A RADIOCARBON-BASED MODEL OF CHANGING BURIAL RITES IN EARLY MEDIEVAL ENGLAND

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ABSTRACT. This paper uses a "dates as data" approach to understand how grave good use and cemetery space changed across the early medieval period in England. A series of composite kernel density estimations were created, based on a dataset of nearly 1100 graves with associated radiocarbon dates, from between the fourth and ninth centuries AD. This modeling revealed a previously unrecognized peak in grave furnishing around 600 AD, which coincides with a peak in isolated burials, and a low point for unfurnished graves and for small cemeteries. It argues that this peak is unrecognized as previous models of chronological change have focused only on graves containing chronologically distinctive artifacts and highlights the importance of radiocarbon dating as a way of avoiding this limitation.

KEYWORDS: burial practice, early medieval England, Kernel density estimation.

INTRODUCTION

Burials are one of the most important sources of evidence for the early medieval period in England, and the way in which burial practices changed between the fourth and ninth centuries AD is a vital source of evidence for changing societies. The chronology of changes in the burial rite, including the use of grave goods and their decline, and the use of different types of cemeteries, is still being refined. This paper uses a "dates as data" method (Rick 1987) as a new way of understanding the chronology of such changes, with important implications for their significance. Summed methods of radiocarbon dating have become an increasingly popular way of studying change over the long durée, particularly within prehistory, but have only rarely been applied to the medieval period. By looking at radiocarbon dated burials, this paper will shed new light on key issues relating to the period, such as the transition from Roman to medieval, the transition from furnished to unfurnished burial, and varying use of cemetery space.

Changes in Burial Practice across the First Millennium AD

Burial in the early medieval period is characterised by the varied deposition in grave goods. Often a clear distinction is made between the furnished burials of the early medieval period, and the unfurnished ones which preceded them (Gerrard 2015:566). Earlier studies of fourth century, late Roman burials suggested that they were largely unfurnished inhumation, with some limited use of dress accessories, footwear, coins and knives (Quensel-von-Kalben 2000: 218–223; Philpott 1991:136, 226). More recent work has highlighted more variability; urban late Roman cemeteries were more richly furnished, in terms of both quantity and quality of objects, than rural ones were (Pitts and Griffin 2012:261). Some unfurnished cemeteries, previously thought to be Late Roman, have since been shown to continue into the fifth and sixth centuries following radiocarbon dating (Gerrard 2015:567–568). The questions of overlap between late Roman and the early medieval burial practices remains poorly understood. Evidence from sites such as Spong Hill in Norfolk, Mucking in Essex, and Wasperton in Warwickshire, show greater continuity in practices than previously assumed, and question our assumptions about strict chronological divisions in funerary rites (Hills and Lucy 2012:297–300; Lucy and Evans 2016:438; Carver et al. 2009).

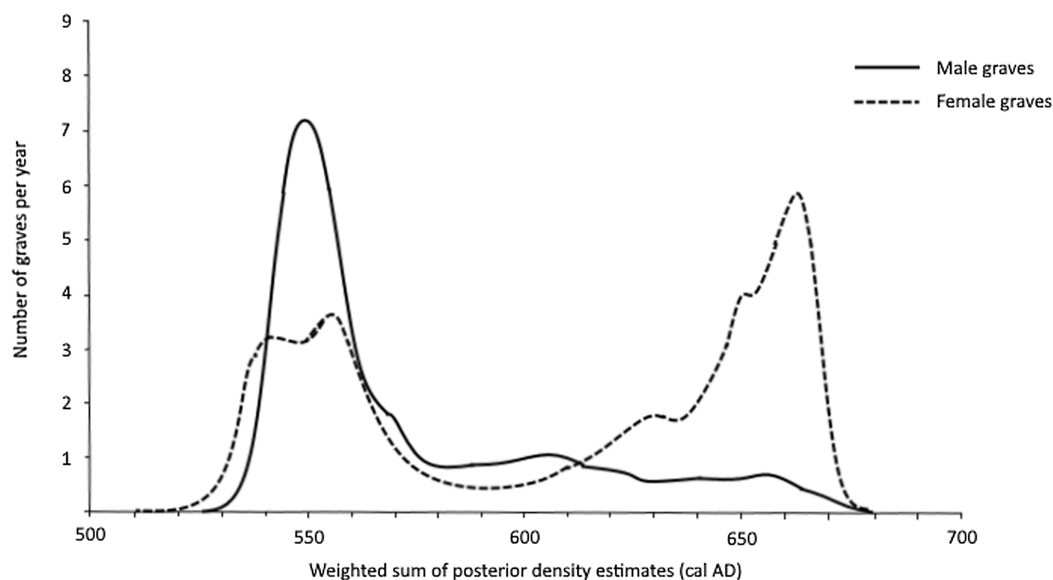*Corresponding author. Email: ecb58@cam.ac.uk

Figure 1   Frequency of furnished burial according to the ASCF. Redrawn after figure 8.14 in Hines and Bayliss (2013).

By the end of the fifth century, grave goods were regularly deposited with the dead, ranging from weapons, jewelry, and dress accessories, to personal items such as knives; the items employed varied depending on the sex, age, and social status of the deceased (Lucy 2000:87–90). Although some level of unfurnished burial did continue, the use of these grave goods is a defining feature of burials of the fifth, sixth, and seventh centuries. Yet in the seventh century, grave good use declined again, until by the end of the eighth century, the majority of burials were unfurnished (Boddington 1990:182; Geake 1997; Brownlee 2021b). Geake (1997:130) suggested that the end of furnished burial occurred around 720–730 AD, having declined from the mid-seventh century onwards. As well as overall number of objects declining, the types of objects used also became more restricted, with fewer weapons deposited in particular (Härke 1992:159–161). Styles of objects also changed, with regionally distinctive brooch types being replaced with brooches which mimicked Roman and Byzantine fashions (Geake 1997:132), and precious metals and gemstones became more commonly deposited (Hamerow 2015:104). More recently, Hines and Bayliss's (2013) Anglo-Saxon Chronological Framework (ASCF)—later refined by the addition of graves from RAF Lakenheath (Hines 2021)—sought to refine the chronology of changing burial rites through a combination of high-precision radiocarbon dating, correspondence analysis, and Bayesian modeling. This framework put the peak in furnished burial in the middle of the sixth century, and suggested that it had entirely ceased by the end of the seventh century (Figure 1) (Bayliss and Hines 2013:479; Scull 2015:77). The decline was not uniform, however. For males, the number of furnished burials dropped by around 80%, then continued at this low, but even rate until the 670s (Bayliss and Hines 2013:476), with the exception of the "princely" burials such as Sutton Hoo and Prittlewell in the early seventh century. Female furnished burial also declined in popularity after a peak in the mid-sixth century but experienced a second peak in the second and third quarters of the seventh century (Bayliss and Hines 2013:479; Scull 2015:77), seen with richly furnished graves such as West Hanney (Hamerow 2015), the Westfield Farm "Princess" (Lucy et al. 2009), or the Streethouse Loftus bed burial (Sherlock 2012). Furnished female burial was six times as
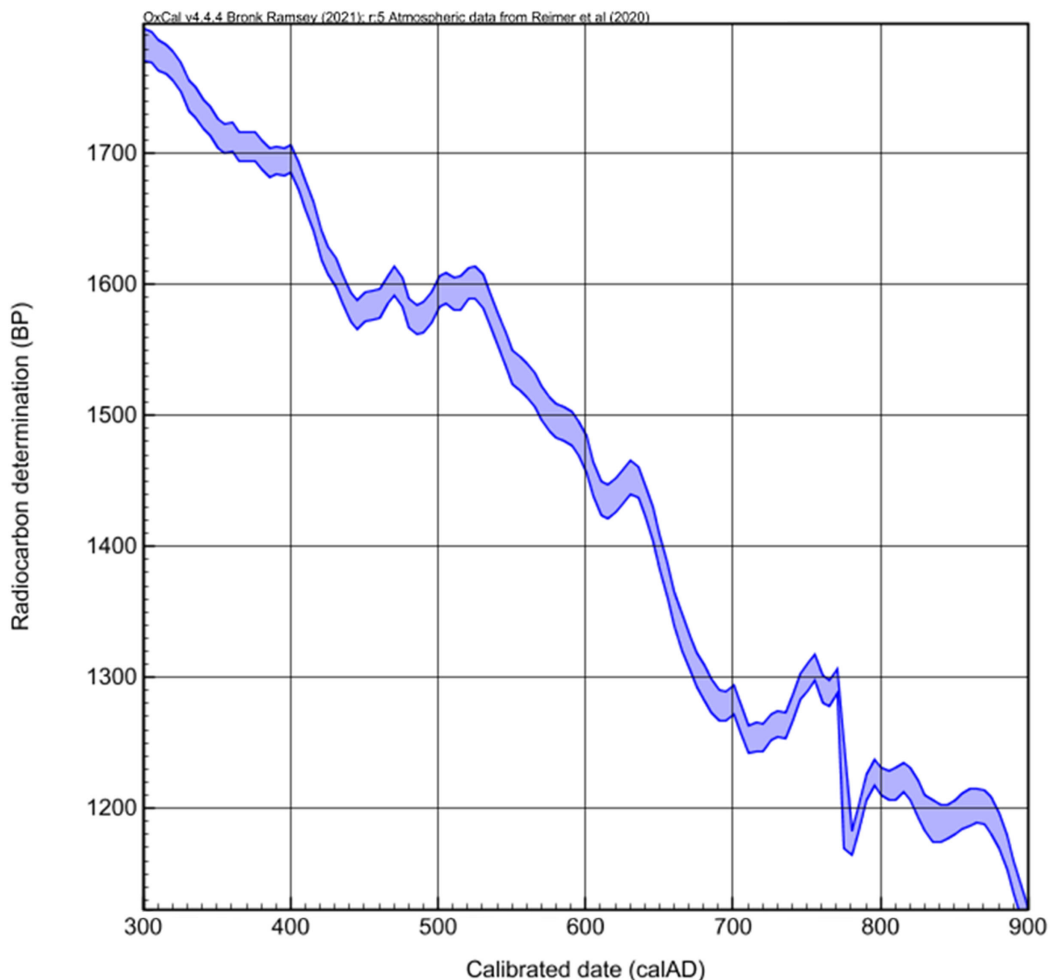
Figure 2   The radiocarbon calibration curve (IntCal20), 300–900 AD.

common as furnished male burial in the middle of the seventh century (Hines 2013a:539). From the eighth century onwards, some negligible grave good use continued, mostly in the form of token objects, but on nowhere near the scale seen before (Scull 2013:526–527).

