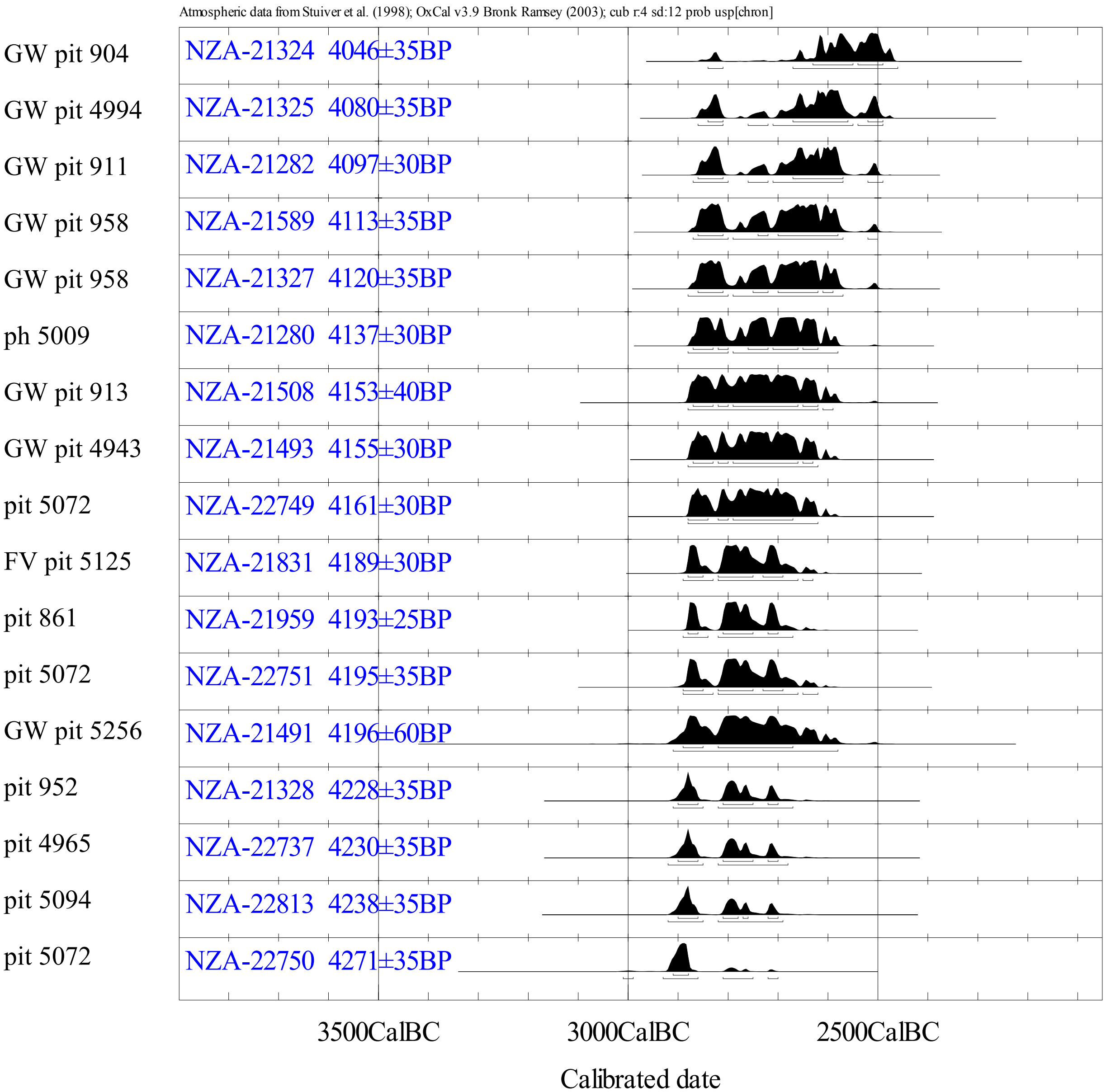

Figure 6. Radiocarbon distributions from Grooved Ware pits, and other features which have produced 'Grooved Ware' dates. (GW= Grooved Ware; FV= Food Vessel, features without an ascription were aceramic and were 'undated')

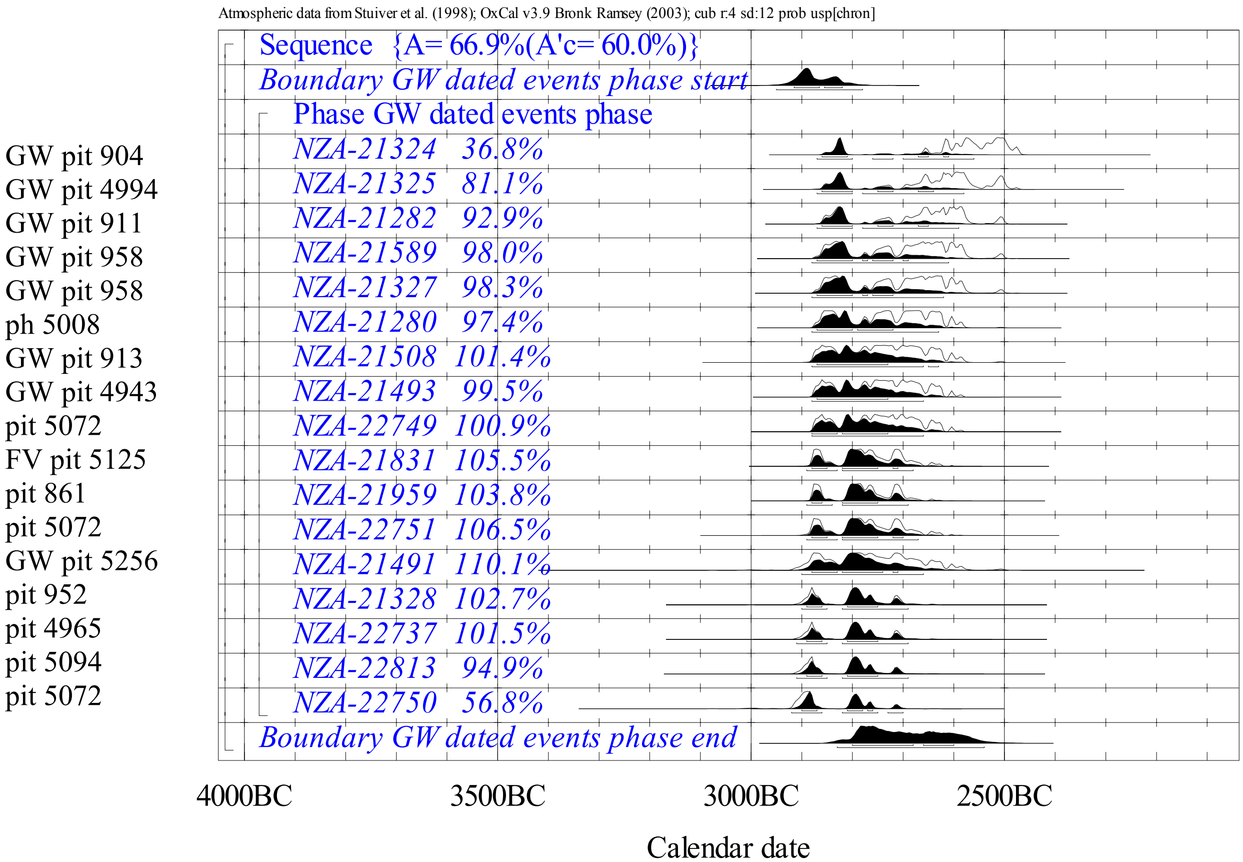

Figure 6a. Chronological model showing the posterior density distributions of all dated Grooved Ware events.

Overall the chronological model of the dated elements indicate a dated phase starting *at 2950-2780 cal BC (95% probability; GW dated events phase start*) and ending at *2830-2550 cal BC* (*95% probability; GW dated events phase end*: Figure 6a) spanning only *c* 50-230 years, and we can generally consider this phase to date from *c* 2900-2600 cal BC. No indication of distinct phases or chronological separation can be discerned within this range, largely as a result of the radiocarbon plateau and gentle curve between *c* 2950 and *c* 2600 cal BC which encompasses most results from 4250 to 4000 BP (Figure 7). The results do, however, enable this phase to be seen as independent within the dated phases of the site (see Figure 1). The results may, however, indicate episodes that could occur within a short period of time (ie <100 years), but for which the 'plateau' on the calibration curve (Figure 7) has given same-age results. Superficial examination of the radiocarbon distributions (Figure 6) seems to suggest that four dated events fall earlier than the Grooved Ware phase (WHS pits 4965, 5072 and 4995; PIL pit 952), and that two 'later' events exist (WHS pit 4994 and PIL pit 904 (at PIL98). The chronological analysis shows that the whole group form a consistent sequence (agreement =66.9%), and that these are not chronologically different from the main phase of activity (Figure 6a).

The results do, however, confirm that a number of packages of placed bone in pits and treehollows (features 861, 952, 4965, 5072 and 5094) do form a part of the Grooved Ware phase (Figure 6a), and thus other similar deposits can be assumed to belong to this phase.

