

Chapter 6: Radiocarbon dates

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INTRODUCTION

Ten samples were submitted for radiocarbon dating from Site 3, Site 4 (Trench 54) and Site 5 (Table 6.1). Radiocarbon results are discussed here with reference to the nature of the dated materials and the contexts from which they were recovered (cf. Waterbolk 1971).

METHODOLOGY

Samples were processed and measured at the Scottish Universities Environmental Research Centre Accelerator Mass Spectrometry (AMS) facility. Charred plant macrofossil samples were pretreated as described in Stenhouse and Baxter (1983). Cremated bone was pretreated as described in Lanting *et al.* (2001) and bone samples following a modified version of Longin (1971). CO₂ was extracted using the method outlined in Vandeputte *et al.* (1996) and graphitised as described in Slota *et al.* (1987). AMS dating followed the methods of Xu *et al.* (2004).

With the exception of a single modern sample (below) the results were calibrated using the Reimer *et al.* (2009) curve and the OxCal v4.1 computer program (Bronk Ramsey 1995; 1998, 2001; 2009a; 2009b). Ranges are quoted as described by Stuiver and Polach (1977), with error terms rounded out by ten years, but adapted for the increased precision now available.

Ranges in Table 6.1 were calculated using the maximum intercept method (Stuiver and Reimer

1986) and are cited at 95% confidence unless otherwise stated. Distributions calculated using the probability method are shown in Figs 6.1 and 6.2 (Stuiver and Reimer 1993). Posterior density estimates (see below) are shown in Fig. 6.4.

RESULTS

Site 3

The articulated tibia and metapodial from a dog burial in fill 3203 of ditch 3361 provided material for SUERC-30625 (Fig. 6.1). Because the bones from the dog burial were articulated, and the burial was therefore deposited while the remains were still fleshed, there is unlikely to be an offset between the date of death of the dog and the date of its burial in the ditch. The result therefore provides a robust *terminus ante quem* for the excavation of the ditch in 350–40 cal BC (95.4% confidence) or 200–90 cal BC (68.2% confidence)

Site 5

A sample of human bone from cremation burial 6067/6070 provided material for SUERC-30618 (Fig. 6.2). The sample was intended to establish a date for the burial and explore whether it was associated with late Iron Age settlement or the Roman field boundaries on the site. The cremation probably occurred in 770–400 cal BC (95.4% confidence) or 760–410 cal BC (68.2% confidence; SUERC-30618; cf.

