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Citation for published version:
Hamerow, H, Leggett, S, Tinguely, C & Le Roux, P 2024, 'Women of the conversion period: A biomolecular investigation of mobility in early Medieval England', *Antiquity*. https://doi.org/10.15184/aqy.2023.203

Digital Object Identifier (DOI):
10.15184/aqy.2023.203

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Antiquity

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Download date: 11. Feb. 2024

Women of the Conversion Period: A Biomolecular Investigation of Mobility in Early Medieval England

Abstract: Marriage alliances involving royal women played a prominent role in the conversion of the early English kingdoms. The large number of well-furnished female burials dating to the seventh century, however, suggests a more far-reaching change in the role of women. This paper presents the results of an isotopic analysis of seventh-century burials designed to compare male and female mobility, and the mobility of well-furnished versus poorly/unfurnished females. The study suggests increased mobility in the Conversion Period; that well-furnished females were more likely to be local to their place of burial than their poorly furnished counterparts; and that 'non-local' females had several distinct origins.

Keywords: Anglo-Saxon England, burials, the Conversion period, isotope analysis, gender, mobility, exogamy

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Introduction

During the conversion of the Anglo-Saxon kingdoms to Christianity, women briefly took centre stage in English history. Written sources – above all Bede's Ecclesiastical History (*HE* III.8; Colgrave & Mynors 1969) – record that they were often the first family members to convert and suggest that women possessed a special link with the supernatural which could be used to legitimize their family's claim to land and resources. We see this in the well-documented lives of royal women like St Hilda, who established and governed major family monasteries. The growing number of female burials dating to this period that are richly furnished and contain precious objects suggest, however, that this special role was not restricted to women from royal households.

The first female-led monasteries such as those at Whitby and Ely were founded in the middle decades of the seventh century and provided a means by which royal dynasties kept control of land (Yorke 2003). A few decades earlier, some families began to bury certain female members with precious jewellery, amulets and religious objects, at a time when males graves were largely unfurnished (Bayliss & Hines 2013). Over a hundred such 'well-

furnished' female burials have been excavated to date; they cannot all have been 'princesses', despite a tendency by the media to label them as such (e.g. *The Oxford Times*, Sept. 24, 2009, 'Precious Saxon Discovery'). It is likely, nevertheless, that these two developments were linked and that royal abbesses who, like Hilda, found their way into the written record, were part of a wider, undocumented phenomenon: women and girls who – even in death -- served as intercessors with the supernatural, cementing their family's claim to resources, their bodies instrumentalized for political ends (Hamerow 2015, 2016, 2020).

What set the individuals buried in this ostentatious manner apart? Written sources such as royal genealogies and the poem 'Beowulf' indicate that female exogamy – marrying female family members outside of their group/tribe -- was sometimes practiced and that brides could serve as 'peace pledges' between rival families ('Beowulf' line 2017; Yorke 1990; Yorke 2003). Is it possible that these well-furnished burials are connected to this practice? There is prime facie evidence to suggest that this was so, from three well-furnished 'bed burials': one at Trumpington, Cambridgeshire, where an adolescent girl was buried on a bed, accompanied by a garnet-inlaid gold pectoral cross (Fig. 1), and two at Barrington, Cambridgeshire (Evans *et al*. 2018; Malim & Hines 1998). All three have isotope compositions suggesting they did not grow up in England (Leggett 2020). But such a small sample is not conclusive; long-distance mobility may also have been common amongst men and amongst women buried in poorly furnished and unfurnished graves. This article presents results of isotope analysis of a large number of seventh-century burials undertaken to establish whether 'well furnished' women were indeed more likely than other members of their communities to be non-local to their place of burial. Increasingly precise radiocarbon dates, improved understanding of the distributions of oxygen and strontium isotopes across Britain and Ireland, and the development of more reliable baselines for the interpretation of geographic origins, make such analysis possible.

Materials and Methods:

These questions were investigated using isotopic analysis of tooth enamel to identify individuals whose isotopic compositions are inconsistent with the location where they were buried, that is, who grew up in a region with a different climate and underlying geology. It should be emphasised that the term 'non-local' need not imply movement over long

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distances and could involve communities that lay within a day's travel of each other; mobility has therefore been investigated using two different radii for 'non-local' designations (see below).