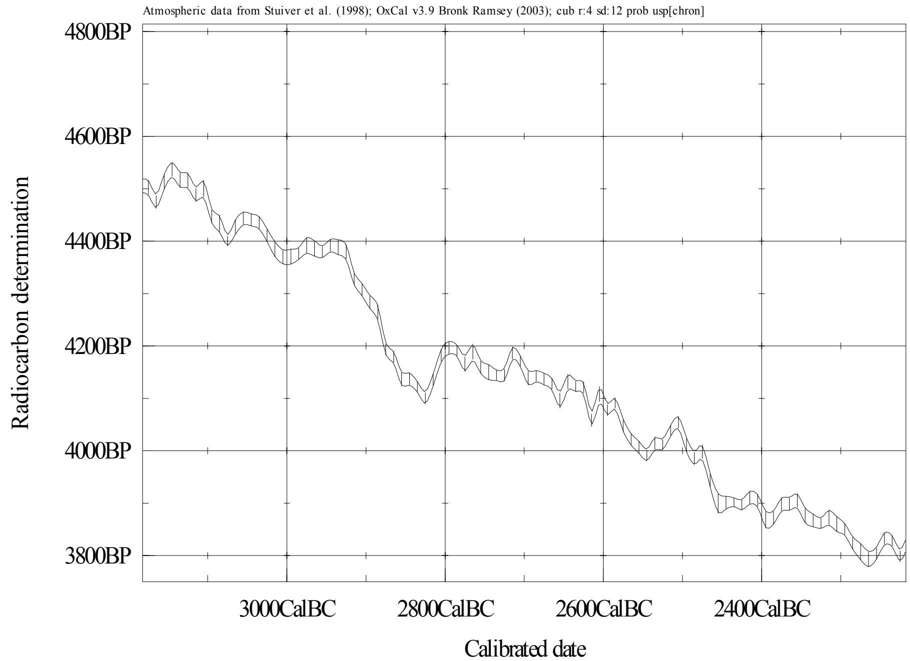

Figure 7. Radiocarbon calibration curve covering the Grooved Ware phase 2900-2400 cal BC.

Clacton style Grooved Ware

A series of features contained Clacton style Grooved Ware (*c* 2900-2400 cal BC), and eight samples from seven pits were selected to date both the features and the pottery to determine the duration of this ceramic phase. The posterior density distributions (Figure 7a) and chronological analysis indicate that this phase starts at *2940-2620 cal BC* (*95% probability: GW pottery phase start*) and ends at *2680-2420 cal BC* (*95% probability; GW pottery phase end*) with a duration of up to 220-430 years.

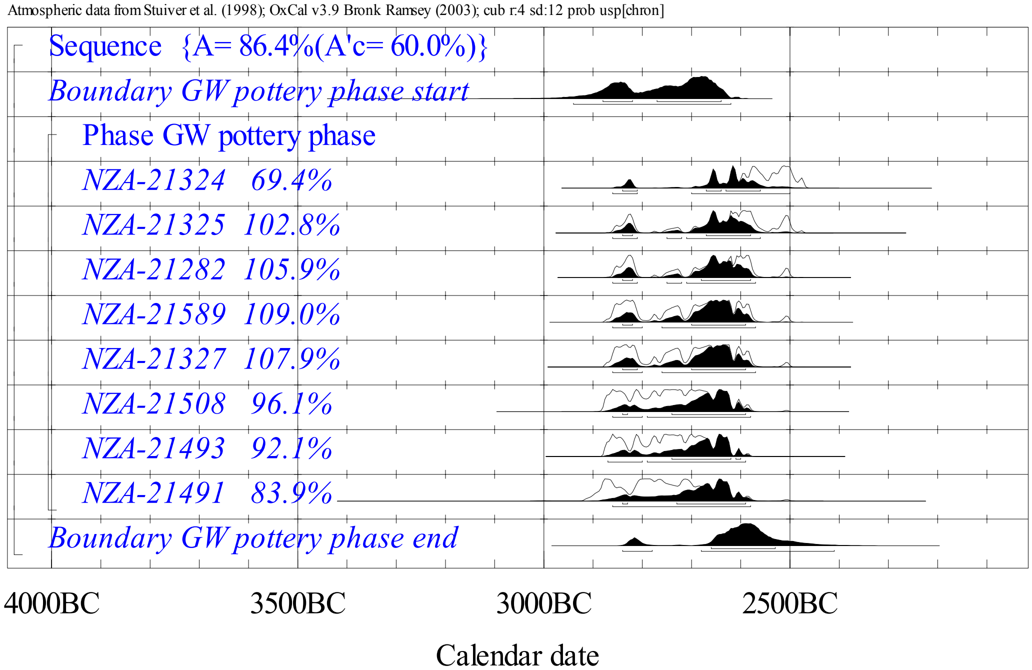

Figure 7a. Posterior density distribution of the Clacton Grooved Ware pottery

Grooved Ware activity at White Horse Stone (WHS) and Pilgrims Way (PIL)

A number of events were seen at both Pilgrims Way and White Horse Stone. Several were dated and these chronologically modelled to determine if they were contemporary and could be considered a single 'Grooved Ware site'. Within each site those events specifically associated with Grooved Ware pottery were modelled as a phase separate from other Grooved Ware dates (Figure 7b).

	Number of results	***Start date***	***End Date***	***Duration 95% (68%)***
White Horse Stone: Grooved Ware pottery	3	3300-2600	2850-2250	0-850 (0-650)
White Horse Stone: Grooved Ware events	7	3000-2710	2880-259	0-360 (0-180)
White Horse Stone: Grooved Ware Phase	10	2980-2760	2860-2560	
Pilgrims Way: Grooved Ware pottery	5	2980-2580	2680-2310	0-600 (0-290)
Pilgrims Way: Grooved Ware events	2	3180-2710	2880-2430	0-600 (0-320)
Pilgrims Way: Grooved Ware Phase	7	3020-2690	2839-2390	
Grooved Ware Phase	17	2950-2780	2830-2550	30-360 (50-250)

Table 5. Summary of Grooved Ware dating

The phases of activity of each site form a single sequence (agreement = 81.6%) indicating that the activity in these two areas is coeval (Figure 7b).

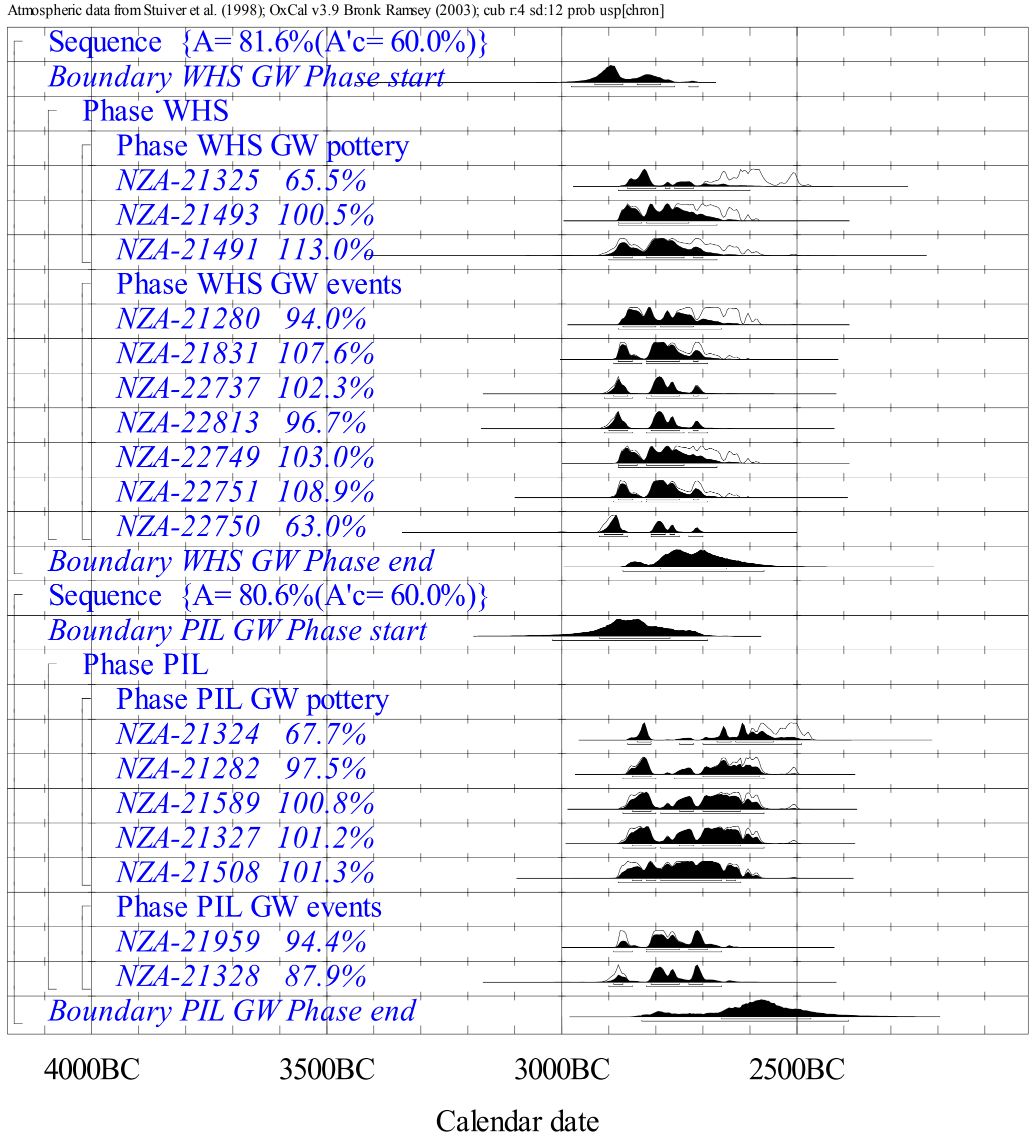

Figure 7b. Chronological model for Grooved Ware dated pottery and Grooved Ware events at White Horse Stone (WHS) and Pilgrims Way (PIL)

Specific relationships with the Grooved Ware features

Several very specific chronological relationships were examined. The occurrence of aurochs was considered to be of interest and, in particular, results were tested to confirm that these were a part of the dated phase and belonged to the Grooved Ware activity rather than being curated or 'heirloom' items. Determinations from auroch vertebrae (4120±35 BP, NZA-21327) and cattle phalanx (4113±35 BP: NZA-21589) in pit 958 are indistinguishable at the 95% confidence limit (T'=0.9; T'(5%)=3.8; v=1; Ward and Wilson 1978), and demonstrate that the aurochs bone was contemporary with the cattle at 2870-2570 cal BC and was not a curated item.