Radiocarbon Dating and the Early Medieval Burial Record

Radiocarbon dating was historically not widely used within early medieval archaeology, being seen as too imprecise to be able to contribute to a relatively short timescale (Bayliss et al. 2013: 35). In the period in question, there are several notable plateaus in the most recent iteration of the calibration curve (Reimer et al. 2020) which would produce long date ranges; one from around 435 to 545 AD, another from 670 to 775, and a final one from 775 to approximately 875 (Figure 2). Although these plateaus are far from ideal, refinement of successive calibration curves means that they are not as great an impediment as they once were (Hines 2021:109–110). Improvements in the precision of radiocarbon dating, meaning that errors on date can be less than 20 years, has led to the increased utilisation of radiocarbon dating for answering questions

over shorter, historical timescales. Additionally, more sophisticated computational analyses have developed, including the correspondence analysis used by the ASCF, as well as summed methods, meaning that radiocarbon has become a more valuable method for the Roman and early medieval periods.

The ASCF represented a huge step forward in all of these developments in radiocarbon dating and computational approaches to constructing chronologies. However, there are hints from within the ASCF itself that parts of it may not be accurate. In several graves towards the end of the sequence, there were contradictions between the dates suggested in the chronological model, and those from well-established coin chronologies (Archibald 2013:508–509). Incorporating new data from RAF Lakenheath proved challenging (Hines 2021:139), and there are still questions to be resolved around the timing of burial change.

An alternative method of assessing changing funerary rites over time might be through the use of radiocarbon-dated burials, using a "dates as data" principle (Rick 1987). This is based on the principle that if a large enough data-set of radiocarbon dates can be compiled, changes in frequencies of dates will reflect changes in frequencies of human activities (Rick 1987:56; Crema and Bevan 2021:23). This method has the advantage of being able to asses change across any time span, without any of the issues of periodisation that can affect studies, although the popularity of radiocarbon dating may vary between periods and regions. Exact methods of summing dates vary, but the most commonly used include summed probability densities (SPDs) and kernel density estimates (KDEs) (Crema 2022). Although dates as data methods are popular in studies of prehistoric demography, relatively few studies have focused on the early medieval world, and none on England. Yet a few studies have demonstrated its use in the early medieval period. In Ireland, it has been used to elucidate overall demographic trends, as well as craft-working patterns (Hannah and McLaughlin 2019; Hannah 2021). The method has also been used specifically to examine changing funerary rites in Ireland and Scotland. Gleeson and McLaughlin (2021) looked at the balance between cremation and inhumation in Ireland and Scotland, demonstrating a peak in the use of inhumations in the seventh century, and peaks in cremation slightly later. In Scotland, Maldonado (2013) showed that total burial activity increased from the fifth century onwards, peaking in the seventh century, before declining, with distinctions between the use of long-cists, barrows, cairns, and earth-cut graves. Summed probability approaches have also been applied to Belgian burials, where they showed a sharp rise in inhumations from the start of the seventh century, while cremation had dominated for much of the fourth, fifth, and sixth centuries (Capuzzo et al. 2020:1820–1821). The use of summed radiocarbon dates therefore has potential as a method for assessing how popular different types of burial may have been over time.

The use of summed methods of radiocarbon dates relies on the assumption that there is a direct correlation between past human activity and frequency of radiocarbon dates. This is rarely the case, and research biases, sampling strategies, and past cultural behavior can all result in peaks and troughs in summed radiocarbon models that have little to do with the questions being asked of them. Many of the critiques of the method relate specifically to attempts to use this method demographically, with arguments that fluctuating levels of radiocarbon dates could instead reflect changes in cultural behaviors which are independent of the size of society (Torfing 2015; Freeman et al. 2018). If the focus of study is those cultural behaviors, this is much less of a concern. Another critique is that in small samples, statistical noise is indistinguishable from true patterns of past behavior, leading to difficulties in identifying how large a peak or trough has to be to be confident that it represents a real change in the

archaeological record (Contreras and Meadows 2014:593–594). Although radiocarbon dating is now much more widely employed for the early medieval period, identifying how large a sample is needed to be confident of the patterns observed is still a problem. Perhaps of most concern is the issue of researcher bias in what samples are sent for radiocarbon dating. As such, all patterns observed in this study are considered in terms of potential research biases as well as historical causes.

MATERIALS AND METHODS

This analysis is based on a dataset of radiocarbon dated graves from England, with conventional radiocarbon ages (CRA) of 1950–950. This date range is larger than the period of interest in this study, so that edge effects do not affect the resulting models (Crema 2022). Dates from disarticulated bone, and cremated bone were not included; the former because they lacked the original burial context, and the latter because furnishing patterns vary between inhumations and cremations, introducing an additional variable which would need to be accounted for (Lucy 2000:110). Finally, dates with error ranges of more than ±100 were also discounted as being too broad to be useful when looking at changes over so short a time period. The dataset collated by Bevan et al. (2017) was used as a starting point, and contextual information about each burial was added to the database, including the age and sex of the individual in the grave, the grave goods present, and whether the burial was part of a larger cemetery, or isolated. Where available, any associated stable isotopes were also added, so that the potential impact of marine reservoir effects could be investigated. Bevan et al.'s data collection was reasonably comprehensive but did not include dates published after 2016 (Bevan et al. 2017; Supp. Info. 1). Dates subsequently published were added, with the Archaeology Data Service's (ADS) grey literature repository proving particularly useful. When multiple radiocarbon dates were available for a single burial, they were combined using OxCal's combine function, and the resulting single date entered into the main database. If the accompanying chi-squared test performed in OxCal indicated that the dates were not contemporary, the original publication was referred to, to assess which date should be used.

Large dense datasets offer the most reliable radiocarbon density models, especially when the dates are from a number of studies with different research aims, and therefore differing biases in selecting samples for radiocarbon dating (Timpson et al. 2014:550; Hannah 2021:246). A large dataset is necessary to balance out those competing research biases (Crema 2022). Dates obtained from commercial excavations, which form the majority of reports on the ADS, represent more of a random sample of past activity, driven by modern construction patterns, but the burials chosen for dating with commercial sites are still driven by specific questions. The final dataset contains 1085 radiocarbon-dated graves.

The data was analysed using the R program, Rcarbon (Bevan and Crema 2021). Composite kernel density estimates (cKDE) with bootstrapping were created for various subsets of the whole dataset. Binning protocols were used to help reduce biases created by differences in the ability of site excavators to fund radiocarbon dating (Crema 2022). KDEs were favoured over SPDs due to their ability to illuminate small-scale changes when lower bandwidths are employed (McLaughlin 2019:493), and their ability to smooth the effects of the calibration curve which contributes to noise in SPD models, making this method more suitable for use over smaller timeframes (Timpson et al. 2014:550; Bronk Ramsey 2017:1818; Crema 2022). To further reduce the effects of the shape of the calibration curve, the radiocarbon dates were not

normalised when calibrating (Crema and Bevan 2021:28). The KDEs were calculated with a bandwidth of 30 years, approximately a generation, following Hannah (2021).

The potential for marine reservoir effects also had to be considered. Where $\delta^{13}C$ values were available, the contribution of marine protein in the diet was calculated using the methodology laid out by Jarman et al. (2018:191–192; see supplementary material). Many of the radiocarbon dates did not have $\delta^{13}C$ reported, or only had results obtained via the original AMS radiocarbon determinations; these are not reliable enough for use in marine reservoir corrections (Jarman et al. 2018:192). Marine corrections have therefore only been applied to those dates with a $\delta^{13}C$ value known to have been obtained via IRMS, approximately 65% of dates in the database. This inevitably means that some dates affected by a marine reservoir will not have been corrected. However, it is not thought that marine fish was a large component of diet in the early medieval period (Leggett 2022:535). Marine reservoirs are most likely to affect individuals of Scandinavian origin, particularly those relating to the Viking Age migrations in the ninth century, as has already been demonstrated at Repton (Jarman et al. 2018). They are also known to affect late Roman populations, who have elevated $\delta^{13}C$ values compared to early medieval populations (Leggett 2022:533). KDEs were created both with and without marine corrections (see supplementary material), and in most instances were found to make little difference, supporting evidence for a very small marine component to diet in the early medieval period. The full code and data necessary to reproduce the analysis are available in the supplementary material. This will also make it possible to refine the models in future as new dates are published.