Oxygen and strontium isotope analysis are well established techniques used to provenance humans from archaeological contexts (see Evans *et al*. (2012), Lightfoot & O'Connell (2016), and Pederzani and Britton (2019)). The isotopic composition of water varies in a systematic way, tied to geography and climate; δ^{18}O values vary with altitude, latitude, distance from the coast, humidity and temperature (Pederzani & Britton, 2019; Rozanski *et al*., 2013). When food and drink are sourced locally, the δ^{18}O values of tooth enamel will reflect the climate a person was living in during tooth crown formation. The "brewing and stewing" effect, resulting from the consumption of artificially heated liquids in large amounts, can, however, make people look like they spent time in "hotter" climes (Brettell, Montgomery, *et al*., 2012; Pederzani & Britton, 2019).

Strontium isotope analysis is based on the principle that the natural variation of ^{87}Sr in different geologies enters the food chain through plants and water (Evans *et al*., 2012). The strontium isotope values of the geologies on which someone was living (or from which they sourced their food which, in this period, are likely to to be the same) during enamel formation can therefore be compared to the geologies on which they are buried to test for mobility during an individual's lifetime. As with oxygen, there are complicating factors such as sea spray, flooding, pollution, and fertilizer use which can alter bioavailable strontium values from those of the underlying bedrock (see Evans *et al*. 2012, Bataille *et al*. 2021, and Holt *et al*. 2021). Despite these caveats, it is in principle possible to establish if someone spent periods of their life in a different climatic and geological zone from the one on which they are buried.

Enamel formation (the point at which isotope values are preserved in the mineral structure of the tooth) occurs at specific, predictable intervals dependent on the tooth in question. This is useful as we can then look at residency signatures for specific age ranges within a person's life, which can have implications for distinguishing between different kinds of mobility. Here, second premolars and second molars were preferred due to their similarity

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in formation timings and the fact that they represent a post-weaning signature (enamel formation c. 2-8 years). However, the broader dataset includes isotope data from a variety of teeth introducing more variation in the age ranges represented. For instance, third molar enamel formation occurs between approximately 12-16 years, whereas a first premolar would represent residence from c. 1 ½ to 6 years of age and could include breastfeeding and weaning effects (Scheid 2007; Brettell *et al*. 2012).

Eighty-six burials – 47 females, 38 males and 1 unsexed adult individual -- were analysed for both oxygen and strontium isotopes; five individuals were later excluded following radiocarbon results showing them to pre-date the seventh century, and the unsexed adult was excluded from this study as our focus here is on gendered mobility, leaving a core group of 80 individuals (Supplementary Table 2). Combining the two isotope proxies provides greater resolution in pinpointing possible origins than analysing either isotope alone. Oxygen is the most abundant type of mobility-related enamel isotope data currently available for early Anglo-Saxon burials. Within a total database of 541 burials, 293 have strontium data (paired or unpaired with oxygen) whereas 510 have some form of δ^{18}O data available; the present project has nearly doubled the number of strontium results for burials of the seventh century (Leggett 2020; Leggett *et al.* 2021; Leggett, Hakenbeck & O'Connell 2022). The 80 core burials come from six cemeteries and one isolated burial; over half come from Kent, where cross-Channel mobility may have been particularly marked (Fig. 2; Gretzinger et al. 2022, Leggett 2021). The majority come from cemeteries thought to date to the seventh century (although potentially extending into the eighth); some contained closely dateable burial assemblages and 18 have been radiocarbon dated, eight as part of this project (Supplementary Table 1). Phasing of the burials follows that proposed by Leggett *et al*. 2021, which is based on Bayliss and Hines' 'leading artefact types' (Bayliss & Hines 2013) but also incorporates Brownlee's more recent (2021) re-phasing of cemeteries not included in the 2013 study. Slightly modified date categories unifying both chronological frameworks and incorporating other absolute dating evidence (radiocarbon and numismatic) were therefore used. Our focus is on graves falling within date categories C-E (c. 580-800 AD). For full details of phasing and date category aggregation, see Supplementary Table 2.