Hollow 5073, with three determinations, provides some superficially interesting chronological relationships (Figure 8).

pit 5072, pig scapula

pit 5072, cow calcaneum

pit 5072, cow skull

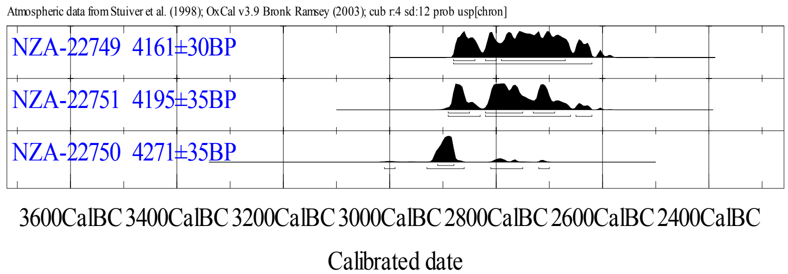

Figure 8. Radiocarbon distributions from pit 5072.

Two determinations from pig scapula (4161±30 BP, NZA-22749) and cow calcaneum (4195±35 BP, NZA-22751) were individual isolated elements with the same single fill (5073) of the pit and are indistinguishable at the 95% confidence limit (T'=0; T'(5%)=3.8; ν=1; Ward and Wilson 1978). The cow calcaneum, however, may have been apart of an articulated cattle foot over which a cow skull was placed. The cow skull in the same deposit produced a result (4271±35 BP, NZA-22750 - in fact the oldest result from the 'Grooved Ware phase') slightly older than the calcaneum on which it was placed. However all three items pass χ^2 (T'=5.8; T'(5%)=6.0; ν=2), and indicate that the skull is a part of this single event (combined date 2890-2690 cal BC). It is not curated as skulls and bone items at Stonehenge (Allen and Bayliss 1995) or Irtlhingborough (Healy *et al.* forthcoming) were, as these items were *c* 375 years older than the deposit of feature in which they were placed.

The isolated skull from pit 5072 was also compared with cattle bone representing more than one individual in the nearby Grooved Ware pit 4994 which contained no skull, but which did contain a chopped atlas vertebra indicating that one of the animals represented had been beheaded. The cattle skull in pit 5072 (4271±35 BP) could not belong to the headless cattle bones in pit 4994 (4080±35 BP), as they fail a χ^2 test (T'=14.9; T'(5%)=3.8; ν =1) and are not part of the same event (Figure 8a). The difference between the two events is between *2930–2860 cal BC (82%).*

pit 5072, cow skull

pit 4994 cow scapula

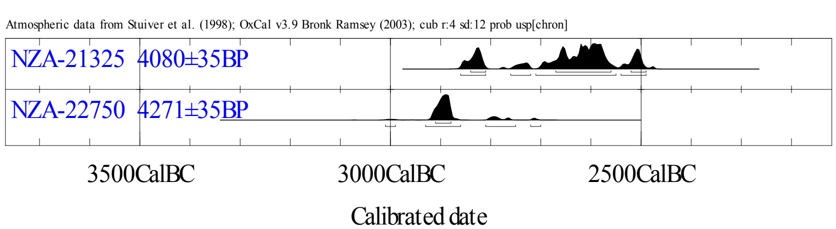

Figure 8a. Radiocarbon distributions of the cow head in pit 5072 and scapula from partial cow skeleton with chopped atlas vertebra in nearby pit 4994.

2.3.4 Food Vessel-associated events

One Food vessel-associated deliberate deposit (*c* 2200-1700 cal BC) was made in pit 5128. A feature adjacent (pit 5125) was undated but contained a similar, albeit pottery-free, range of artefacts, and was considered potentially to be another 'Food Vessel phase' feature. Finding material suitable to date that was clearly associated with deposited artefacts was difficult. Charred remains of flax and several hazelnuts were present, but were not clearly or definitely associated with the artefacts or even in the same context. A cattle bone was, however, considered to be a part of the placed deposits (A. Barclay pers. comm; C. Hayden pers. comm.) and was submitted on this basis. The result 41895±30 BP, NZA-21831 gave a date of 2890-2630 cal BC, clearly at least four, if not seven, centuries earlier than Food Vessels. The dated animal bone, and by inference this feature, was not, therefore, a part of the placed deposit with Food Vessel pottery, but was activity centuries earlier, that belonged with similar deposits in the 'Grooved Ware phase' (see above).

2.3.5 Bronze Age events

A small programme of dates were intended to examine the chronological relationship between the Middle Bronze Age structure at PIL98 (posthole 571) and ditch 4025 at WHS98. As with the Grooved Ware phase two results of previously undated events are also included in this phase; pit 5454 with a deliberate deposit of mainly sheep bones, and charcoal from posthole 5415 with Decorated Bowl (see above for comments). In addition these could be compared with dated cremation related deposits.

Middle and Late Bronze Age non-funerary events (Figure 9)

The activity associated with secondary fill (section 4105, context 4016) of ditch 4025 was dated by a discrete dump of animal bone (3151±35 BP; NZA-21326). The PIL structure lacked any charcoal representing the burnt timbers and was dated using charred *Hordeum vulgare* (barley) grains from the fill of posthole 571, which were assumed to relate to the use of, and activity associated with, the structure. A number of charred barley grains (at least 6) were recovered from the same sample (23) and these are assumed to have fallen down voids between post and earth during the use of the structure (3079±30, NZA-21840). Both indicate Middle Bronze Age activity of 1520-1310 cal BC and 1430-1260 cal BC respectively. They pass a χ^2 test (T'=2.4; T'(5%)=3.5; ν=1; Ward and Wilson 1978), and are therefore part of the same chronological event, and no significant difference between them exists. Indeed the previously undated pit 5454 (3140±40 BP, NZA-22035) calibrating to 1520-1310 cal BC, and barley from posthole 5415 (3064±50BP; NZA-21490) calibrating to 1440-1130 cal BC, all pass χ^2 test (T'=3.8; T'(5%)=7.8); ν=2; Ward and Wilson 1978), indicating that they could have been contemporary.

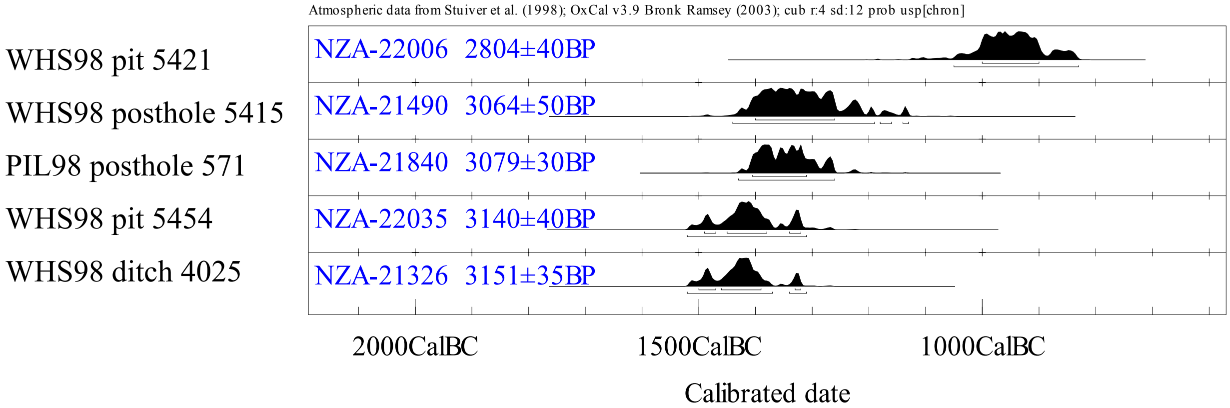

Figure 9. Radiocarbon distributions of Middle and late Bronze Age non-funerary events.

Barley was dated from both postholes 5415 and 571 from WHS98 and PIL98 respectively, and combined with the presence of loomwieghts confirm cultivation and crop processing at both areas at the same time. Barley was the most common crop in southern Britain in the Middle Bronze Age.

Late Bronze Age pit 5421 was dated by sooting and residue on a body sherd (PRN 1563). This formed part of an assemblage which seems to lie at the transition between late Bronze Age plain and decorated phases (Barrett 1980) and which, on ceramic grounds, has been dated to the 9th century cal BC (1000-900 cal BC). The result of 2804±40 BP (NZA-22006) confirms a Late Bronze Age date - 1130-890 cal BC – which is consistent with the ceramic chronology. It also indicates at least a two century gap between the dated Middle Bronze Age events (Figure 9), and fails a χ^2 test (T'=50.96; T'(5%)=9.5: ν=4) when added to the other Middle Bronze Age dated events.

Late Bronze Age cremation burials

Two undated cremation burials by the Pilgrims Way (PIL 98) were dated to determine which phase of activity they belong to. Both cremation burials (852 and 948) were dated with charred onion couch grass tubers thought to be the tinder of the pyre (see Robinson 1988).