RESULTS

Overall Patterns

The cKDE for the entirety of the dataset shows a rise in radiocarbon-dated burials from the fourth century to the eighth century, after which point levels remain consistently high (Figure 3). This should not be read as a sign of increasing population, or necessarily of an increasing preference for inhumation, although cremations in Britain did make up a higher proportion of burials in the fifth and sixth centuries (Gleeson and McLaughlin 2021:389). The increase is equally likely to be due to biases in the types of samples selected for radiocarbon dating. Burials from within the period of furnishing are less likely to be selected for radiocarbon dating, as there are artifacts to provide a date without the need for costly and destructive analysis, especially in the early days of radiocarbon dating when error ranges were large. In contrast, burials from after the period of furnished burial can only be dated scientifically, and so comparatively more of them have been radiocarbon-dated (Geake 1997:10). The low numbers of inhumation graves seen in fourth century England are also likely to be because radiocarbon dates are less commonly used on Roman sites, due to the distinctive nature of Roman material culture. Previous demographic studies have shown lower levels of activity across the Roman period that are likely to be an artifact of this, rather than a genuine difference (Bevan et al. 2017; Capuzzo et al. 2020:1823). The chronological distribution of English inhumations is more even than that seen in the summed radiocarbon models from nearby regions. In both Scotland and Ireland, the peak in inhumation burials between the fifth and seventh centuries is much more noticeable (Maldonado 2013:4; Gleeson and McLaughlin 2021:388). While Belgian inhumations were also most common after the seventh century, they were only rarely found beforehand, resulting in a steep increase in the seventh century.
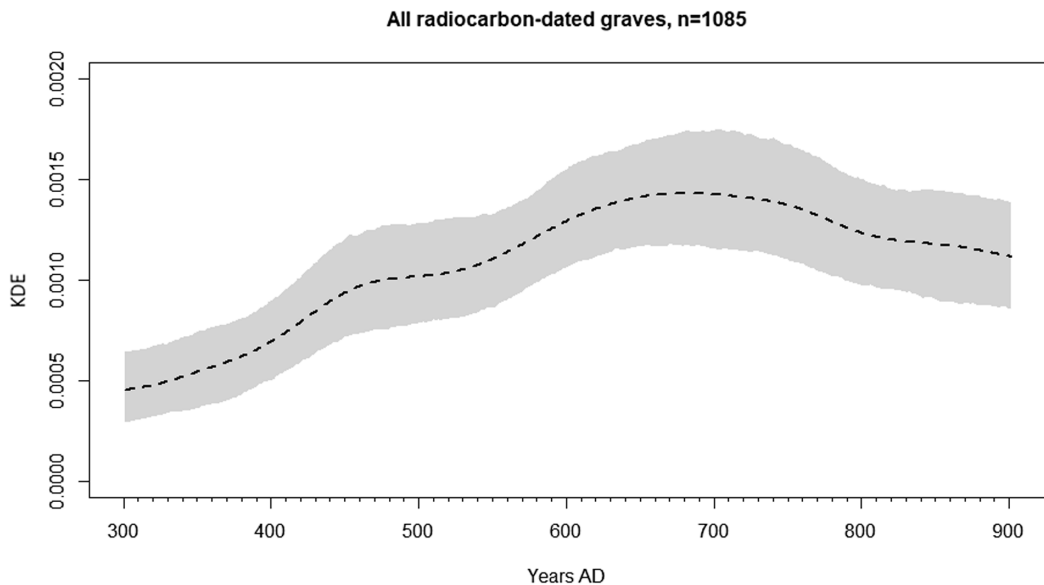
All radiocarbon-dated graves, n=1085

Figure 3   KDE for all radiocarbon-dated burials.

Furnishing Graves

Furnished burials were rarely found across the fourth century, then increased unevenly, with a plateau in the second half of the fifth century before a rise to a slight peak at the end of the sixth century and start of the seventh century (Figure 4). After this, the frequency of furnished burial decreased. It was still used in the eighth century, although at a minimal level, and it was not until the ninth century that levels of furnished burial returned to the low levels seen in the fourth century. The pattern of furnishing when weighted by the number of objects in the grave is very similar but emphasize the period around the year 600 AD as a particularly important point in time for funerary investment.

Unfurnished burials, meanwhile, show a similar pattern in reverse. They were present in low, but constant, levels from the fourth to sixth centuries. Their numbers increased rapidly over the course of the seventh century and remained high across the eighth and ninth centuries.

When split by sex, we can see some variations in these overall patterns. Female furnished burial was proportionally more common in the fifth century than male furnished burial was, and levels of furnishing in female graves were relatively consistent from the middle of the fifth century to early seventh century (Figures 5 and 6). Female furnished burial also declined more gradually, and a greater proportion of female furnished burials persisted into the eighth century. Almost equal numbers of male and female furnished graves are found in the dataset, but the male furnished burials are more concentrated around that peak at the end of the sixth century and start of the seventh century. When weighted by the number of objects per grave, the late sixth to early seventh century peak for males was even more pronounced, with proportionally fewer grave goods in the fifth century. This suggests that not only was there a high number of male furnished graves around 600 AD, but those graves were more lavishly furnished, while for female graves, the numbers of objects being deposited in graves was relatively consistent regardless of how popular the practice of furnishing was. For both male

(a)

Furnished graves, n=353
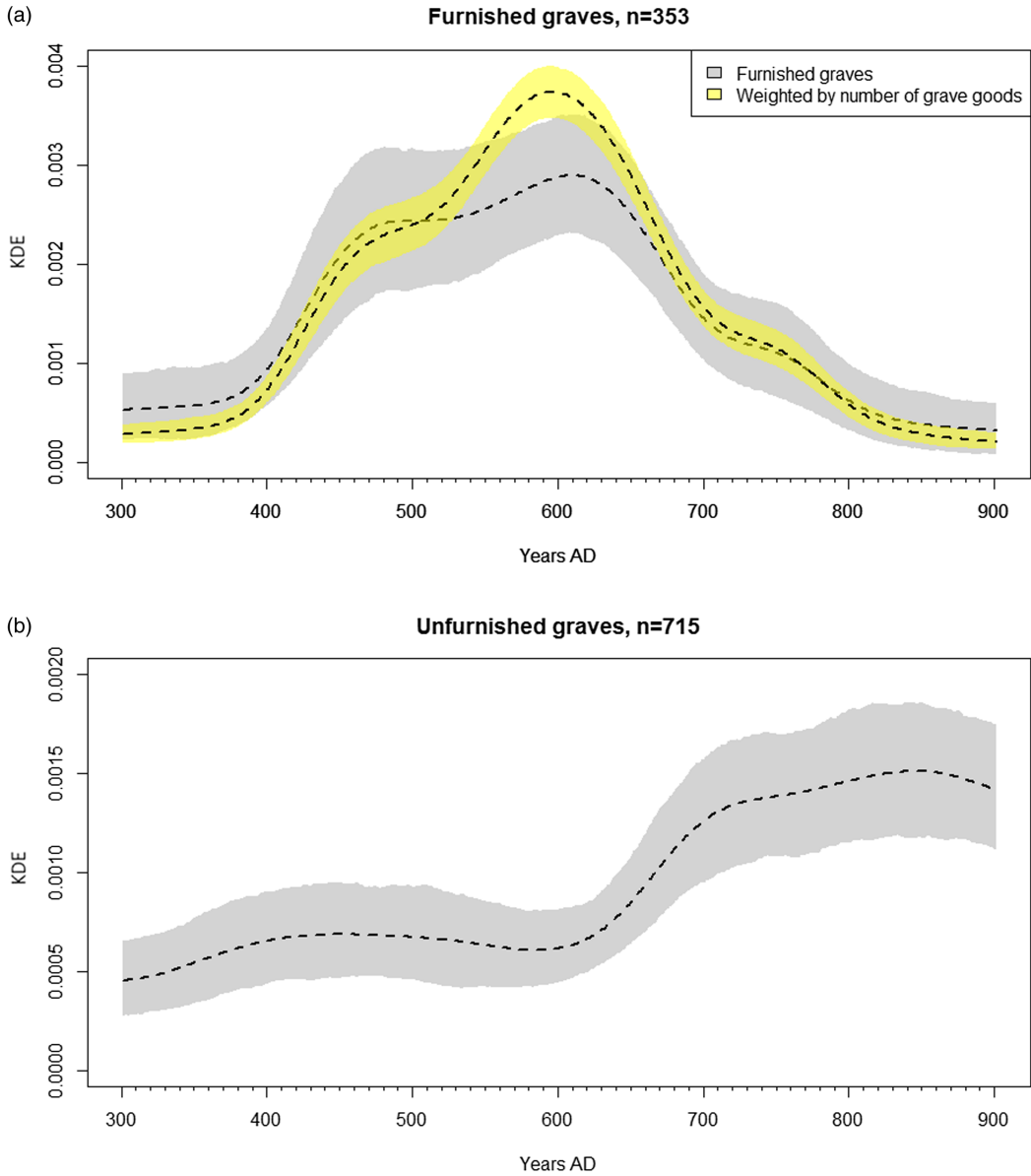

(b)

Unfurnished graves, n=715

Figure 4   Furnishing patterns: (a) KDE of furnished burials and burials weighted by number of grave goods; (b) KDE of unfurnished burials.

and female graves, a slight dip can also be seen in unfurnished burial around 600 AD. Although this is only a small fluctuation in the model, and so should be treated with caution, the fact that it coincides with the peaks in grave good use suggests a genuine preference for furnished burial at this point in time.