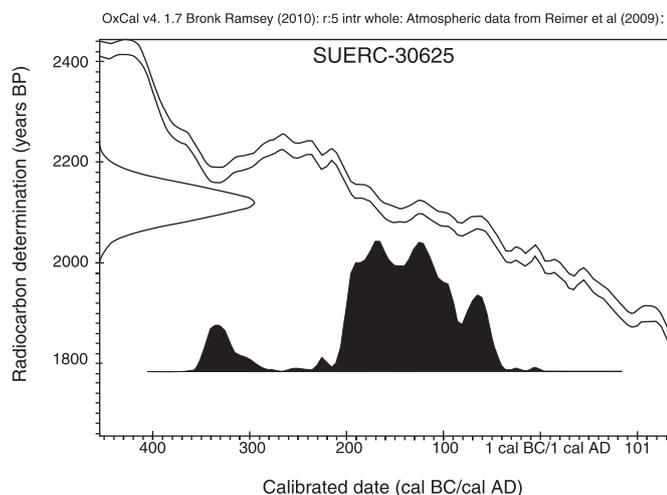


Fig. 6.1 Site 3, probability distribution of the radiocarbon result

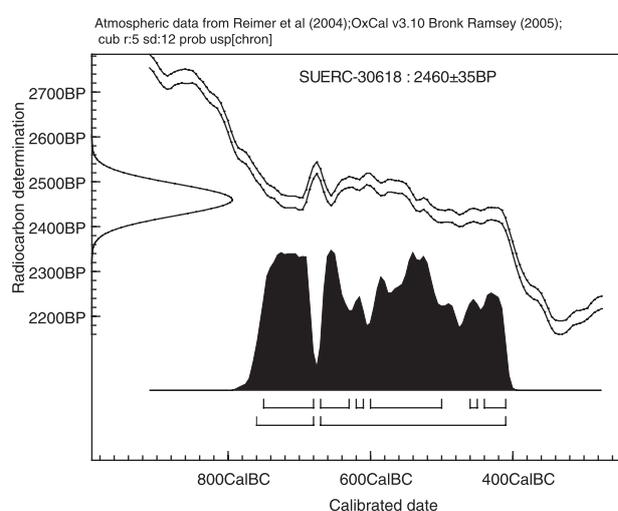


Fig. 6.2 Site 5, the calibrated radiocarbon result

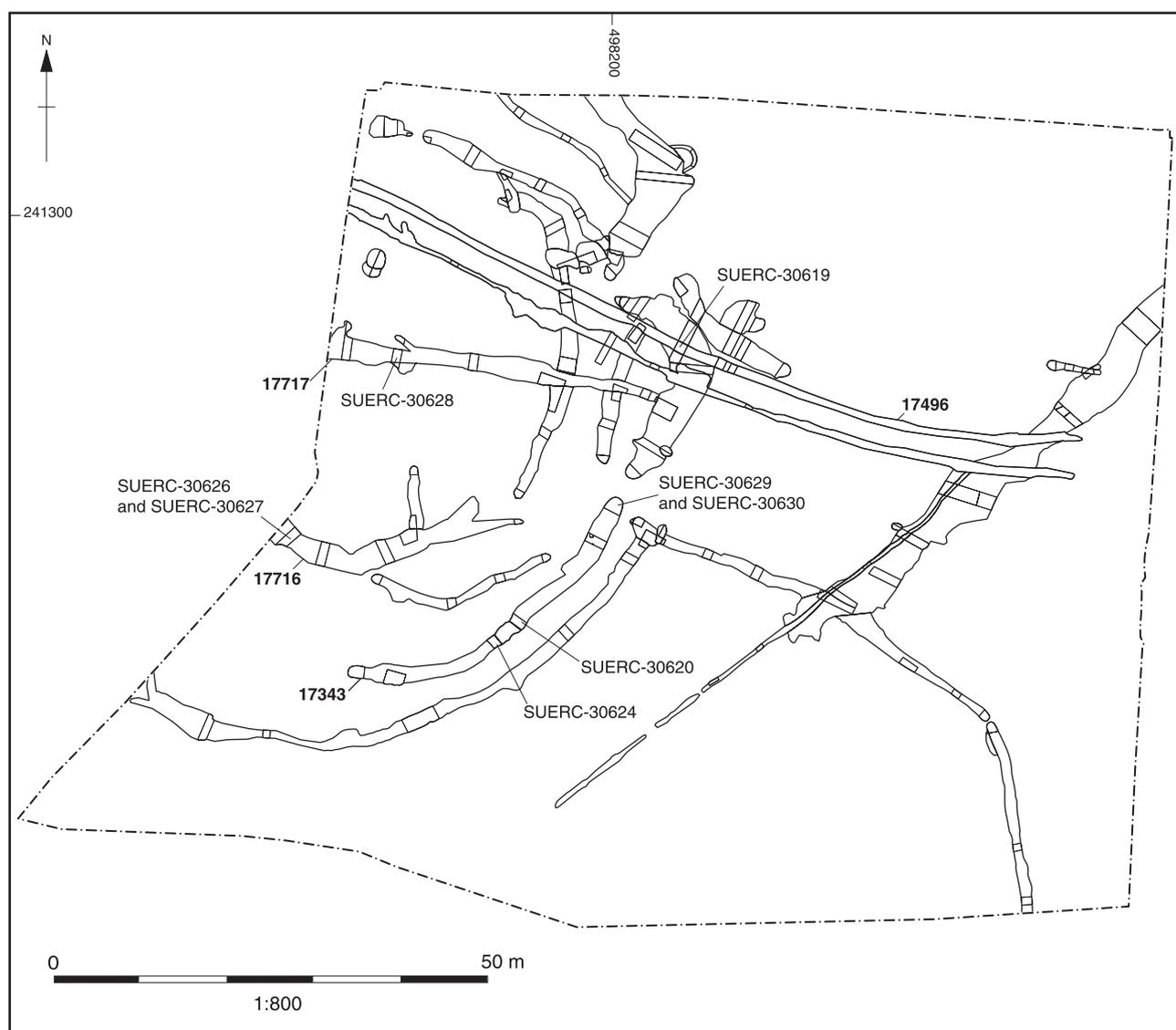


Fig. 6.3 Site 4 (Trench 54), location of samples submitted for radiocarbon dating