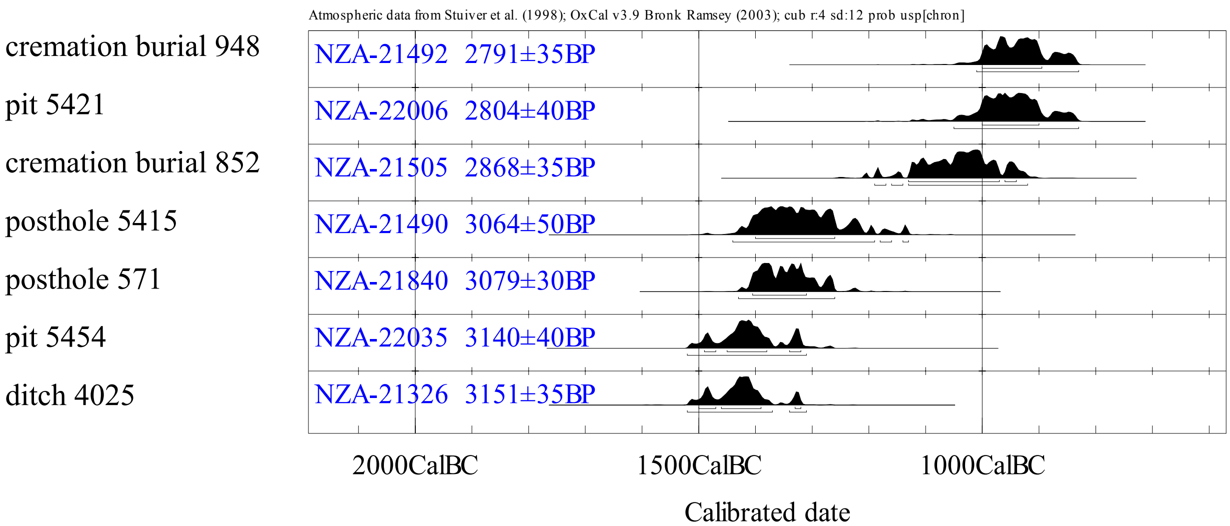

Figure 10. Radiocarbon distribution of Late Bronze Age events (NZA-21494, cremation burial 948; NZA-22006, pit 5421, and NZA-21505, cremation burial 852) compared with the Middle Bronze Age evens shown in figure 9. (Note there is later pottery which embraces the gap between the Middle and Later Bronze Age).

Late Bronze Age cremation burial 852 (2791±35BP, NZA-21492; 1190-920 cal BC) and cremation burial 948 (2868±35BP; NZA-21505; 1010-830 cal BC), both from Pilgrims Way, are statistically indistinguishable (T'=2.4; T'(5%)=3.8; ν=1; Ward and Wilson 1978) and are consistent with the date from pit 5421 at White Horse Stone (Figure 10). If these cremation burials are representative then they form part of the Late Bronze Age activity and are five centuries earlier that the dated Iron Age cremation event.

Middle and Late Bronze Age phases of activity

When these dates are compared, the chronological analysis (Figure 10a) indicate that the middle and late Bronze Age sets of dates belong to separate phases. The three results from the Late Bronze include settlement and cremation events and have an overall agreement of 106.7%, while the four results from the Middle Bronze Age settlement events have an agreement of 111.4%. The model suggests that the Middle Bronze Age dated activity started in *1660-1320 cal BC* (*95% probability; MBA activity start*) probably in the mid 15th century BC, and ended at *1420-1070 cal BC* (*probability 95%; MBA settlement activity end*), in the early 14th century BC. The same model (Figure 10a) suggest that the Late Bronze Age events started at *1350-920 cal BC* (*95% probability; LBA settlement and cremation start*) and ended at *1000-720 cal BC* (*95% probability; LBA settlement and cremation end*), with each dated phase possibly lasting less than 100-150 years.

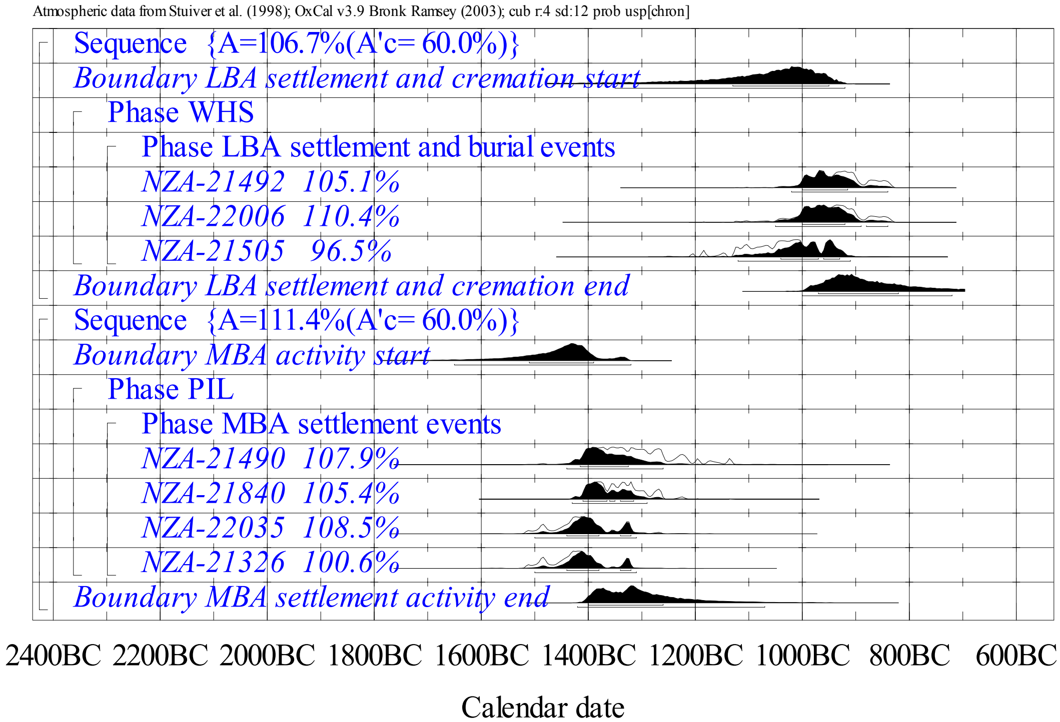

Figure 10a. Chronological analysis and posterior density distributions of the Middle Bronze age and Late Bronze Age dates

3 IRON AGE PROGRAMME

The later prehistoric programme attempted to define any chronological separation between settlement, storage (four post structures and pits), industry (metalworking) and burial (inhumation and cremation) during the Iron Age, and to examine if different designated 'areas' were chronologically related in any way. More detailed questions involved determining if disarticulated human bone in the pits was contemporary with the refuse in the pit or had been curated or retained in any way, and to relate these human remains to the date of more formal burial practices (inhumation and cremation). A number of pits clearly contained different deposits near their base and top enabling an attempt to discern if these events occurred over a long (>250 years) or short (<100 years) timescale. Further, the close association with defined ceramic forms enabled some absolute dating of specific vessel forms. Undertaking this for the Iron Age can be notoriously difficult because of the Early Iron Age radiocarbon plateau at *c* 800/750-400 cal BC (Figure 11).

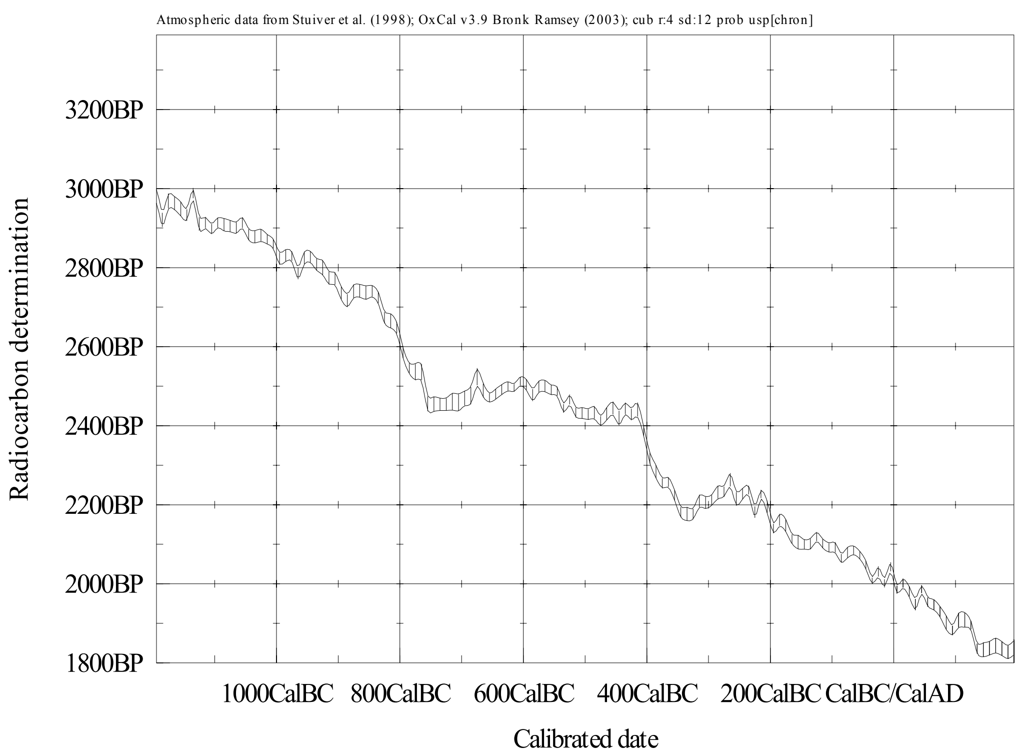

Figure 11. Iron Age radiocarbon plateau

A radiocarbon programme embracing the early Iron Age with the aims above would potentially be unachievable without the ability to analyse the results (see Bayliss above). However, on the basis of the first radiocarbon dates from the assessment (Gu-9089 and GU-9088) and the artefact-dated events (deposits in pits, industrial activity, four post structures, and burials) the Iron Age activities were all suggested to be generally either between 500-300 cal BC or 400-200 cal BC (Hayden pers. comm.).

On this basis 14 determinations were obtained from twelve features (Table 2). These included six pits from four different areas, two industrial features, two four post structures and a single cremation and single inhumation burial.

Despite the archaeological consideration that most dated events were likely to be Middle Iron Age or early Late Iron Age, most of the results were Early Iron Age falling on to the radiocarbon plateau and giving same-age results (Figure 12). However analysis and modelling these results has enabled significant amplification of the chronology and longevity of the use of the site during the Iron Age phase.