The trends in furnished and unfurnished burial over time also show regional variability. The radiocarbon dated burials are not evenly distributed throughout England; dates from furnished

(a)

Female furnished graves, n=162

(b)

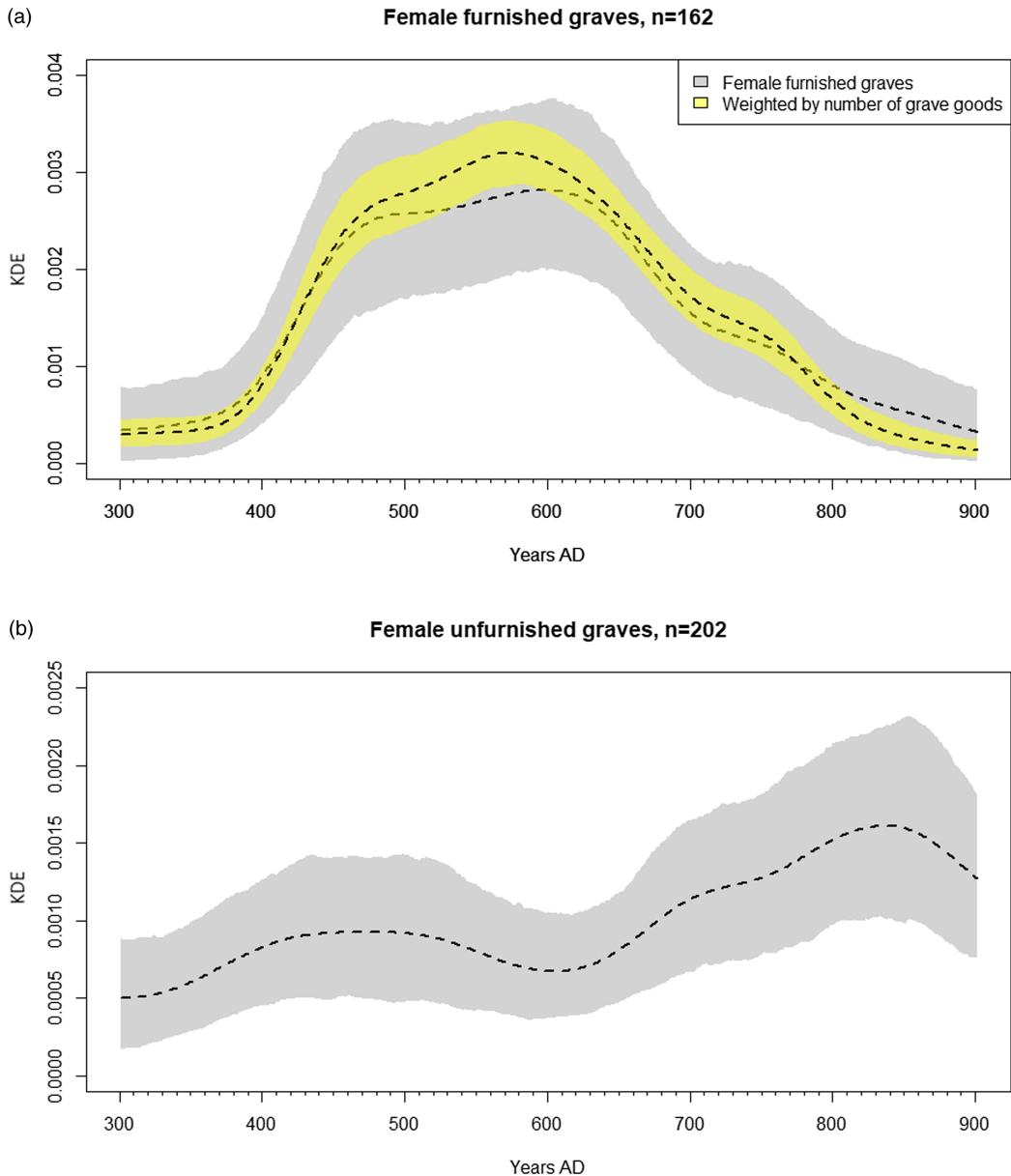**Female unfurnished graves, n=202**

Figure 5   Female furnishing patterns: (a) KDE of female furnished burials and burials weighted by number of grave goods; (b) KDE of unfurnished burials.

burials were found largely in the east and south, whilst unfurnished burials were more evenly distributed across the country (Figure 7). Sample sizes were too small to be able to analyse any of the early medieval kingdoms individually, but the dataset was split into "south and east" and "north and west" to compare the areas where furnished burial was most common with those where it was rarer. The resulting KDE for the south and east was reasonably similar to that for all furnished burial, with a peak in furnished burial, and a trough in unfurnished burial around 600 AD, but the one from the north and west showed that the majority of furnished burial
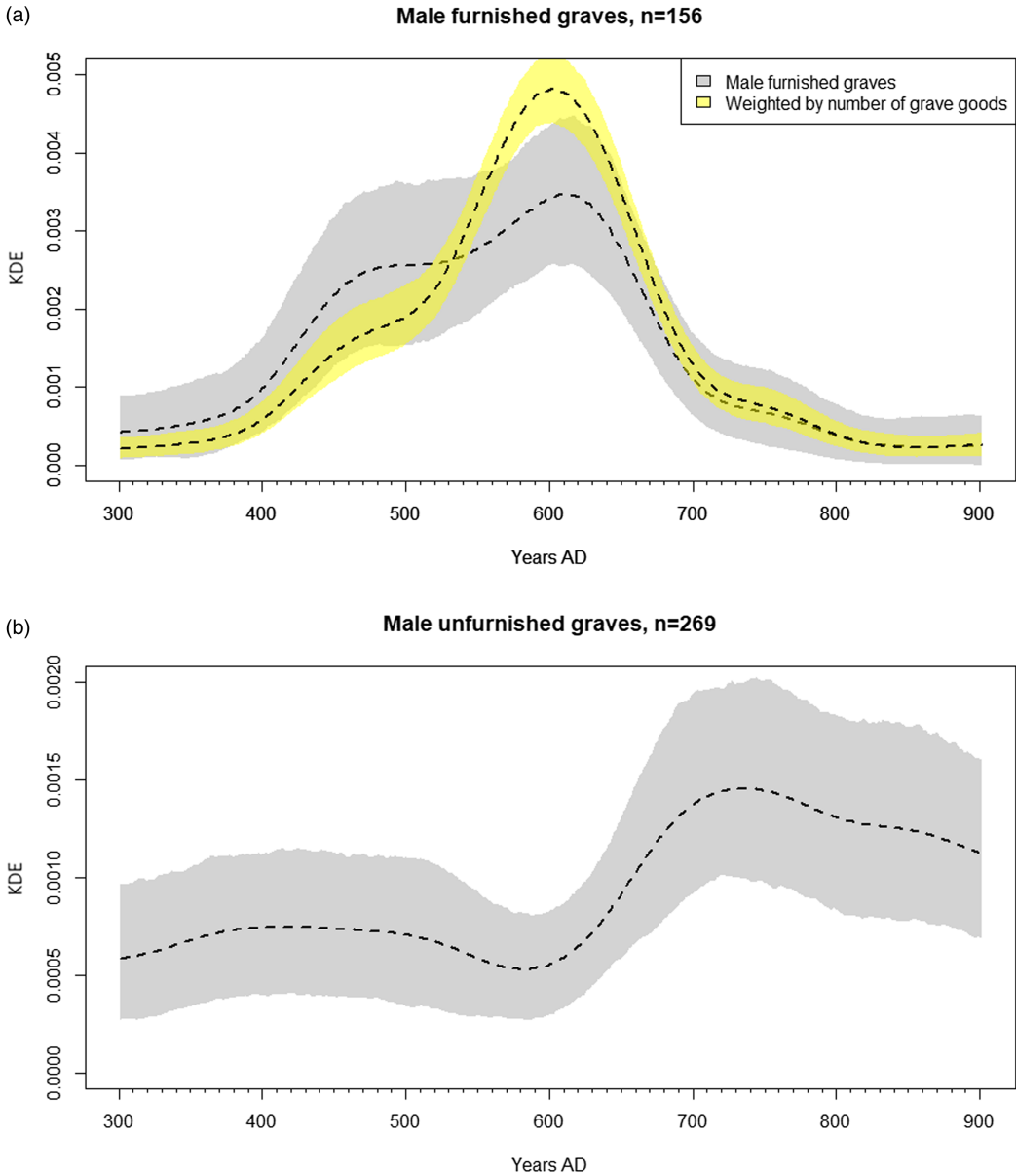
Figure 6   Male furnishing patterns: (a) KDE of male furnished burials and burials weighted by number of grave goods; (b) KDE of male unfurnished burials.

dated to that peak around 600 AD, with much less pronounced increases in the fifth century. There is also a notable dip in the frequency of unfurnished burials in the south and east around 600 AD (Figures 8 and 9).

Previous studies have emphasized not only the distinction between furnished and unfurnished burial, but also the way in which the nature of furnishing changed. Burial in the seventh century was wealthy in terms of the materials used, not just in terms of pure numbers of artifacts (Hines
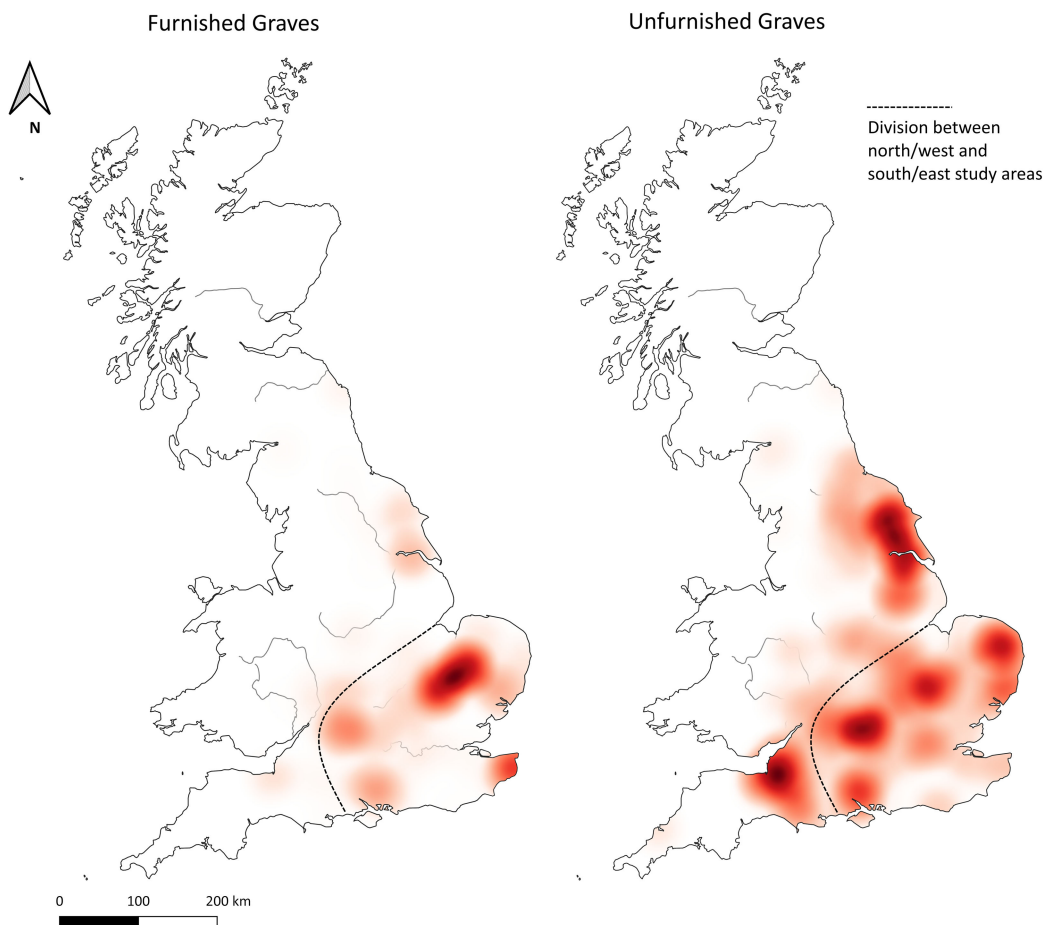
Figure 7   Location of furnished and unfurnished radiocarbon-dated graves and division between the "north and west" and "south and east" study areas.