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For Tables 1-3 and Figure 3, isotope data for burials other than those analysed for this project were included to increase sample sizes, mitigate regional biases, and allow comparison with mobility patterns seen in the fifth and sixth centuries. Numbers of individuals per site and period are summarised in Supplementary Tables 3-5, with all sites included shown in Figure 2; for full grave details see the "WOCP_England_Only_Mobility" spreadsheet in the data compendium. For the Conversion Period this included 258 gendered individuals: 130 females, and 128 males; 133 individuals with both strontium and some form of oxygen data, 112 with only oxygen data and 13 with strontium data only. There were 99 females and 73 males from the fifth-to-sixth century included; 87 with both strontium and some form of oxygen data, 70 with only oxygen, and 15 with strontium data only.

To be classed as 'well-furnished', a female burial had to meet at least two of the following criteria: contain one or more objects made of precious metals, a 'relic box' (Blair & Hills 2020), exotic materials such as cowrie shell and amethyst, or a box/casket; be buried under a barrow or in a bed (cf Bayliss & Hines 2013, 538-9); or contain ten or more grave goods. To avoid what remains to some extent an artificial distinction between 'well- furnished' burials and 'the rest', the comparison was restricted to 44 core females for which information regarding associated finds and/or (for poorly furnished and unfurnished burials) radiocarbon dates were available.

The larger dataset was drawn from a previous meta-analytical study by Leggett et al. (2021) which included novel data (sites 1, 3, 8, 9, 10, 15, 18, 25, 27, 28, 30, 32, and 33 in Fig. 2) plus previously published data (sites 7, 11, 13, 14, 17, 19-23, 26, 29, 31, 35, 37, 38, 40 in Fig 2.) (Booth, 2016; Brettell et al., 2012; Buckberry et al., 2014; Budd et al., 2004; Doornbos, 2010; Evans et al., 2012; Groves et al., 2013; Hughes et al., 2014, 2018; McKinley, 2016; Millard, 2014; Montgomery et al., 2005; Pitts et al., 2002; Tatham, 2004). This was updated to include more recently published and previously overlooked isotope data (see Supplementary Material section 2; sites 12, 16, 24, 34, 36, 39) (Andrews et al., 2019; Falys and Lewins, 2019; Falys and Socha-Paszkiewicz, 2020; Farber and Lee-Thorp, 2020; Ford and Falys, 2016; Lewis et al., 2014). Details of the 86 individuals analysed as part of this study can be found in Supplementary Table 2 and our online data compendium (see link below), including isotopic measurements and strontium concentration data. Details of laboratory

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methods can also be found in the supplementary material. Individuals with neither clearly gendered grave goods nor biological sex data were excluded from analysis, as our focus is on gendered mobility. Data on these individuals are still available in the supplementary material. All other data files, analysis details and R code are available at: https://osf.io/ynx3m/.

For ease of comparison between data and for probabilistic isoscape modelling $\delta^{18}O_{carb\ (PDB)}$ values were converted to $\delta^{18}O_{phosphate\ (SMOW)}$, $\delta^{18}O_{dw}$ and $\Delta^{18}O_{dw\text{-}MAP}$ values using equations from Chenery et al. (2012). For simplicity only $\delta^{18}O_{phosphate\ (SMOW)}$ and $\Delta^{18}O_{dw\text{-}MAP}$ values are reported and visualised below; however, the full range of oxygen isotope conversions are available at https://osf.io/ynx3m/.

Details of data analysis can be also found in the supplementary material, especially the R code, all analyses were performed using R Statistical Software (v.4.1.3; R Core Team 2022) in RStudio (v.2021.09.0.351; RStudio Team 2021). Due to issues in defining migrants via statistical outlier approaches, especially if a high degree of mobility in the population is likely, and the fact that apart from our 80 core individuals, not all burials had both oxygen and strontium data, we adopted an Exploratory Data Analysis approach (see supplementary material; Leggett, 2021; Lightfoot & O'Connell, 2016). This negates the need for statistical significance and instead focusses on patterning in the data (Tong 2019, Tukey 1977).