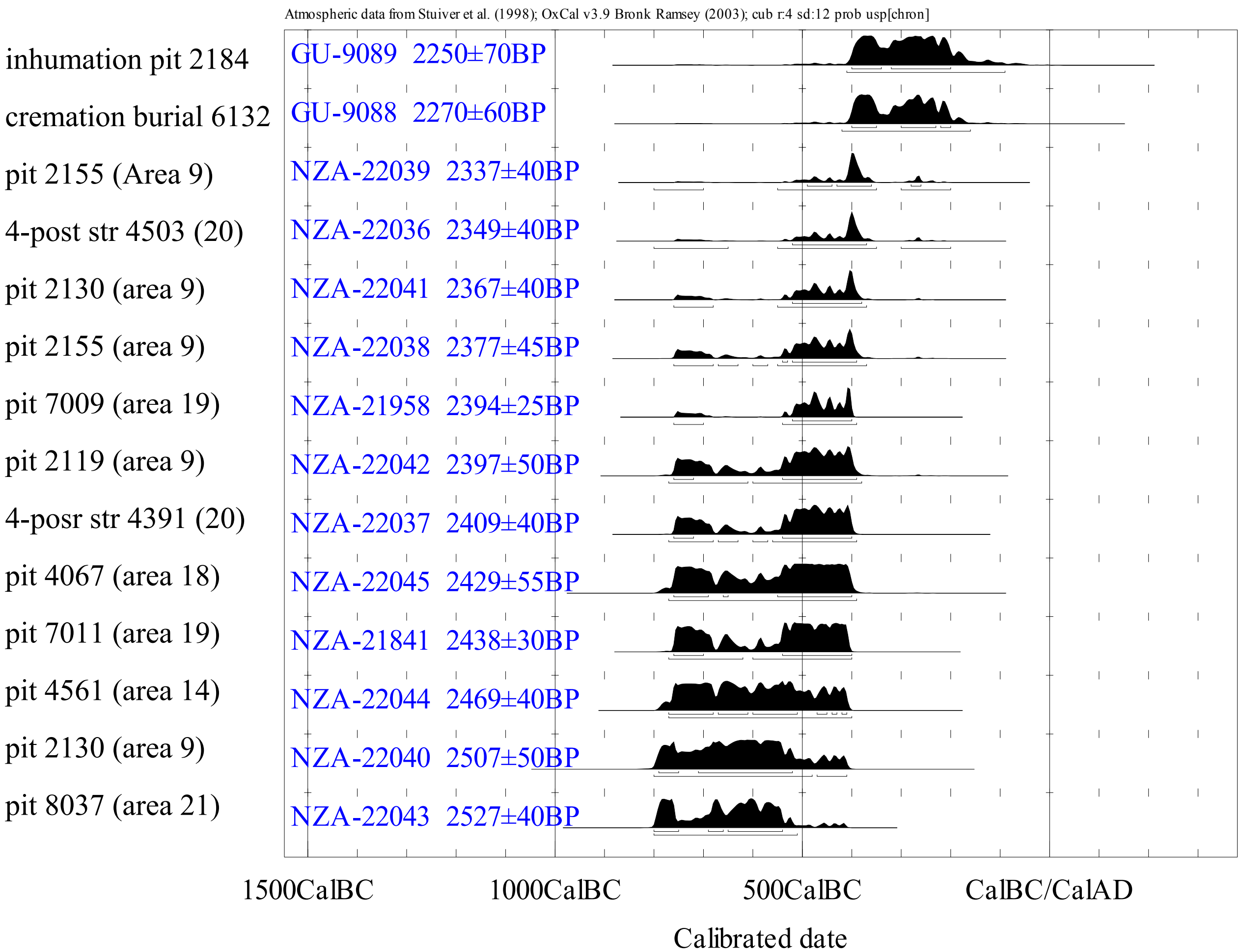

Figure 12. Radiocarbon distributions of the Iron Age results

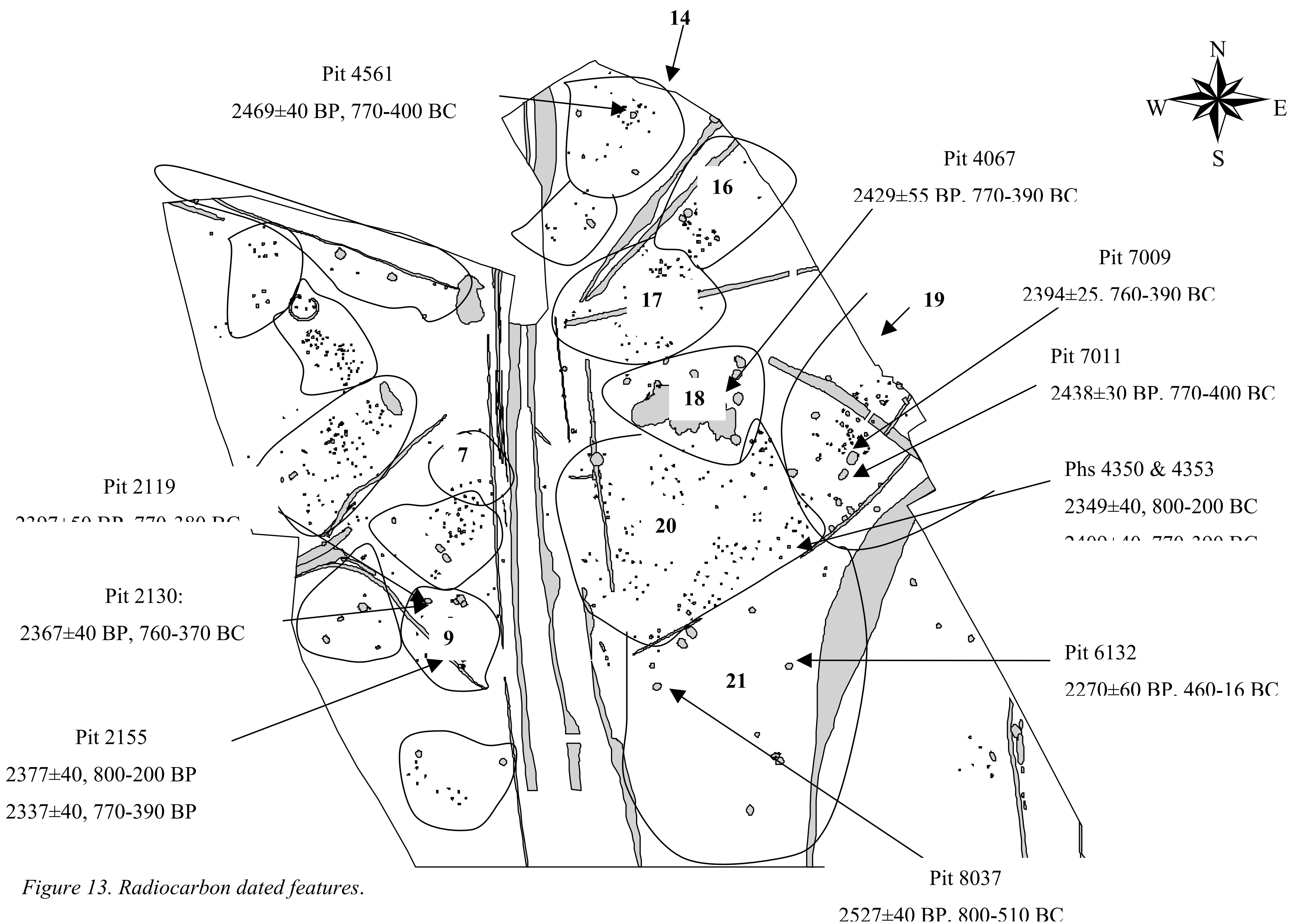

Figure 13. Radiocarbon dated features.

3.1 Iron Age occupation

The span of the results indicate a potential range of occupation from 800-200 cal BC. When analysing the results it is difficult to separate the limited dated elements by area. For instance the dated settlement elements from areas 4, 18, 20 and pit 2155 (area 9) all pass a χ^2 test (T'=9.3; T'(5%)=14.1; ν=7; Ward and Wilson 1978), however when the remaining results from area 9 (pits 2119 and 12130) and area 21 are also consider they fail the χ^2 test. As such we can model the northern area of the site (areas 14, 18, 19, 20 and pit 2155) as a phase and analysis indicates that this starts at *590-400 BC* (*95% probability; start IAN*) and ends at *500-350 cal BC* (*95% probability; end IAN*) (Figure 13a). This phase of activity is, therefore, short-lived, possibly with 100 years (Figure 13b) during the 5th century BC.