Table 6.1: Summary of radiocarbon dates

Lab. ID	Site	Feature or deposit	Ctx	Material
SUERC-30625	Site 3	Dog burial in ditch 3361	3203	Bone from an articulated dog burial
SUERC-30619	Site 4 (Trench 54)	Ditch 17496	17293	Horse skull on base of ditch
SUERC-30620	Site 4 (Trench 54)	Burnt clay layer in ditch 17343	17255	Cremated medium mammal long bone shaft fragment
SUERC-30624	Site 4 (Trench 54)	Burnt clay layer in ditch 17343	17187	Cremated large mammal bone fragment
SUERC-30626	Site 4 (Trench 54)	Ditch 17716	17181	Charred grain (cf. <i>Triticum</i> sp.)
SUERC-30627	Site 4 (Trench 54)	Ditch 17716	17181	Charred nutshell (<i>Corylus avallana</i>)
SUERC-30628	Site 4 (Trench 54)	Ditch 17717	17090	Charred grain (<i>Triticum</i> sp.)
SUERC-30629	Site 4 (Trench 54)	Terminal of ditch 17343	17200	Charred grain (Poaceae)
SUERC-30630	Site 4 (Trench 54)	Terminal of ditch 17343	17200	Roundwood charcoal, species indet.
SUERC-30618	Site 5	Cremation burial 6067/6070	6068	Cremated human bone

van Strydonck *et al.* 2010) and so dated from the early Iron Age, predating the late Iron Age or Roman-British activity at the site by several centuries.

Site 4 (Trench 54)

Dating aims

Radiocarbon samples from Site 4 (Trench 54) were submitted in order to provide a chronology for the enclosure ditches (Figs 6.3-4).

Key research questions at Site 4 (Trench 54) included:

- whether the multiple ditch circuits were established contemporaneously, early in the history of activity, or whether the enclosure developed sequentially;
- whether the burnt clay deposit in ditch 17343 (including contexts 17187 and 17255) represented a single archaeological event, and when in the history of the enclosure it occurred;
- whether ditch 17717 was contemporary with the Iron Age activity at the site or was a more recent feature.

Sample associations

Four samples were submitted from ditch 17343 (Fig. 6.3): two from secondary fill 17200 and two from the overlying burnt clay layer (17187=17255). The two single entity, short-lived samples from the fill 17200 (SUERC-30629 and SUERC-30630) were intended to provide *termini ante quos* for the ditch excavation and estimate the date of the secondary infilling of the ditch, as well as providing *termini post quos* for the burnt clay deposit.

Context 17200 comprised a thin band of charcoal that was interpreted as representing vegetation burnt *in situ* in the ditch. This was immediately overlain by a pink, heat-discoloured burnt clay deposit. The burnt clay deposit was not burnt *in situ* in the location from which it was

recovered; it was interpreted as either soil from an associated bank, which was heat effected during the burning event and collapsed or slipped into the ditch, or material from the burning event that was tipped into the ditch during 'clean up' of the site after the fire. Two results (SUERC-30620 and SUERC-30624) were produced on cremated bone from the burnt clay layer. In order to have been cremated the bone must have been subject to high-temperature burning (>600 °C; Naysmith *et al.* 2007). In order to confirm that material from the burnt clay layer recorded in different interventions represented the same archaeological event, material for dating was selected from two separate interventions.

Two results were commissioned on short-lived, single entity material from fill 17181 of ditch 17716 (SUERC-30626 and SUERC-30627). These measurements were produced on charred plant remains from a discrete charcoal-rich deposit immediately overlying the primary silts in the ditch. The discrete nature of this deposit suggests that the collection and burning of the material, and its deposition in the ditch took place over a short duration, with no significant offset between the burning of the material and its deposition. If this interpretation is robust, these results provide estimates for the infilling of the ditch and *termini ante quos* for the ditch excavation.