To be conservative in our identification of non-locals, we used three statistical and spatial approaches; the outcomes of each are presented below. First data were compared to established British Geological Survey (BGS) human enamel ranges for the UK: $\delta^{18}O_{phosphate}$ (16.6-18.7‰) and $^{87}Sr/^{86}Sr$ (0.7079-0.7114 for England with local maxima up to 0.7140, UK max = 0.7221) (Evans et al. 2012, BGS 2020). This was repeated at a site-specific baseline level on BGS maps for our core individuals for whom we had both oxygen and strontium data. Second, $\Delta^{18}O_{dw\text{-}MAP}$ values were created for every individual with oxygen data as per Leggett *et al*. (2021) for a basic measure of isotopic fractionation between the tooth enamel values and local drinking water values. Individuals with values beyond ±2‰ were considered likely to be migrants, with "brewing and stewing" effects (including breastfeeding) considered for individuals with positive fractionation values. There was no consistent offset in early forming teeth to suggest that fractionation from breastmilk has affected our results

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(see Supplementary Material section 9). Finally, for individuals with oxygen and strontium isotope data from the same tooth, we undertook double-isotope probabilistic geographic assignment modifying code from Bataille *et al.* (2021) which necessitated the conversion to $\delta^{18}O_{dw}$. This was combined with an EDA approach to compare mobility between women and men, but also between 'well-furnished' and poorly-furnished women.

We sought to distinguish female exogamy from virilocality -- the practice of brides moving to live with or near their husband's kin – by considering the distance of a burial from likely place of origin. Individuals originating from a zone with a radius of greater than 10km but less than 100km from place of burial were considered as potentially representing virilocality, while those originating more than 100km from place of burial were considered as potentially representing exogamy (Roper 1979; Tobler 1993). Although territories in seventh-century England were probably poorly defined, a broadly contemporary document known as the Tribal Hidage indicates that the size of such territories, while mostly small, varied considerably (Davies & Vierck 1974). The 100km radius was therefore chosen to filter out virilocality, as at this scale it would be unlikely that the place of burial lay within the territory where an individual spent their childhood. The two radii were applied to the georeferenced probabilistic models using buffers in QGIS (version 3.26.3) where the results were not immediately apparent; if an individual's origin model produced a greater than fifty percent chance of origin within the given radius (excluding areas across major bodies of water or other substantial boundaries such as the English Channel or the Pennines if covered by the 100km buffer for instance), that individual was classed as probably local.

Given the isotopic baseline similarities in both oxygen and strontium between different regions of the UK, and between the UK and other regions of potential childhood origins such as Ireland, the Low Countries and France, as well as the conservative nature of the spatial modelling applied (Bataille *et al.* 2021), some non-local individuals will appear to be 'local' using these methods. It is important to note, therefore, that the estimations presented below are likely to underrepresent the true number of non-local individuals.

Results

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Table 1 and Figure 3 (first column) indicate that, during the fifth to late sixth century, women were somewhat more likely than men to be non-local to their place of burial, and both were equally likely to come from outside the 100km radius. A large degree of isotopic overlap between males and females is apparent in this period, especially in terms of oxygen data, which shows bimodality for both (Figure 3). During the period c. 580-630 AD, most people appear local to their place of burial when only oxygen proxies are used (Table 2 and Fig 3 A and B). When outliers are excluded, women have a large range of $\delta^{18}O_{phosphate}$ values (Fig. 3A) which suggests more diverse origins than men, their marked bimodality suggesting at least two distinctive isotopic origins. Non-local males are more homogenous, implying that they originate from regions with similar climatic conditions. The strontium data (Fig 3C) shows that males have a broader range of values (even when outliers are excluded), and that the genders diverge significantly in their distributions, suggesting different origins.

For the period c. 630-700 AD women again have a larger range for oxygen, but also for strontium (excluding outliers), and there is a distinctive bimodality for both isotopic systems, again supporting more diverse origins for non-local women. When factoring in a high-level of uncertainty using $\Delta^{18}O_{dw\text{-}MAP}$ values (Figure 3B), males are again more homogenous than females for both oxygen and strontium (3C), the double-isotope models showing more long-distance male than female mobility (Table 3).