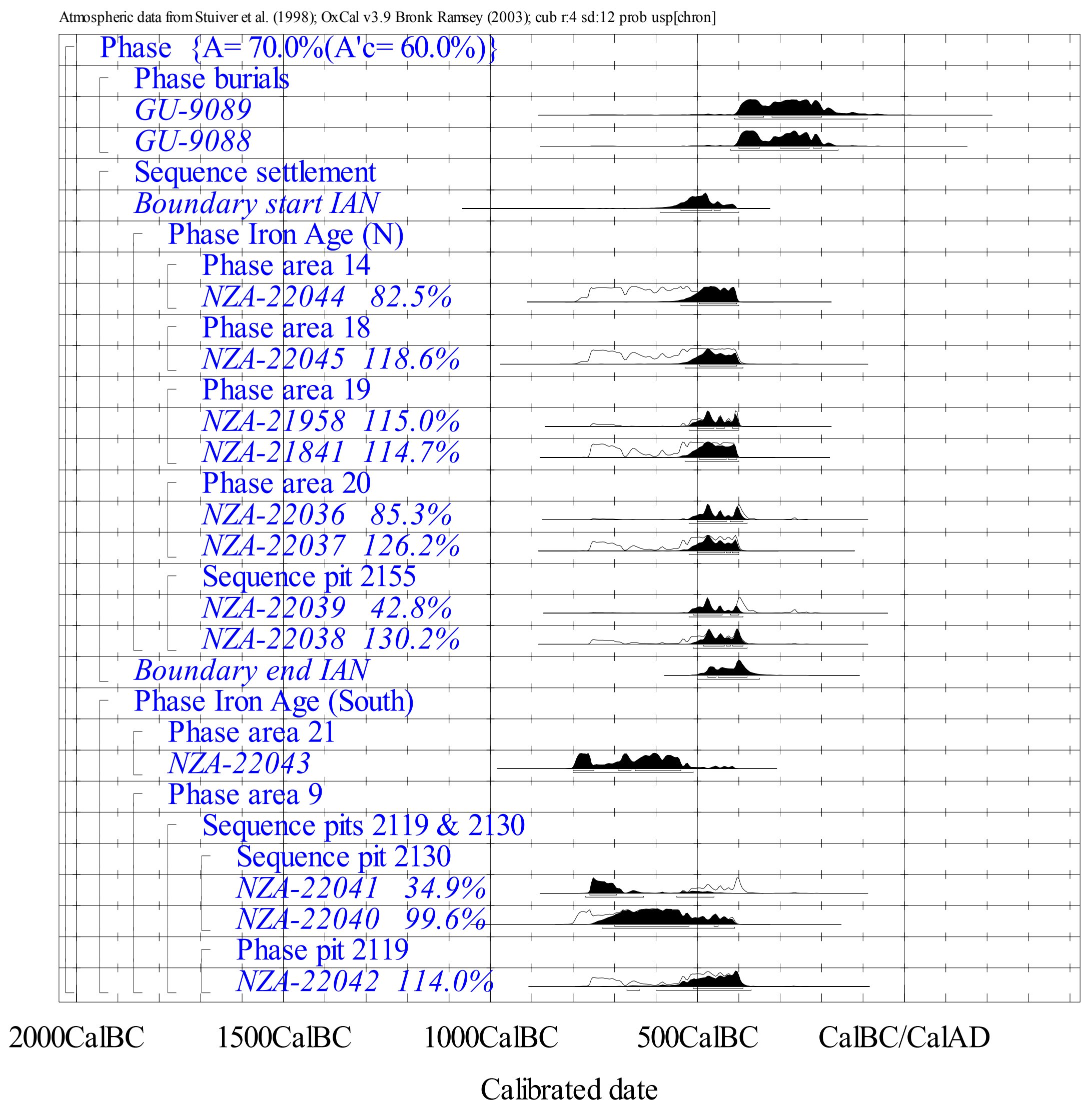

Figure 13a. Probability distributions and posterior density estimates of dates from the Iron Age sequences

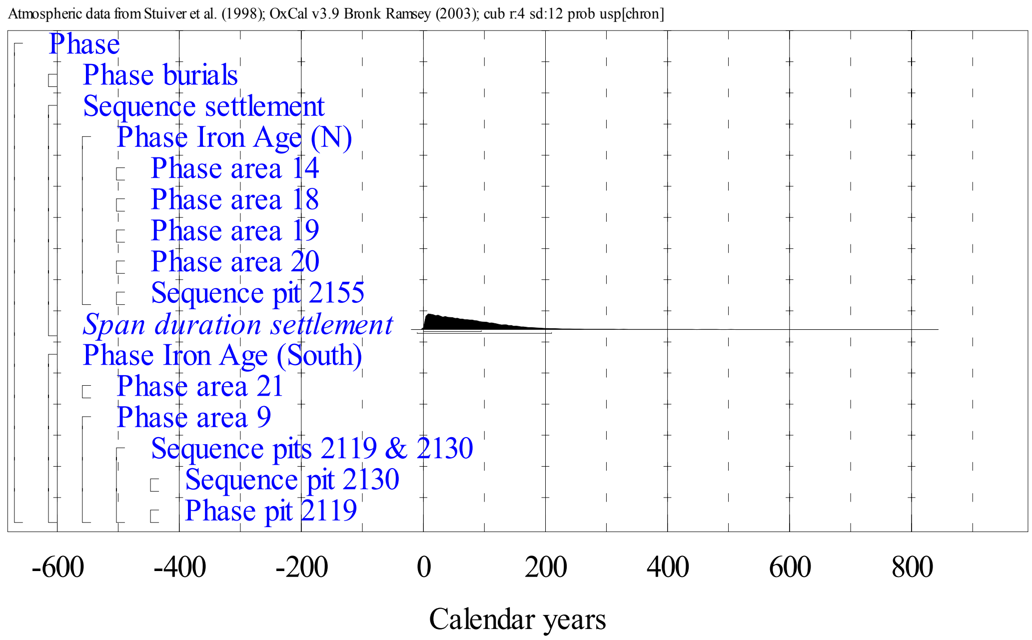

Figure 13b. Analysis showing the span of the Iron Age settlement of the northern areas is likely to be less than 100 years.

3.1.1 Settlement, pits and metalworking

Despite the fact that most result fall into the radiocarbon plateau, it is clear that the dated pits (2119, 2155, 4067, and 8037), embrace the same period as the dated four post structures (4350 and 4363) and the metalworking (pits 7009 and 7011) in the 5th century BC. No chronological separation or distinction can be made between the various defined areas (Figure 13), except that the dated elects in the southern area (area 21 and pits 2119 and 2130 I area 9) are earlier and fall onto the radiocarbon plateau, indicating a date range of about 750-400 cal BC.

3.1.2 Longevity of pit use

The pattern of deliberately deposited remains within the pits often included charred remains near the base, and animal bones and pottery near the top, potentially enabling the timespan over which these events occurred to be estimated. Did this occur over a long timescale (>250) or relatively short timescale (<100 years)? Two pits were examined in this way, but one (pit 2130) was complicated by the presence of human remains, discussed below. Nevertheless, samples from pit 2155, which included barley from a deposit of charred remains at the base of the pit and a pig jaw from a placed bone deposit near the top, were dated. These produced results of 2377±45 BP (NZA-22038) and 2337±40 BP (NZA-22039) respectively calibrating to 760-370 and 800-200 cal BC (Figure 14). These results are statistically indistinguishable at the 95% confidence level and pass χ^2 (T'=0.4; T'(5%)=3.8;

ν =1; Ward and Wilson 1978), and can be considered a part of the same phase (See Figure 10a), of about 500-400 cal BC.

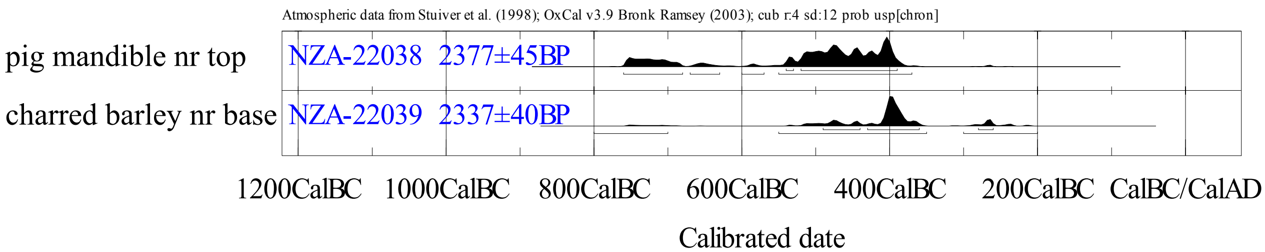

Figure 14. Radiocarbon distributions from pit 2155

3.1.3 Human remains

Several pits (eg 2119, 2130 and 2214) contain disarticulated human skeletal remains mixed with other placed deposits of animal bone and pottery. Human bone was dated from two stratigraphically related pits to examine whether the human remains were generally contemporary with the placed deposits or were curated items. The stratigraphically earliest result was barley from a deposit of charred remains (2153) near the base of pit 2130 (2367±40 BP, NZA-22041). Near the top of this pit (2125) was a group of placed bone including a human fibula (2507±50 BP, NZA-22040). Cutting this pit, and representing the latest result was pit 2119, again contain a deposit of bone, and again amongst this was a human fibula (2397±50 BP, NZA-22042).

pit 2119
(2114) human bone: 2397±50 BP, 770-380 BC

pit 2130
(2125) human bone: 2507±50 BP, 800-410 BC
(2153) charred barley: 2367±50 BP, 760-370 BC

The radiocarbon distributions seem to indicate some chronological differentiation (Figure 15a), but together they all pass the χ^2 (T'=5.0; T'(5%)=6.0; ν =1; Ward and Wilson 1978), and they are not significantly different. (Figure 15b), and can all be considered a part of the same phase (See Figure 13a), of about 500-400 cal BC.

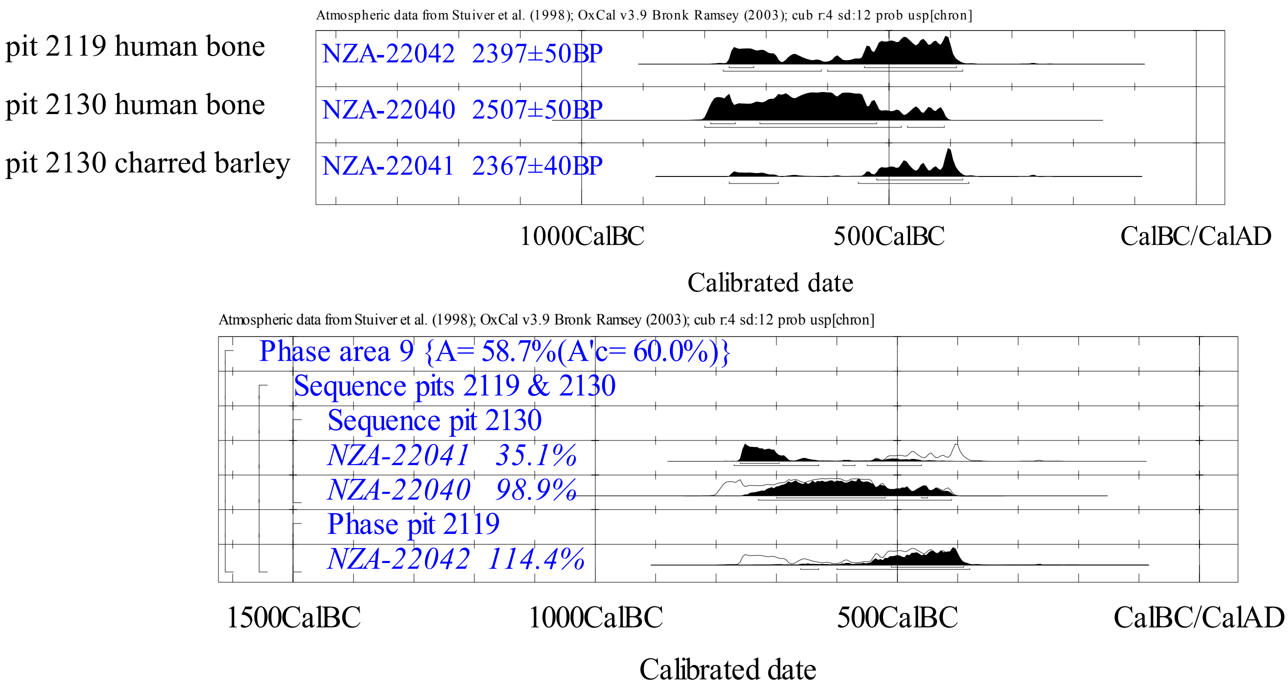

Figure 15 a). Radiocarbon distributions from pits 2130 and 2119 and b) the probability distributions and posterior density estimates from the modelled data.