A result from ditch 17717 (SUERC-30628) was commissioned in order to explore the date of this feature. According to the stratigraphic relationships recorded on site, this feature should be middle Iron Age, but it contained a modern iron nail and dress pin as well as quantities of Iron Age pottery.

A further date was obtained for a horse skull that appeared to have been deliberately placed on the base of enclosure ditch 17496 (SUERC-30619). There may be an offset between the date of death of the horse and the date of deposition in the ditch. The result on the horse skull from 17496 is probably best understood as a *terminus post quem* for the deposition of the overlying ditch fills.

$\delta^{13}\text{C}$	Radiocarbon age (BP)	Calibrated date (95.4 % confidence)	Posterior density estimate (95.4% probability)
-21.1 0/00	2120 ± 35	350-40 cal BC	-
-22.7 0/00	2080 ± 35	200 cal BC-cal AD 10	360-290 cal BC (29.9%) or 210-130 cal BC (65.5%)
-28.0 0/00	2185 ± 35	380-120 cal BC	350-160 cal BC
-29.1 0/00	2195 ± 35	390-160 BC	350-170 cal BC
-21.9 0/00	2180 ± 35	380-110 cal BC	360-170 cal BC
-24.4 0/00	2250 ± 35	400-200 cal BC	380-200 cal BC
-23.9 0/00	See text	See text	-
-23.8 0/00	2165 ± 40	370-90 cal BC	370-190 cal BC
-25.1 0/00	2185 ± 35	380-120 cal BC	370-190 cal BC
-23.2 0/00	2460 ± 35	770-400 cal BC	-

Results

Excluding SUERC-30628, all the results from Site 4 (Trench 54) are just statistically consistent ($T'=12.4; T'5\%=12.6; =6$; SUERC-30639, -30630, -30620, -30624, -30626, -30627, -30619; Ward and Wilson 1978), indicating that it is possible that they are of the same actual age.

The duplicate radiocarbon measurements are statistically consistent:

- SUERC-30629 and SUERC-30630 from context 17200 in ditch 17343 ($T'=0.1; T'5\%=3.8; =1$);
- SUERC-30624 and SUERC-30620 from 'burnt deposit' 17187=17255 in ditch 17343 ($T'0.0; T'5\%=3.8; =1$);
- SUERC-30627 and SUERC-30626 from context 17181 in ditch 17716 ($T'=2.0; T'5\%=3.8; =1$).

The consistency of the duplicate results suggests that they reliably date the formation of their parent contexts, or in the case of SUERC-30624 and SUERC-30620 the formation of the 'burnt clay layer'. The consistency of these results, and the interpretation that the duplicate results were produced on material from deposits representing single archaeological events, has been used in the model described below to produce estimates for the formation of these contexts.

The measurement from ditch 17717 (SUERC-30628) produced a fraction modern result of 1.1537

± 0.0049 . The result calibrates to either AD 1957-58 (up-slope of the bomb peak) or AD 1989-1992 (down-slope of bomb peak; cf. Reimer *et al.* 2004; calibrated using the CALIBomb calibration curve; <http://calib.qub.ac.uk/CALIBomb>). If the ditch is regarded as Iron Age, this result confirms the presence of intrusive material in the fill. Alternatively the result and the modern material culture in the ditch may indicate that the feature is of modern origin and that the Iron Age pottery from the fill was redeposited.

Bayesian model

Sufficient radiocarbon results were obtained from Site 4 (Trench 54) to produce a Bayesian model of the data which uses archaeological or 'prior' information regarding the stratigraphic sequence (Fig. 6.4). The model uses Markov Chain Monte Carlo sampling, applied in OxCal v4.1, details of which can be found on the online manual (<http://c14.arch.ox.ac.uk/>; Bronk Ramsey 1995; 1998; 2001; 2009a; 2009b).

Ditches 17716 and 17343 have produced internally consistent radiocarbon dates. Assuming that there is no significant offset between the events sampled by these results and the formation of the ditch fills, the model presented here provides a chronology for the archaeological phase of ditch infilling. From this model *termini ante quos* for the excavation of the two ditches are calculated.