2013a:541–542). Those graves which are particularly richly furnished, which here means those containing silver, gold, or semi-precious gems, have a different chronological distribution to those without such high-status objects. They were relatively rare in the fifth century, and although they reached their peak at the start of the seventh century, at the same time as furnishing more generally peaked, they did not decline until well into the eighth century (Figure 10). It is worth noting that there was a particularly small number of rich graves, resulting in a wider error range than for most other models. The potential for the shape of this distribution to change with the addition of more dates is therefore greater in this instance than others.

Understanding Cemetery Space

As well as changing intensity of furnished burial over time, it is also possible to use this data to understand how the use of different spaces for burial may have changed, comparing burial in large cemeteries to burial in small groups, or isolated places. Execution cemeteries, representing a very specific function quite different from most cemetery space, were not included here (see supplementary material, Figure S16).

(a)

Furnished graves in the north and west, n=72

(b)

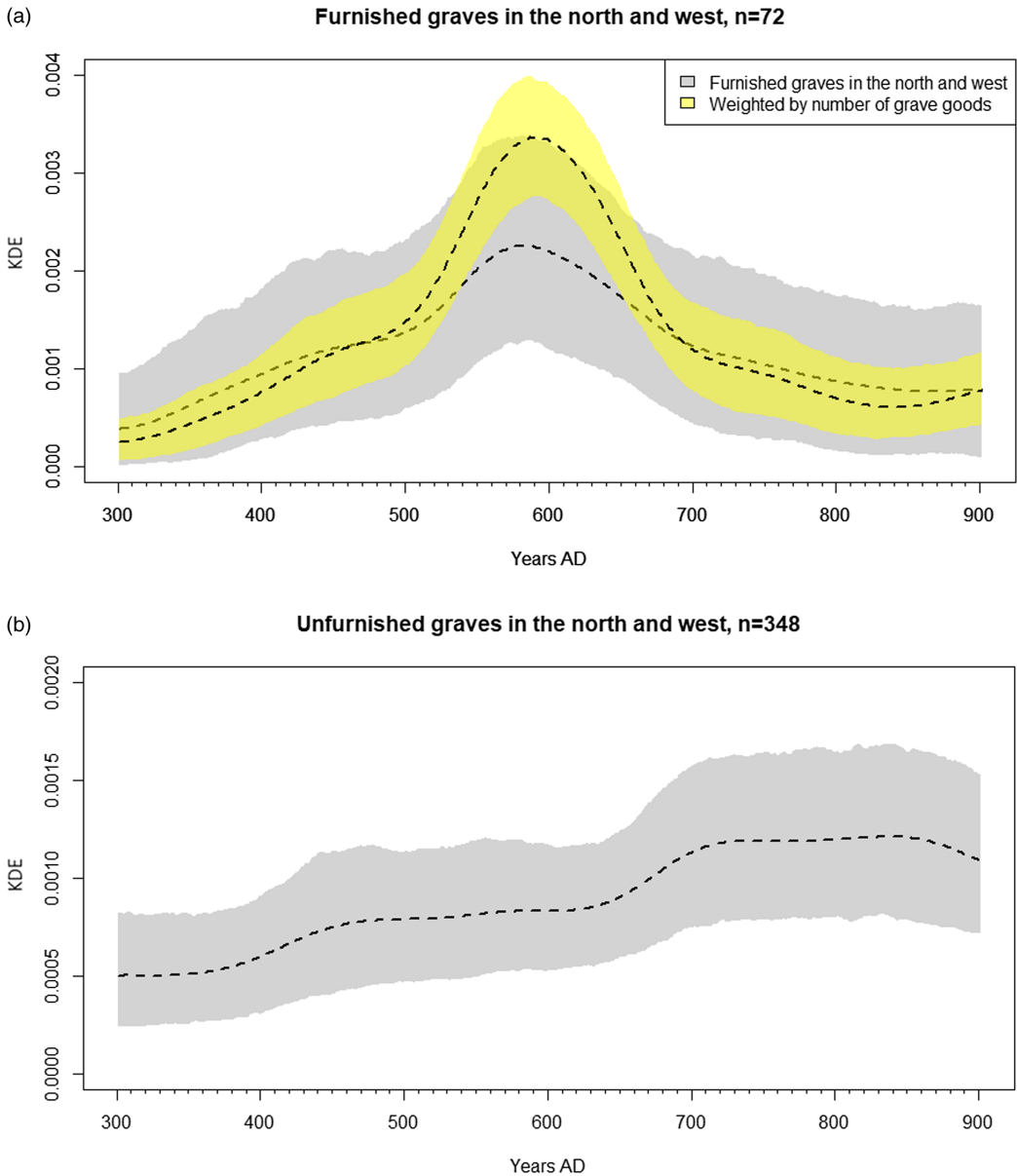**Unfurnished graves in the north and west, n=348**

Figure 8 Furnishing patterns in the north and west: (a) KDE of furnished burials and burials weighted by number of grave goods; (b) KDE of unfurnished burials.

Isolated burials had peaks in the fourth century, and the end of the sixth and start of the seventh century. Burials in small groups, defined as five burials or fewer, were most common at the end of the fourth century and start of the fifth century, before declining to a low point at the end of the sixth and start of the seventh century, and then increasing in popularity again. This is in contrast to larger cemeteries which were relatively rare in the fourth century, and increased in frequency over time, reaching their high point by the seventh century and remaining at that level (Figure 11).
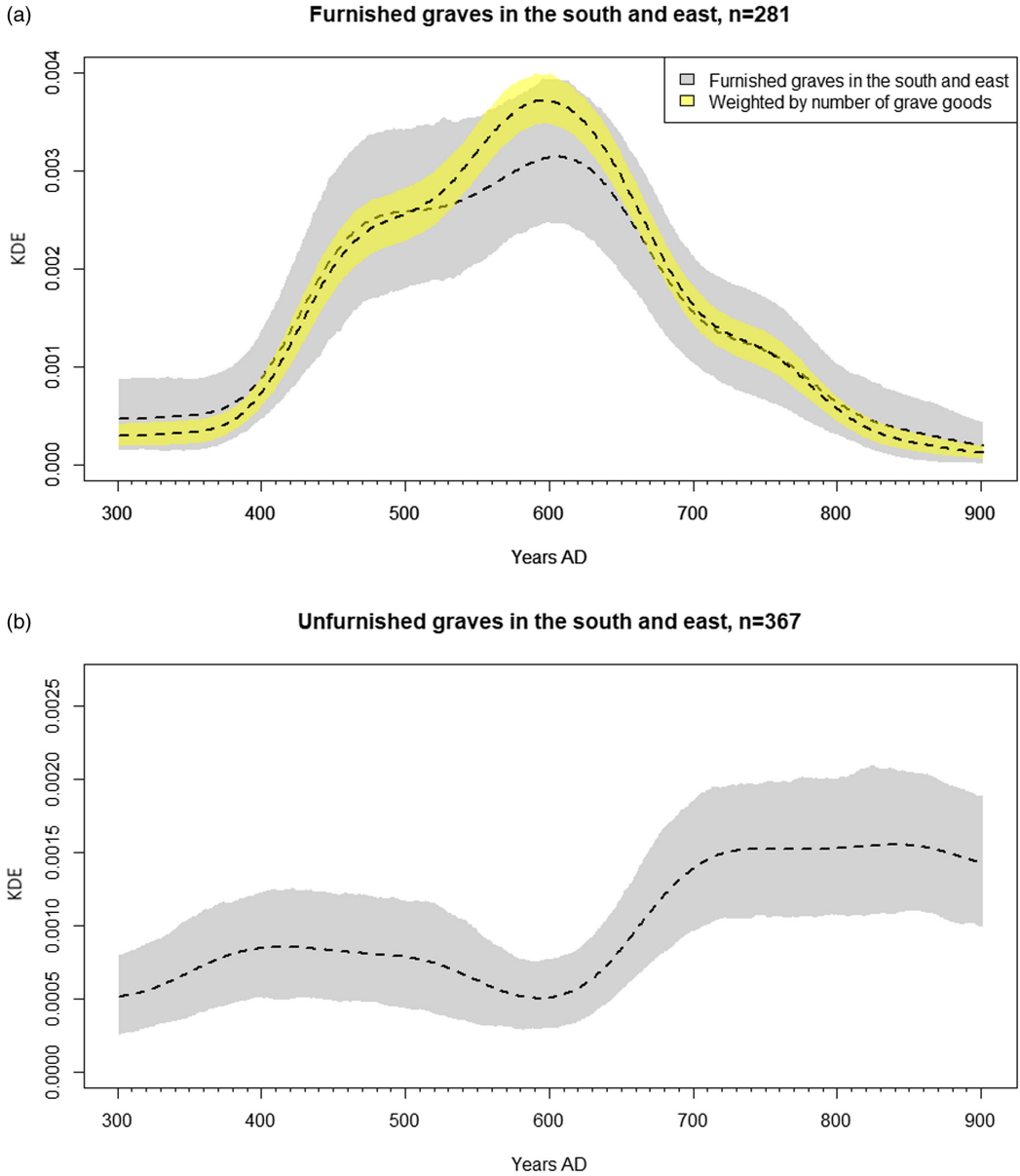
(a)

(b)

Figure 9   Furnishing patterns in the south and east: (a) KDE of furnished burials and burials weighted by number of grave goods; (b) KDE of unfurnished burials.