3.1.4 Burial

The two dated burials; inhumation 2291 (2250±70 BP, GU-9089) and cremation burial 6132 (2270±60 BP, GU-9088) fall after the main dated occupation and industrial activity (Figure 12; Figure 13a; Table 2) at 410-90 cal BC and 450-160 cal BC. They can generally be considered to belong to the 3rd and 4th centuries BC (Figure 13a).

3.1.5 Absolute dating the Iron Age ceramic forms

One other aim of the radiocarbon dating programme was to aid with clarifying and providing a formal chronology for the proposed ceramic phases.

There was little pottery from ceramic phase 1 and no secure context was present to obtain a radiocarbon dated. Although the dated ranges for phases 2 and 3 are large due the radiocarbon plateau it is clear that the dated events clearly overlap.

Phase		***suggested Date range***	***C14 dated ranges***	***Modelled***	***Characteristic features***
Phase 1		499-400 cal BC 6th - 5th centuries BC			incised, geometric decoration; finger-tip decoration
Phase 2		499-200 cal BC later 5th – 3rd centuries BC	800-370 cal BC		shoulder vessels etc.
	Phase 3	399-100 4th - 2nd centuries BC	770-400 cal BC and 460-160 cal BC		saucepan pots (R22) slack-profiled forms (R18, R12, R46) jars R12 + R13 bowls R46 saucepans R2

Cremation 6132 was assigned to ceramic phase 3 (forms R1, R20, R22 and R31) and was dated to 460-160 (2270±60 BP, GU-9088). The dated events in pit 4561 included a placed deposit with bone and pottery exclusively assigned to ceramic phase 3 (forms R43, R3) dating to 770-400 cal BC (2469±40 BP, NZA-22044), but this result clearly falls outside the expected range so has been re-assigned to ceramic phase 2 / 3. One other result, that from inhumation 2291, contained forms R32 and R3, but this result is not significantly different from that from the cremation deposit (T'0.0; T'(5%0 3.8) df=1; Ward and Wilson 1978). On this basis this has been ascribed to ceramic phase 3 for chronological analysis. Although the phase starts at *900-200 cal BC* (*95% confidence; Ceramic Phase 3 start*), and ends at *400-200 cal BC* (*95% probability' Ceramic Phase 3 end*), the posterior density distributions suggest a range of the 3rd to 4th century BC (Figures 13a; 16).

When results from ceramic phase 2/3 and ceramic phase 2 are considered as a phase they reach an overall agreement of 75.1% and thus are modelled as a single sequence (Figure 16). Dated events with pottery of ceramic phase 2 (early CP 3.2) included forms R2 (saucepan pots), R3, R17, R32, R40, R43, R45 and, although the radiocarbon results calibrate to broadly 770-370 cal BC, when considered as a phase it starts at *780-410 cal BC* (95% probability; start cp 2) and ends at *510-320 cal BC* (*95% probability; end cp 2*). The posterior density distributions of this phase (Figure 16), as with the overall Iron Age phasing (Figure 13a), suggest that they are most likely to belong with the 100 years of the 5th century BC

Ceramic phase 1 continued to be the earliest with ceramic phases 2 and 3 overlapping but phase 3 containing later forms. The only feature with just late pottery (cremation burial pit 6132) produced a late date (460-160 cal BC). We may, however, need to consider that the vessel with this cremation may be an heirloom. If not, it is clear that the three ceramic phases may not be entirely sequential. Although this may in part be a result of the relatively small number of determinations, it does seem real.

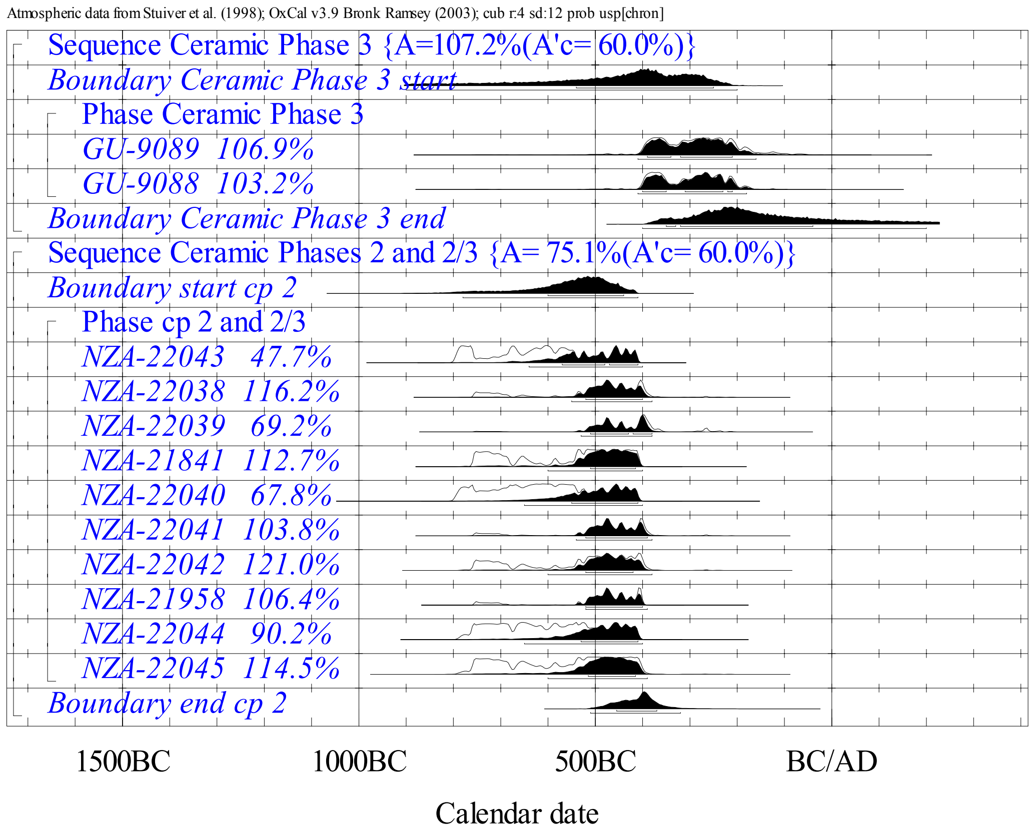

Figure 16. Probability distribution of ceramic phase 2 (with 2/3) and ceramic phase 3.

Thus we can suggest that ceramic phase 2/3 belong the 5th century BC and ceramic phase 3 to the 4th and 3rd centuries BC. The latter, however is based on few results.

3.2 Conclusions; the Iron Age settlement

In short we can see that the majority of settlement activity occurred over a very short period of one century during the 5th century BC. This included the use/construction of pits, four-post structures and metalworking. The main settlement activity is accompanied by pottery of ceramic phase 2 or 2/3. There is evidence to suggest that settlement activity started before this (pit 2119 and pit 8037in the south of the site (areas 9 and 21). The dated burials (cremation and inhumation) both fall in the 4th and 3rd century BC and the cremation is accompanied by material from ceramic phase 3, suggesting a general date range of at least 400-300 cal BC.

4 SAXON ACTIVITY

Two undated animal burials (one horse and one cow) at West of Boarley Farm were considered to be Late Iron Age/Romano-British. However, the pottery in the area was debatably Saxon. Radiocarbon dates were obtained to date the burials and by inference the activity in the vicinity. Both results are clearly later Saxon. The horse burial (pit 1061) produced a result of 1210±50 BP (GU-9087) cal AD 680-900, while the cow (pit 1021) was later (1130±50 BP; GU-9086) at cal AD 700-1000.

A human inhumation burial adjacent to the Saxon Pilgrims Way (PIL98), was considered also to be of Saxon date. A femur was submitted and the result of 1190±60 BP (GU-9013), confirms that this is indeed a late Saxon burial, cal AD 680-980.