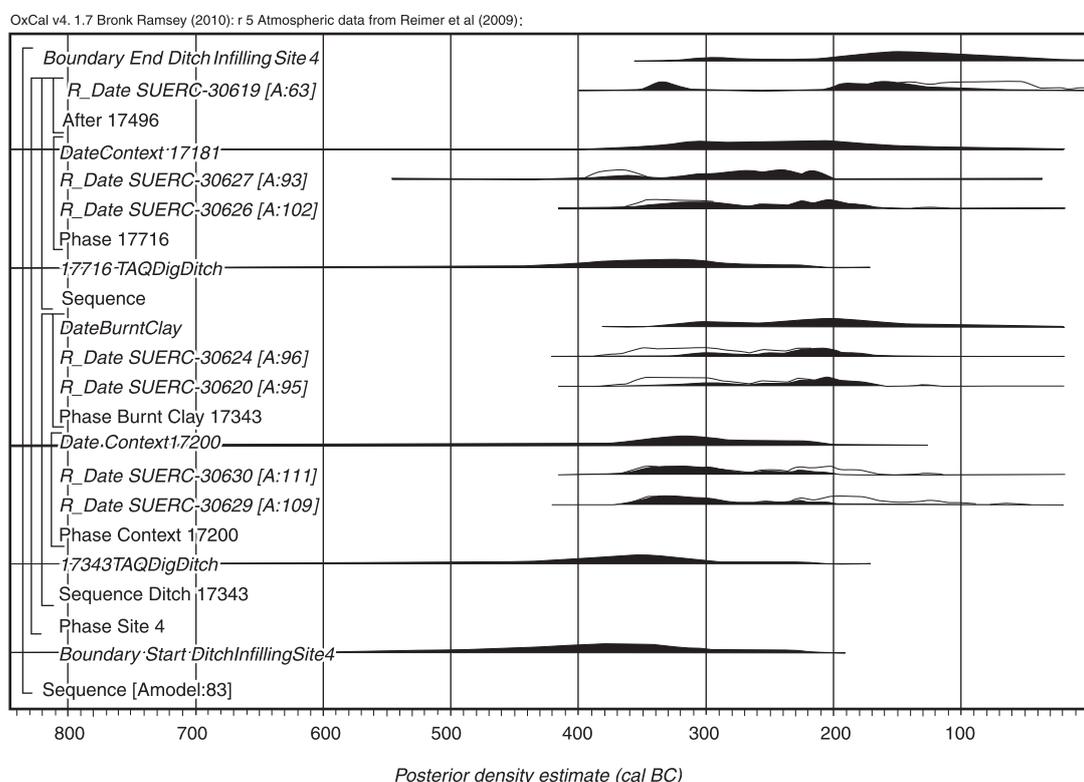


Fig. 6.4 Site 4 (Trench 54), probability distributions of results

A *terminus ante quem* for the excavation of ditch 17343 is estimated as 530-200 cal BC (95.4% probable; or 430-290 cal BC 68.2% probable; 17343DigDitch).

The estimate for the formation of context 17200 in ditch 17343 is 440-190 cal BC (95.4% probable or 360-220 cal BC 68.2% probable; DateContext17200). It is most probable that context 17200 formed in the second half of the 4th century cal BC or the first 80 years of the 3rd century cal BC, although there is a one in three chance it lies outside this range. The formation of the burnt clay deposit occurred in 340-70 cal BC (95.4% probable; or 310-150 cal BC 68.2% probable; DateBurntClay).

A *terminus ante quem* for the excavation of ditch 17716 is estimated as 520-200 cal BC (95.4% probable; or 410-270 cal BC 68.2% probable; 17716TAQDigDitch).

In ditch 17716, context 17181 formed in 430-50 cal BC (95.4% probable; or 340-170 cal BC 68.2% probable; DateContext17181).

The estimate from the horse skull from ditch 17496 (SUERC-30619) dates its death in 360-300 cal BC (23.0% probable) or 210-50 cal BC (72.4% probable; 350-320 cal BC 17.0% probable, or 200-130 cal BC (51.2% probable) and provides a *terminus post quem* for the infilling of the ditch 17496.