The distributions of isolated graves and small groups of burials in particular are unlikely to be affected by researcher biases, as their unusual and often unexpected nature means that they are more likely to be radiocarbon dated than graves found as part of a larger cemetery. There are still relatively few graves in these models, however, 72 and 79 respectively, and so the error ranges on these models are large, but they are likely to represent a greater proportion of burials in that category than the other models.
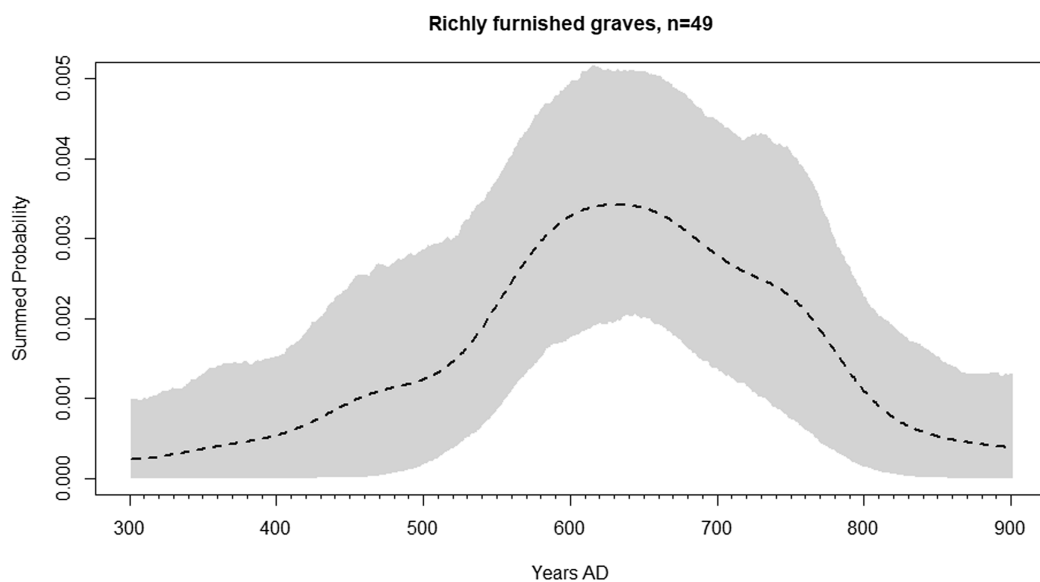
Richly furnished graves, n=49

Figure 10   KDE of richly furnished graves, containing precious metals or gemstones.

DISCUSSION

The pattern of chronological change suggested by modeling radiocarbon-dated graves aligns more with that proposed by Geake (1997), rather than more recent studies such as the ASCF. These models show clear evidence for the persistent use of furnished burial beyond the ASCF's terminal point of 685 AD. A reduced, but notable, number of burials were still being deposited with grave goods in the eighth century, fitting more with Geake's chronology which placed the end of grave good use around 720–730 AD (Geake 1997:130). None of the graves which dated solely to the eighth century or later were particularly rich, but they did contain a wide range of objects. Although knives were the most common object type deposited towards the end of furnished practice (Geake 1997:102), these later graves still contain a full repertoire, including combs, beads, coins, brooches, swords, keys, and animal remains. Some, such as the Repton graves, can be attributed to Scandinavian migration (Jarman et al. 2018), but others represent a continuation of earlier practices, if in a reduced form; for example, a grave at Kilnwood, Oxfordshire, radiocarbon dated to cal AD 878–1024 (2σ), contained a necklace consisting of six glass beads and two silver rings, and a knife, a combination that would not have looked out of place two centuries earlier (Taylor 2016:6). The use of grave goods after the seventh century is considerably reduced compared to what went before, but it would be incorrect to say that grave good use had entirely ceased before the eighth century started.

Perhaps the most common criticism of summed radiocarbon methods is that they reflect research interests rather than true patterns of past activity. The sample of radiocarbon dated graves available is not unbiased but has been shaped by choices about which samples are worth radiocarbon dating, and so it is worth considering how this may have affected results. Researcher choices are almost certainly the reason why numbers of burials are consistently low in the fourth century. As discussed above, radiocarbon dating is generally underused in the Roman period. Based on what is assumed of late Roman burial practices, it might be expected that unfurnished burials would be higher at this point in time. That the models show little

(a)

Isolated burials, n=72

(b)

Small groups of burials, n=81

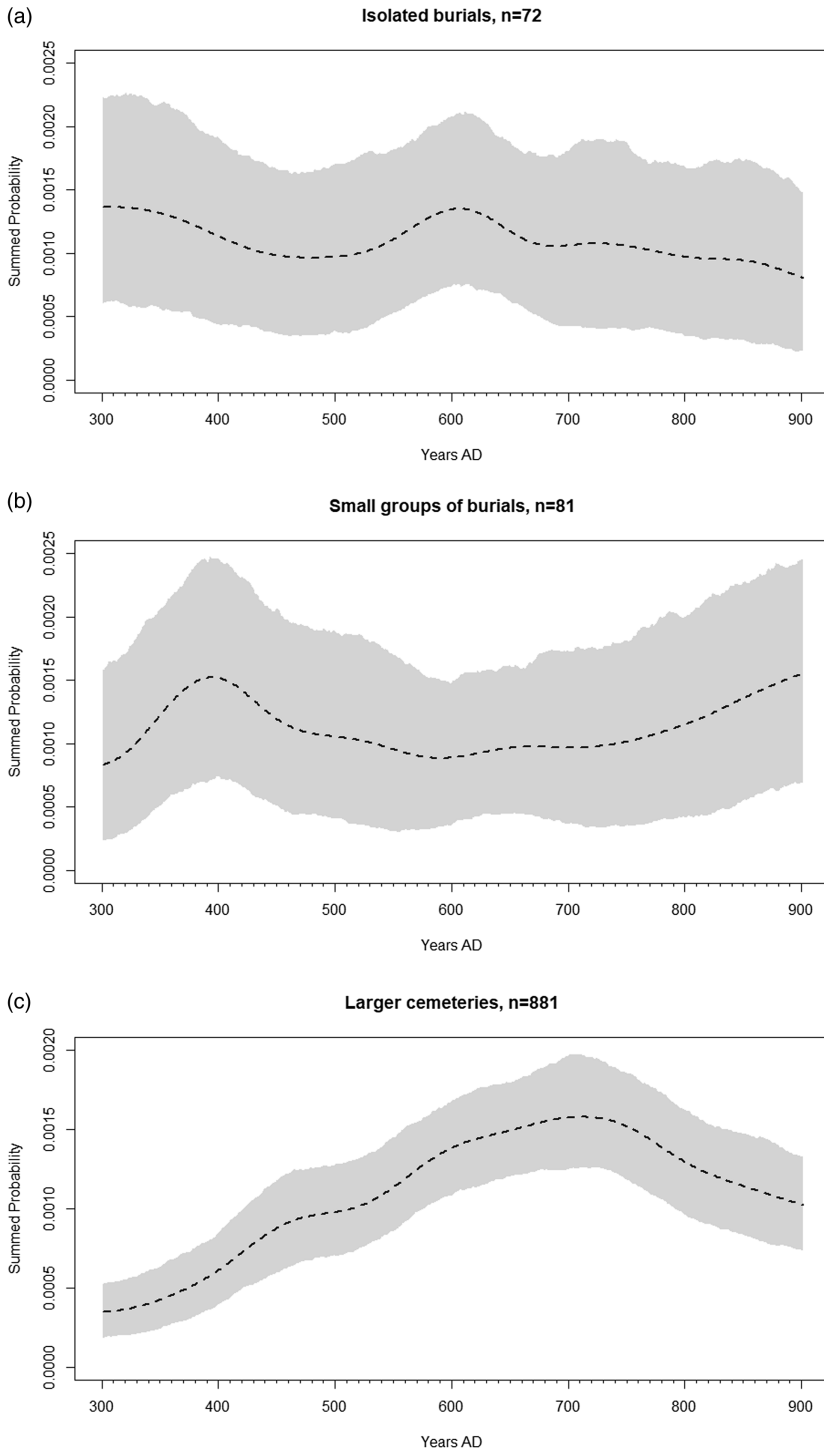(c)

Larger cemeteries, n=881

Figure 11   Cemetery types: (a) KDE of isolated burials; (b) KDE of small groups of burials; (c) KDE of large cemeteries.

difference between the frequency of unfurnished burial in the fourth and fifth centuries is almost certainly due to the rarity with which radiocarbon dating is deployed for burials of that period. Unfurnished burial was consistently found across the fourth to seventh centuries alongside furnished burials, and it should not be assumed that unfurnished burials were automatically later (Scull 2013:524–525). However, this work has demonstrated that unfurnished burial was not a constant and waxed and waned in popularity just as furnished burial did.