5 SUMMARY

In conclusion we can define the main phases of activity, as defined by radiocarbon dating as follows:

	start	***end***	***estimates***
Allerod Phase WHS	-	-	*1450-11020*
Allerod Phase Kent	*11800-11580*	*11150-10750*	
Growth of pine trees			8630-7620
Early Neolithic long house	*4100-3820*	*3780-3550*	3950-3700
Grooved Ware activity	*2950-2780*	*2830-2550*	2900-2600
Clacton Style GW	*2940-2620*	*2680-2420*	
Middle Bronze Age	*1660-1320*	*1420-1070*	1450-1300
Late Bronze Age	*1350-920*	*1000-720*	1000-800
Iron Age settlement			400-500
(and ceramic phase 2 and 2/3)			
Iron Age burial			400-200
(and ceramic phase 3)			

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Site code	*Feature*	*context*	*Sample*	*context details*	*Material*	*result no.*	*δ C[13]*	*result BP*	*cal*	*estimate*
Allerod dates										
WHS 98	Alllerod soil	4934	321	Allerod soil	uniseriate dicotyledenous material	NZA-22046	-26.25	11130±48	11500-10900	11K-13K
WHS 98	Alllerod soil	4934	321	Allerod soil	uniseriate dicotyledenous material	with above				11K-13K
Mesolithic (Pre- Long house)										
WHS 98	Longhouse posthole 4834	4835	626	Posthole fill from Neolithic longhouse	*Pinus* charcoal	NZA-21381	-25.57	8516±35	7600-7520	3900-3600
WHS 98	Longhouse posthole 5113	5114	414	Posthole fill from Neolithic longhouse	*Pinus* charcoal	NZA-21349	-24.79	9182±40	8530-8280	3900-3600
Neolithic Long house										
WHS 98	Longhouse posthole 5008	5009	407	Posthole fill from Neolithic longhouse	Maloideae charcoal	NZA-21280	-24.75	4137±30	2880-2580	3900-3600
WHS 98	Longhouse posthole 5008	5009	407	Posthole fill from Neolithic longhouse	Calcined animal bone	FAILED				3900-3600
WHS 98	Longhouse posthole 4817	4818/1		Posthole fill from Neolithic longhouse	Charred cereal	NZA-11463	-23.37	4911±-60	3920-3530	
WHS 98	Longhouse posthole 4817	4818/2		Posthole fill from Neolithic longhouse	*Alnus/Corylus* charcoal	NZA-11464	-24.13	4974±60	3950-3640	
WHS 98	Longhouse posthole	4904		Posthole fill from	cow molar	NZA-21278	-23.38	5028±30	3950-3710	3900-3600

	4902			Neolithic longhouse						
WHS 98	Longhouse posthole 4820	4821	377	Posthole fill from Neolithic longhouse	Calcined animal bone	NZA-21769	-17.4	4949±30	3790-3650	3900-3600
WHS 98	Longhouse posthole 4820	4821	377	Posthole fill from Neolithic longhouse	Maloideae charcoal	NZA-21279	-25.13	5123±30	3980-3800	3900-3600
WHS 98	Longhouse posthole 5280	5281	691	Posthole fill from Neolithic longhouse, cut by GW pit 5256	Charred *Triticum* sp	NZA-21504	-25.98	5007±75	3960-3660	3900-3600
WHS 98	Longhouse hearth 4874	4876	289	hearth in long house	charred cereal grain	NZA-21506	-26.54	5039±25	3950-3760	2800-2400
WHS 98	Longhouse posthole 4817	4818	291	Posthole fill from Neolithic longhouse	Calcined animal bone	NZA-21770	-24.6	5067±30	3960-3790	3900-3600
WHS 98	Longhouse hearth 4830	4831	533	GW hearth in longhouse	Maloideae charcoal	KIA-25383	-25.22	5165±31	4050-3810	2800-2400
Neolithic 2; Grooved Ware										
PIL 98	GW pit 904	907		Deliberate placed package	Pig radius (left)	NZA-21324	-20.9	4046±35	2840-2460	2800-2400
WHS 98	GW pit 4994	4998		Deliberate placed package	Cattle scapula	NZA-21325	-20.42	4080±35	2860-2490	2800-2400
PIL 98	GW pit 911	924		Deliberate placed package	Pig mandible	NZA-21282	-21.08	4097±30	2870-2490	2800-2400
PIL 98	GW pit 958	959		Deliberate deposit	cattle phalanx	NZA-21589	-23.46	4113±35	2870-2500	2800-2400
PIL 98	GW pit 958	959		placed deposit	Aurochs vertebra	NZA-21327	-23.24	4120±35	2880-2570	2800-2400
PIL 98	GW pit 913	928		Deliberate deposit	cattle phalanx	NZA-21508	-24.12	4153±40	2880-2590	2800-2400

WHS 98	GW pit 4943	4945	645	upper fill	charred hazelnuts	NZA-21493	-24.03	4155±30	2880-2620	2800-2400
WHS 98	Pit/hollow 5072	5073		??placed pig bone	pig scapula	NZA-22749	-20.7	4161±30	2880-2610	2800-2400
WHS 98	Pit/hollow 5072	5073		cow skull placed on cattle feet	cow skull	NZA-22750	-24	4271±35	2930-2690	2800-2400
WHS 98	FV deposit/pit 5125	5127		Deliberate deposit adjacent to pit with FV deposit	cattle radius	NZA-21831	-18.5	4189±30	2890-2630	2200-1900
PIL 98	pit/treehole 861	862		undated deposit in pit	cattle tibia	NZA-21959	-23.93	4193±25	2890-2660	4000 or 2200
WHS 98	Pit/hollow 5072	5073		cattle feet with cow skull placed on top	cow calcaneum	NZA-22751	-24.2	4195±35	2890-2620	2800-2400
WHS 98	GW pit 5256	5258	639	dump of 50+ hazelnut shells	charred hazelnuts	NZA-21491	-22.22	4196±60	2910-2580	2800-2400
PIL 98	undat pit 952	953		placed deposit	Aurochs tibia	NZA-21328	-19.15	4228±35	2910-2670	2800-2400
WHS 99	Pit 4965	4967		dump of scraps of animal bone	Cow calcaneum	NZA-22737	-22.7	4230±35	2920-2660	2800-2400
WHS 99	Pit 5094	5095		antler with other group of objects	Red deer antler	NZA-22813	-22.7	4238±35	2920-2690	2800-2400
EBA/FV										
WHS 98	Decorated bowl posthole 5415	5417	891	Postpacking	*Prunus* charcoal	NZA-21281	-19.94	3415±30	1870-1620	3600-3300
MBA										
WHS 98	LBA pit 5421	5449	Prn1563	Deliberate deposits in pit	pottery residue	NZA-22006	-26.73	2804±40	1130-890	1000-900
WHS 98	Decorated bowl	5417	891	Postpipe	charred hulled	NZA-21490	-24.85	3064±50	1440-1130	3600-3300

	posthole 5415				*Hordeum*					
WHS 98	Ditch 4025	4016		distinct + deliberate deposit	Horse humerus	NZA-21326	-19.3	3151±35	1520-1310	1600-1200
WHS 98	pit 5454	5462		undated deposit in pit	Sheep/goat tibia	NZA-22035	-21.48	3140±40	1520-1310	4000 or 2200
PIL 98	Pil Str - p/hole 571	572	23	Posthole fill from Pil Str	*Hordeum vulgare*	NZA-21840	-24.91	3079±30	1430-1260	1500-1300/1300-1100
LBA										
PIL 98	cremation burial 948	949	95	pyre debris	onion couch grass	NZA-21492	-26.54	2791±35	1010-830	?
PIL 98	Cremation burial 852	854	53	pyre debris	onion couch grass	NZA-21505	-25.48	2868±35	1190-920	?

Table 1. Early prehistoric radiocarbon results

Iron Age settlement and pits

WHS 98	IA pit, area 9 2155	2153	7	charred remains in dump nr base of pit + pottery	*Hordeum vulgare*	NZA-22039	-25.07	2337±40	800-200	400-500
WHS 98	metalworking pit 7009	7080	681	hearth of metalworking furnace with tap slag	*Prunus spinosa*	NZA-21958	-26.61	2394±25	760-390	400-200
WHS 98	metalworking pit 7011	7152	699	charcoal associated with metalworking debris	*Prunus spinosa*	NZA-21841	-25.53	2438±30	770-400	400-200
WHS 98	4-post str 4503, phole4350	5351	151	Posthole	*Hordeum vulgare*	NZA-22036	-24.16	2349±40	800-200	400-200
WHS 98	IA pit, area 9 2155	2103		bone deposit in top of pit + pottery	pig mandible	NZA-22038	-21.48	2377±45	760-370	400-500
WHS 98	IA pit, area 9 2130	2125	9	charred remains in dump nr base of pit	*Hordeum vulgare*	NZA-22041	-23.97	2367±40	760-370	500-300
WHS 98	IA pit, area 9 2119	2114		human bone in pit	Human fibula	NZA-22042	-20.31	2397±50	770-380	500-300
WHS 98	4-post str 4391, phole 4353	4354	129	Posthole	*Triticum* cf *diococcum*	NZA-22037	-23.01	2409±40	770-390	400-200
WHS 98	IA pit area 18 4067	4050		typical pit + pottery	Fowl femur	NZA-22045	-20.09	2429±55	770-390	400-200
WHS 98	IA pit, area 14 4561	4562		typical domestic assemblage and	Cattle humerus	NZA-22044	-22.42	2469±40	770-400	400-200

			pottery						
WHS 98	IA pit, area 9 2130	2120	bone deposit in top of pit	Human fibula	NZA-22040	-20.27	2507±50	800-410	500-300
WHS 98	IA pit, area 21 8037	8026	bone deposit in pit	Sheep/goat foot (articulated)	NZA-22043	-22.13	2527±40	800-510	500-300
IA cremation/burial									
WHS 98	inhumation in pit 2184	2291	Inhumation burial	Human femur	GU-9089	-21	2250±70	410-90	
WHS 98	Cremation burial in pit 6132	6130	Cremation deposit within pit	Charred grain (2)	GU-9088	-23.7	2270±60	460-160	
Early Medieval burial									
BFW 98	animal burial pit 1061	1060	horse burial	horse radius	GU-9087	-22.6	1210±50	AD 680-900	
PIL 98	Inhumation ditch 9011	9025	Inhumation adjacent to Pilgrims Way	human bone, femur	GU-9013	-20.2	1190±60	AD 680-980	
BFW 98	animal burial pit 1021	1034	cattle burial	cattle tibia	GU-9086	-22.3	1130±50	AD 700-1000	

Table 2. Radiocarbon results from Iron Age and later events