Gender differences were further explored statistically with the isotopic space package rKIN and BEST tests (see supplementary material); considerable overlap of isotopic spaces is apparent (approximately half of all people come from isotopically similar regions), but the shape, size and nature of the isotopic spaces occupied by each gender are different. During the period c. 630-700, 'non-local' men were more likely to come from cooler climates and women from warmer (compared to place of burial), with low bioavailable strontium geologies (e.g. chalk) the dominant signature regardless of gender.

In Figure 4, which compares 'well-furnished' and poorly-furnished women, we see the same clear trends as in Figure 3 – bimodality in both oxygen and strontium data. Indeed, regardless of whether $\delta^{18}O_{phosphate\ (SMOW)}$, $\Delta^{18}O_{dw\text{-}MAP}$ or strontium values are considered (Figure 4A, B and C) the larger mode or "bump" for 'well-furnished' women is at the

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opposite end of the scale from poorly-furnished women. This indicates that most of the 'well-furnished' women in this study had different origins than those in poorly-furnished graves. The data for all women in Figure 4 fall within known strontium ranges for southern Britain (below the lines on 4C), and only a few fall outside the known oxygen range for the UK (lines on 4A), but the subtle differences in their individual double-isotope probabilistic maps (see supplementary material) hints at more 'well-furnished' women coming from cooler climes and chalkier geologies, with poorly furnished women more likely to have origins in warmer, non-chalk regions.

The rKIN comparisons of the two groups of women confirm that poorly furnished women occupy a much larger isotopic space than 'well-furnished' women, suggestive of higher levels of mobility and greater diversity of childhood origins; this is likely driving the overall trends seen in Figure 3. We further investigated this isotopic divide using hierarchical cluster analysis (see Figure 5 and supplementary material). The results reveal three clusters for seventh-century women: Cluster 1 (black) consists of 17 individuals (14 well-furnished and 3 poorly-furnished), mostly local to their place of burial, their $\delta^{18}O_{phosphate}$ and $^{87}Sr/^{86}Sr$ values suggesting origins on the chalk geology of eastern Britain; Cluster 2 (orange) includes 13 women (6 'well-furnished', 7 poorly-furnished), most of whom are non-local with isotopic signatures consistent with "Atlantic Fringe" zones not on chalk; Cluster 3 (blue) includes 14 women (6 'well-furnished' and 8 poorly-furnished), again mostly non-local to their place of burial, with a similar non-chalk strontium range to Cluster 2 but with a $\delta^{18}O_{phosphate}$ range indicative of cooler conditions outside of Britain. These results indicate that 'well-furnished' women are statistically more likely to come from a chalky region (probably biased by our selection of Kentish cemeteries) and to be local to their site and region than poorly furnished women, who are more likely to be non-local and from radiogenic geologies.

Discussion

While caution is needed in drawing wider conclusions from a comparatively small, regionally biased sample, the findings of the present study have important implications for our understanding of gendered mobility and of the well-furnished burial rite in seventh-century England. First, the proportion of individuals who were non-local to their place of burial increased sharply in the seventh and eighth centuries, especially for the period AD 630-800.

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It should be stressed, however, that direct comparisons with the fifth and sixth centuries, for which primarily only oxygen values are available, must be treated with caution. Levels of mobility are also likely to have varied in different parts of the country and it would be unsurprising if cemeteries in East Kent – from which more than half of our sample derives – contained an unusually high proportion of 'non-locals'. The increase could be partly explained if a significant proportion of earlier mobility involved individuals from regions that have similar isotope values (due to similarities in climate and geology) to southern and eastern England, such as Northwest Germany and the Low Countries (cf Gretzinger et al. 2022, Leggett et al. 2022), while in the seventh and eighth centuries, a higher proportion of individuals from isotopically distinct regions was involved.