The models presented here put the high point in furnished burials at the end of the sixth century and start of the seventh. This is the exact point when the ASCF suggests minimal levels of furnishing, placing their peak in the mid-sixth century, with an additional peak in the mid-seventh century for females. It is difficult to think of a reason why this period would have been disproportionately targeted for radiocarbon dating. It is true that a substantial number of dates relating to furnished burial, around a quarter, were from the ASCF, and were initially chosen to focus on the period from 570 to 720 AD. Yet three-quarters of dates from furnished burials come from other studies, with diverse focuses. If those other studies are analysed on their own, without the ASCF samples, the peak around 600 AD is less obvious, but still far higher than would be expected if this was a genuine hiatus in furnishing (see supplementary material, Figure S17). The fact that there are small dips in unfurnished burial which corresponds with the peak in furnished burial suggests that this is indeed a real pattern, and at that point in time, a higher proportion of the population were genuinely being buried with grave goods.

Part of the reason for the distinctions between my models and those of the ASCF may be rooted in their methodology. As the primary aim of the project was to understand grave good use in the seventh century, earlier graves were not as comprehensively sampled as later ones were (Hines 2017:5). Additionally, correspondence analysis required that each grave included had to contain at least two artifact types, and each artifact type had to be present in at least two graves. Graves potentially containing heirlooms were also removed from the analysis (Bayliss et al. 2013:251–252). Although these restrictions were necessary for this type of analysis, it does mean that their sample of graves was not a full representation of the range of funerary practices available, but rather was biased towards the better furnished burials. The absence of well-furnished burials is assumed to indicate a preference for unfurnished, or poorly furnished burial, but no consideration of the unfurnished burials themselves was given.

It is possible that the periods where the ASCF identifies peaks in furnishing are in fact periods when artifact styles were particularly chronologically distinctive. Geake (1997:123) pointed out the difficulty of identifying early seventh century assemblages, because the objects used at that point in time were long-lived styles, in use for well over a century. There are relatively few object types which can be specifically dated to the late sixth or early seventh century (Geake 2002:144). This means that projects which specifically target chronologically distinctive objects will leave this period looking sparsely furnished, regardless of how common it was in reality. This does not mean that the distinct phased assemblages that the ASCF identified are wrong, per se, merely that they are not representative of the totality of furnishing practices.

The stark gendered differences identified by the ASCF are also not visible in the radiocarbon dated graves. The ASCF argued for no direct congruence between male and female trends, particularly in the seventh century (Scull 2013:528). Although furnished female burial did decline from its early seventh century peak more slowly than male burial did, there is no sign of the two distinct peaks that they identify. In contrast to the peaks and troughs identified in

female furnishing in the ASCF, here, female furnished burial is a relatively consistent feature across the fifth to seventh centuries. Rather, it is the male burials which show a more marked peak, with the most investment in male graves being seen around the start of the seventh century. This is also the point in time when "princely" burials were at their most common. Rather than being a unique phenomenon, this suggests that princely burials were the pinnacle of a huge amount of investment in male burial.

One of the most difficult to explain aspects of the ASCF was the peak in female furnished burial late in the seventh century. They suggest that it was more culturally appropriate to bury females in rich graves than males later in the seventh century, possibly because it was more appropriate to keep masculine markers of wealth within society (Hines 2013a:542). Although this work has thrown doubt on whether such a peak in furnishing exists, the types of objects used in graves undoubtedly did change in the seventh century. Of the "richly furnished" seventh and eighth graves identified above, 80% of them were female, indicating a higher level of investment in female than male burial at this point in time, in terms of the quality of the objects if not the quantity. Again, this supports the idea that the ASCF highlighted patterns in the richer, more chronologically distinctive grave assemblages, not furnishing patterns more generally.

The geographical distinctions identified here are visible in the ASCF; graves from their phase MB (sixth century) were more common in the south of England, with relatively few sites further north (Hines 2013a:530). It is notable that their seventh century phase of female furnished burial is more geographically spread to the west and the north than the earlier phases of female burial were (Hines 2013a:537), and it may be that this is the same phenomenon as the c.600 peak in furnished northern and western burial.

Although these radiocarbon models suggest that the decline in furnished burial began after the historically documented conversion to Christianity, this does not make Christianisation any more likely an explanation for funerary change. We have enough evidence from continental furnished burials within churches, and burials with Christian symbolism in their graves, to demonstrate that there is no clear association between Christianisation and unfurnished burial (Boddington 1990:188; Effros 2002:34–35; Effros 2003:76). With the ASCF placing the terminus of burial around 685 AD, they suggest that Theodore of Tarsus's reforms of the English Church had a key role in the final cessation of grave good use (Hines 2013b:553). Yet with plenty of evidence for grave good use after 685 AD, this is unlikely to be the case.

At the same time as the peak in furnished burials in the late sixth and early seventh century, we also see a peak in the use of communal cemeteries, a peak in isolated burials, and a peak in particularly rich graves, as well as a low point for unfurnished burials and for small groups of cemeteries. This suggests that all of these phenomena are connected. A common interpretation of the furnished burial rite is that the creation of a tableau using both the body and the objects associated with it is key in memorializing the deceased (Williams 2006:42). This requires an audience to view the body. Cemeteries are also places where community identity is created (Sayer 2013:155); using furnished burials as a statement of identity and of community belonging only works if there is a community to gather to view the burial. Part of the role of the funerary ritual is to transform an individual's place in society the community of the living to the community of the dead (Fowler 2013:516); furnishing and community cemeteries thus go hand in hand. This ties into ideas that furnishing burials is related to a continued sense of personhood attached to the corpse (Brownlee 2020). This sense of personhood extends to the need to create communities in death, by grouping burials together. It is therefore not surprising that the high

point of furnishing coincides with the low point for small groups of burials, nor that as one declines, the other rises. After furnished burial was abandoned, so too were the majority of the sites in which furnished burial had been used (Scull 2013:528; Brownlee 2021b). This is reflected by the increase seen in small groups of burials over that period (Boddington 1990:188), although given that this study classed "small groups" as five burials or fewer, it does not capture the full extent of changing cemetery size. Nevertheless, that this increase coincides exactly with the decline in grave good use, it suggests that cemetery size and material investment in the burial are linked.

The fact that isolated burials should peak at the same point in time therefore seems counterintuitive. Isolated burials can cover the spectrum of social status, belonging to societal outcasts, or conversely high-status individuals, separated by their rank. Richly furnished, but isolated barrow burials were often located on territorial boundaries as a means of staking a dynastic claim to land and would be located in clearly visible positions along routeways (Hamerow 2020:243; Semple and Williams 2015:150–151). Overall, only a third of the isolated burials in this dataset were furnished. Yet of those which could date to that peak around 600 AD, half of them were furnished. This suggests that the higher numbers of isolated burials at this point in time was primarily caused by their use to claim land ownership. The start of the seventh century was a period in which the visibility of the burial was important, whether that was visibility in the form of tableaus at the graveside, or in the landscape.

CONCLUSIONS

This method has the potential to enable more accurate comparisons of how grave good use changed over time across regions beyond England, something otherwise hampered by the multitude of different methods of dating graves and questions about their comparability (Brownlee 2021a:145). Currently, this is limited by differential use of radiocarbon as a dating technique in different countries, but with greater levels of sampling, the potential is there. The study of Belgian radiocarbon-dated graves was reasonably comprehensive in its data collection, and yet only had 260 inhumations dating to the same period used in this study, the majority of which date to the seventh century and later, after grave furnishing had already begun to decline. This is partly due to poor organic preservation in acidic soils (Capuzzo et al. 2020:1811), but means that further analysis of those graves is currently unlikely to be of much use in answering the types of questions outlined in this paper. What this work highlights is the potential for radiocarbon dating to contribute to questions of funerary change, even in historical periods, if enough data can be gathered.

There is undoubtedly more nuance to the way in which grave furnishings evolved than has been presented here. There has not been the scope in this paper to investigate how different types of objects may have fluctuated over this time period, or how different styles of objects may have changed. With a dataset currently consisting of 353 radiocarbon-dated furnished burials, splitting this into different object types would produce very small datasets which could drastically change if more data were added. Caution should also be taken with the models presented for which there are relatively small sample sizes, particularly those richly furnished graves and isolated and small groups of burials. Nor has this method proved particularly useful for understanding changes in funerary practice between the late Roman and the early medieval period. There are simply too few radiocarbon-dated graves from the third and fourth centuries, and those that exist are unlikely to be fully representative. There is a need to radiocarbon date more unfurnished graves from within those earliest cemeteries, as well as more graves from

Late Roman contexts, to correct for biases in what past researchers have chosen to radiocarbon date.

Despite their shortcomings, these models have proved highly valuable in shedding light on patterns of grave good use and cemetery use, taking into account the entirety of the spectrum of furnishing, including unfurnished graves, poorly furnished graves, and those with chronologically indistinctive artifacts. They have demonstrated a previously unrecognised peak in grave good use, particularly in male burial, around the end of the sixth and start of the seventh century. This was a high point for material investment in many forms, in elite materials as well as quantity of objects, in isolated high-status burials, and it was a low point in unfurnished burials, and in smaller cemeteries. After this peak, material investment in graves declined, but some grave good use continued into the eighth century. These models suggest that the patterns identified in the ASCF represent only a subset of chronologically distinctive artifact types, which are not representative of furnishing patterns as a whole. Instead, older chronologies, such as Geake's 1997 study, give a more accurate picture of how burial furnishing changed across the seventh century.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit https://doi.org/10.1017/RDC.2023.110

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REFERENCES

Archibald M. 2013. Numismatics and the chronological models. In: Bayliss A, Hines J, Hoilund Nielsen K, McCormac G, Scull C, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology Monographs. p. 493–512.

Bayliss A, Hines J. 2013. The frequency of furnished burial through time. In: Hines J, Bayliss A, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology. p. 476–479.

Bayliss A, McCormac G, Thompson M. 2013. Radiocarbon dating of the 6th and 7th centuries AD. In: Hines J, Bayliss A, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology. p. 35–37.

Bayliss A, Hines J, Høilund Nielsen K. 2013. Interpretive chronologies for the male graves. In: Bayliss A, Hines J, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework.

London: Society for Medieval Archaeology. p. 231–338.

Bevan A, Colledge S, Fuller D, Fyfe R, Shennan S, Stevens C. 2017. Holocene fluctuations in human population demonstrate repeated links to food production and climate. Proceedings of the National Academy of Sciences 114(49):E10524–E10531. doi: 10.1073/pnas.1709190114.

Bevan A, Crema E. 2021. rcarbon: Calibration and analysis of radiocarbon dates 1.4.2. https://CRAN.R-project.org/package=rcarbon.

Boddington A. 1990. Modes of burial, settlement, and worship: the final phase reviewed. In: Southworth E, editor. Anglo-Saxon cemeteries: a reappraisal. Stroud: Sutton. p. 177–199.

Bronk Ramsey C. 2017. Methods for summarizing radiocarbon datasets. Radiocarbon 59(6): 1809–1833.

Brownlee E. 2020. The Dead and their possessions: the declining agency of the cadaver in early Medieval Europe. European Journal of Archaeology 23(3):406–427.

Brownlee E. 2021a. Connectivity and funerary change in early Medieval Europe. Antiquity 95(379): 142–159.

Brownlee E. 2021b. Grave goods in early Medieval Europe: regional variability and decline. Internet Archaeology. https://doi.org/10.11141/ia.56.11.

Capuzzo G, Snoeck C, Boudin M, Dalle S, Annaert R, Hlad M, Kontopoulos I, Sabaux C, Salesse K, Sengeløv A, et al. 2020. Cremation vs. inhumation: modeling cultural changes in funerary practices from the Mesolithic to the Middle Ages in Belgium using kernel density analysis on ^{14}C data. Radiocarbon 62(6):1809–1832. doi: 10.1017/RDC.2020.88.

Carver M, Hills C, Scheschkewitz J. 2009. Wasperton: a Roman, British and Anglo-Saxon community in central England. Woodbridge: Boydell & Brewer.

Contreras DA, Meadows J. 2014. Summed radiocarbon calibrations as a population proxy: a critical evaluation using a realistic simulation approach. Journal of Archaeological Science 52:591–608.

Crema E, Bevan A. 2021. Inference from large sets of radiocarbon dates: software and methods. Radiocarbon 63(1):23–39.

Crema E. 2022. Statistical inference of prehistoric demography from frequency distributions of radiocarbon dates: a review and a guide for the perplexed. Journal of Archaeological Method and Theory. https://doi.org/10.1007/s10816-022-09559-5.

Effros B. 2002. Caring for body and soul: burial and the afterlife in the Merovingian world. University Park: Pennsylvania State Press.

Effros B. 2003. Merovingian mortuary archaeology and the making of the Middle Ages. Berkeley: University of California Press.

Fowler C. 2013. Identities in transformation: identities, funerary rites, and the mortuary process. In: Tarlow S, Nilsson Stutz L, editors. The Oxford handbook of the archaeology of death and burial. Oxford: Oxford University Press; p. 511–526.

Freeman J, Byers DA, Robinson E, Kelly RL. 2018. Culture process and the interpretation of radiocarbon data. Radiocarbon 60(2):453–467.

Geake H. 1997. The use of grave goods in Conversion Period England. Oxford: BAR.

Geake H. 2002. Persistent problems in the study of Conversion-Period burials in England. In: Lucy S, Reynolds A, editors. Burial in Early Medieval England and Wales. London: Society for Medieval Archaeology. p. 144–155.

Gerrard J. 2015. Synthesis, chronology, and "Late Roman" cemeteries in Britain. American Journal of Archaeology 119(4):565–572.

Gleeson P, McLaughlin R. 2021. Ways of death: cremation and belief in first-millennium AD Ireland. Antiquity 95(380):382–399.

Hamerow H. 2015. A high-status seventh century female burial from West Hanney, Oxfordshire. The Antiquaries Journal 95:91–118.

Hamerow H. 2020. A Conversion-Period burial in an ancient landscape: a high-status female grave near the Rollright Stones, Oxfordshire/Warwickshire. In: Langlands A, Lavelle R, editors. The land of the English kin: studies in Wessex and Anglo-Saxon England in honour of Professor Barbara Yorke. Leiden: Brill. p. 231–244.

Hannah E. 2021. 800 years of making: Early Medieval craftworking and an 8th-century decline in Ireland. Medieval Archaeology 65(2):238–268.

Hannah E, McLaughlin R. 2019. Long-term archaeological perspectives on new genomic and environmental evidence from early medieval Ireland. Journal of Archaeological Science 23–28.

Härke H. 1992. Changing symbols in a changing society: the Anglo-Saxon weapon burial rite in the seventh century. In: Carver M, editor. The age of Sutton Hoo: the seventh century in north-western Europe. Woodbridge: Boydell. p. 149–166.

Hills C, Lucy S. 2012. Spong Hill. IX, chronology and synthesis. Cambridge: McDonald Institute Monographs.

Hines J. 2013a. Implications for Anglo-Saxon social history. In: Hines J, Bayliss A, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology. p. 529–545.

Hines J. 2013b. Religion and Anglo-Saxon burial practices. In: Hines J, Bayliss A, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology. p. 548–554.

Hines J. 2017. A new chronology and new agenda: the problematic sixth century. In: Insley C, Owen-Crocker G, editors. Transformation in Anglo-Saxon culture: Toller Lecture on Art, Archaeology and Text. Oxford: Oxbow Books. p. 1–21.

Hines J. 2021. The Chronological Framework of Early Anglo-Saxon Graves and Grave Goods: New Radiocarbon Data from RAF Lakenheath, Eriswell, Suffolk, and a new calibration curve (IntCal20). The Antiquaries Journal 101:106–142. doi: https://doi.org/10.1017/S0003581520000517.

Hines J, Bayliss A. 2013. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology.

Jarman C, Biddle M, Higham T, Bronk Ramsay C. 2018. The Viking Great Army in England: new dates from the Repton charnel. Antiquity 92(361):183–199.

Leggett S. 2022. Tackling Western European dietary transitions in the first millennium ad: a hierarchical meta-analytical approach. European Journal of Archaeology 25(4):523–543. https://doi.org/10.1017/eaa.2022.23.

Lucy S. 2000. The Anglo-Saxon way of death. Stroud: Sutton.

Lucy S, Evans C. 2016. Romano-British settlement and cemeteries at mucking: excavations by Margaret and Tom Jones, 1965–1978. Oxford: Oxbow Books.

Lucy S, Newman R, Dodwell N, Hills C, Dekker M, O'Connell T, Riddler I, Walton Rogers P. 2009. The burial of a princess? The later seventh-century cemetery at Westfield Farm, Ely. The Antiquaries Journal 89:81–141.

Maldonado A. 2013. Burial in Early Medieval Scotland: New Questions. Medieval Archaeology 57:1–34.

McLaughlin TR. 2019. On applications of space–time modelling with open-source ^{14}C age calibration. Journal of Archaeological Method and Theory 26(2):479–501.

Philpott R. 1991. Burial practices in Roman Britain: a survey of grave treatment and furnishing A.D. 43-410. Oxford: British Archaeological Reports British Series 219.

Pitts M, Griffin R. 2012. Exploring health and social well-being in late Roman Britain: an intercemetery approach. American Journal of Archaeology 116(2):253–276.

Quensel-von-Kalben L. 2000. Putting Late Roman burial practice from Britain in context. In: Pearce J, Millett M, Struck M, editors. Burial, Society and Context in the Roman World; p. 217-230. Oxford: Oxbow.

Reimer PJ., Austin WEN, Bard E, Bayliss A, Blackwell PG, Ramsey CB, Butzin M, Cheng H, Edwards RL, Friedrich M, et al. 2020. The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). Radiocarbon 62(4):725–757.

Rick JW. 1987. Dates as data: an examination of the Peruvian Preceramic radiocarbon record. American Antiquity 52(1):55–73.

Sayer D. 2013. The social aspects of Early Medieval mortuary practice. History Compass 11(2):147–162.

Scull C. 2013. Burial practice in Anglo-Saxon England. In: Hines J, Bayliss A, editors. Anglo-Saxon graves and grave goods of the 6th and 7th centuries AD: a chronological framework. London: Society for Medieval Archaeology. p. 523–529.

Scull C. 2015. Chronology, burial and conversion: the case of England in the seventh century. Neue Studien zur Sachsenforschung 5:73–84.

Semple S, Williams H. 2015. Landmarks of the dead: exploring Anglo-Saxon mortuary. In: Clegg Hyer M, Owen-Crocker G, editors. The material culture of the built environment in the Anglo-Saxon world. Liverpool: Liverpool University Press. p. 137–161.

Sherlock S. 2012. A royal Anglo-Saxon cemetery at Street House, Loftus, North-East Yorkshire. Hartlepool: Tees Archaeology.

Taylor A. 2016. Kilnwood, Blenheim Hill, Harwell, Oxfordshire: an archaeological excavation. Thames Valley Archaeological Services.

Timpson A, Colledge S, Crema E, Edinborough K, Kerig T, Manning K, Thomas M, Shennan S. 2014. Reconstructing regional population fluctuations in the European Neolithic using radiocarbon dates: a new case-study using an improved method. Journal of Archaeological Science 52:549–557.

Torfing T. 2015. Neolithic population and summed probability distribution of ^{14}C-dates. Journal of Archaeological Science 53:193–198.

Williams H. 2006. Death and memory in Early Medieval Britain. Cambridge: Cambridge University Press.