As shown in Table 3, similar proportions of men and women were non-local to their place of burial using a radius of >10km. The level of short-distance mobility increased somewhat for both during the period AD 630-800 (Table 3), potentially indicating an increase in non-local marriage alliances at a time of growing inter-regional trade (Naylor 2016). While long-distance mobility for females also increased during the same period, as originally hypothesised, it also increased for males. Contrary to expectation, men were in fact more likely to have spent their childhood more than 100km from their place of burial during the seventh century (43% of men compared to 37% of women; Table 2). The high incidence of long-distance mobility for males during the seventh and eighth centuries is unlikely to have had a single cause. Exogamy may have been a factor, despite the emphasis in written sources on female exogamy, along with involvement in warfare and the fosterage of boys, a practice widely alluded to in Anglo-Saxon written sources and likely to have been "integral to Anglo-Saxon child-rearing practices" (Crawford 1999, 122).

Patterns of male and female mobility also differed. The distribution of isotope data for women indicates at least two compositional origins, with cluster analysis allowing three isotopically distinct clusters to be identified. Non-local males, in contrast, came either from the same region or from several regions with similar climates and geologies.

Our results also cast important new light on the relationship between the type of burial rite accorded to women in the seventh century – well-furnished versus poorly

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furnished/unfurnished -- and whether they were local or non-local. The bimodal distribution seen in Fig. 3 indicates, as originally hypothesised, that most of the well-furnished women in our sample had different origins from those in poorly- and unfurnished graves; contrary to expectation, however, 54% of 'well-furnished' females in our sample (14 out of 26) belong to the 'local' isotope Cluster 1, associated with the 'cooler' Cretaceous chalk regions of southern and eastern England, while 83% of poorly furnished/unfurnished women (15 out of 18) belong to Clusters 2 and 3, with origins in 'warmer' non-chalk regions or outside of Britain.

Conclusions

If, as is widely assumed, the 'well-furnished' burial rite is a reflection of high status, these results suggest that women and girls of non-local origin were generally of lower status than their local counterparts (with royal women as an obvious exception). The non-local females in our sample appear, furthermore, to have come from at least two different regions, one of which is consistent with the 'Atlantic Fringe' zone, i.e. Southwest England, Ireland and coastal areas of Wales.

An intersectional perspective suggests that not only status, but also institutionalised sex and age-related mobility such as virilocality played a role in determining burial rite. The geographical distribution of 'well-furnished' female graves is relevant here: they are primarily found in cemeteries in east Kent (from which most of the burials in our sample come), East and North Yorkshire, East Anglia and the Upper Thames Valley, a distribution broadly corresponding to that of the earliest female-led monasteries (Yorke 2003; Bayliss & Hines 2013; Hamerow 2016). These regions are isotopically consistent with Isotope Cluster 1. The same cemeteries also contain a significant number of non-local females belonging to Isotope Clusters 2 and 3, but they were far less likely to have been accorded a 'well-furnished' burial rite. Furnished burial was not practiced in regions such as Southwest England that are isotopically consistent with Isotope Clusters 2 and 3. Identifying the likely origins of these 'non-local' women is the subject of a future study, but the results presented here suggest that unfurnished females were more likely to have originated from western, 'British' regions or from Ireland (Leggett, le Roux , Tinguely and Hamerow, in prep.). We posit, therefore, that several aspects of a woman's identity determined whether she was

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accorded a 'well-furnished' burial: her status, whether she was local or non-local and, if non-local, her place of origin.

Acknowledgements

This project was supported by the John Fell Fund, University of Oxford. The authors are grateful to Julia Lee-Thorpe and Rick Schulting for their comments on an earlier draft of this paper, and to Christopher Day, Phil Janney, Peter Schauer, the Cambridge Archaeological Unit, Duckworth Laboratory Cambridge (especially Trish Biers), Cambridgeshire County Council, Corinium Museum, Duncan Sayer and the Oxfordshire Museums Service for facilitating access to and sampling of the material.

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Captions

1. The seventh-century bed-burial at Trumpington, Cambridgeshire. Reproduced with permission of the Cambridge Archaeological Unit and the University of Cambridge.
2. Map of burial sites analysed and other sites mentioned in the text. Black stars denote sites with new data from this study, dots are sites where previously published data has been included; an asterisk next to a site name indicates sites with published and new data integrated. For all original site data references see the "WOCP_England_Only_Mobility" spreadsheet and supplementary tables 4 and 5.
3. Raincloud plots of female (blue) vs male (yellow) enamel data from the larger dataset. A - $\delta^{18}O_{phosphate}$ (lines indicate UK range from BGS), [left F n=77, M n=74; centre left F n=31, M n=32; right F n=22, M n=18], B - $\Delta^{18}O_{dw\text{-}MAP}$ (lines indicate ±2‰ range for "locals") [left F n=77, M n=74; centre left F n=31, M n=32; right F n=22, M n=18], C – $^{87}Sr/^{86}Sr$ (lines indicate upper limits for England from BGS) [left F n=63, M n=49; centre left F n=27, M n=18; right F n=12, M n=10].
4. Raincloud plots of poorly-furnished [n=18] versus well-furnished [n=26] females. A - $\delta^{18}O_{phosphate}$ (lines indicate UK range from BGS), B - $\Delta^{18}O_{dw\text{-}MAP}$ (lines indicate ±2‰ range for "locals"), C – $^{87}Sr/^{86}Sr$ (lines indicate known upper limits for England from BGS).
5. Dendrogram showing the outcome of hierarchical cluster analysis on $\delta^{18}O_{phosphate}$ and $^{87}Sr/^{86}Sr$ data from the core 44 women. Optimal number of clusters = 3 (see supplementary material) and stars indicate well-furnished women.

Tables:

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		Proportion outside $\Delta^{18}O_{dw\text{-}MAP}$ ±2‰ for place of burial	Proportion non-local to site from double-isotope (Sr-O) models, 10km radius.	Proportion non-local to region from double-isotope (Sr-O) models 100km radius from site.
Men	**All Data**	31.1% (19/61)	19.4% (6/31)	12.9% (4/31)
Women (all)	**All Data**	42.9% (31/77)	23.2% (13/56)	12.5% (7/56)

Table 1: Proportions of non-local individuals dating to c. 400-600 (Leggett et al. 2021 phases A-C, A-D, A/B, B, B-D, B/C, c. 400-600 AD), by gender. Sample sizes in brackets.

		Proportion outside $\Delta^{18}O_{dw\text{-}MAP}$ ±2‰ for place of burial	Proportion non-local to site from double-isotope (Sr-O) models, 10km radius.	Proportion non-local to region from double-isotope (Sr-O) models 100km radius from site.
Men	**All Data**	39.0% (46/118)	52.9% (27/51)	43.1% (22/51)
	Core Group	36.1% (13/36)	52.8% (19/36)	44.4% (16/36)
Women (all)	**All Data**	34.7% (42/121)	58.5% (48/82)	36.6% (30/82)
	Core Group	15.9% (7/44)	43.2% (19/44)	27.3% (12/44)
Well-furnished women (from core group)		15.4% (4/26)	34.6% (9/26)	19.2% (5/26)
Poorly furnished women (from core group)		16.7% (3/18)	55.6% (10/18)	38.9% (7/18)

Table 2: Proportions of non-local individuals dating to the Conversion Period (Leggett et al. date categories B-F, C, C-E, C-G, C/D, D, D-F, D/E, E, E/F – c. 600-800 AD) by gender including the broader dataset (all data) and from core 81 individuals. Sample sizes in brackets.

		Proportion outside $\Delta^{18}O_{dw\text{-}MAP}$ ±2‰ for place of burial	Proportion non-local to site from double-isotope (Sr-O) models, 10km radius.	Proportion non-local to region from double-isotope (Sr-O) models 100km radius from site.
Men	**All Data c. 580-630 AD**	26.5% (13/49)	48.1% (13/27)	37.0% (10/27)
	All Data c. 630-800 AD	46% (29/63)	58.3% (14/24)	50% (12/24)
Women (all)	**All Data c. 580-630 AD**	23.8% (10/42)	50.0% (15/30)	33.3% (10/30)
	All Data c. 630-800 AD	45.7% (32/70)	63.5% (33/52)	38.5% (20/52)

Table 3: Proportions of non-local individuals dating to the early (c. 580-630 AD) and late Conversion Period (c. 630-800 AD) (Leggett et al. 2021, phases C and C/D and phases D, D-F, D/E, E and E/F respectively) by gender, including data from the broader dataset (all data).

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