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Faculty of Arts & Humanities

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An Isolated Anglo-Saxon Cremation from Otford, Kent, England.

by

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ABSTRACT

Osteological analysis has traditionally focussed on inhumation burials, with significantly less analysis of cremations. The early Anglo-Saxon period was dominated by cremation burials and, until work by Jaqueline McKinley (1994), research into this early period was hindered by a lack of formal, cremation specific, methodologies.

When, in 2022, an Anglo-Saxon funerary urn from Otford, in Kent became available to Southampton University, McKinley's formal methods were used to analyse the urn and its contents.

This paper discusses the context of the Otford find and presents the results of analysis of the urn and its contents. One individual, an older mature adult, was identified but the preservation of the remains significantly hindered investigations into sex determination and pathological analysis. Comparisons were also drawn with similar sites at Sancton, Spong hill, Elsham, Cleatham and Collingbourne Ducis that were studied using the same methodology. Overall, the results from this study fit within the current knowledge on Anglo-Saxon cremation practices and provides information into isolated cremation burials.

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Declaration Of Authorship

I, Madeleine Smedley

declare that this dissertation and the work presented in it are my own and has been generated by me as the result of my own original research.

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Contribution to Discipline

This work has provided the first analysis of the cremation urn from Otford, Kent. This has provided new information regarding the Anglo-Saxon period in Otford. The site of Otford has undergone extensive research on the period from 821, after the construction of the Archbishop's Palace. Prior to 821, a small portion of study has been conducted on the Roman occupation of this site. The gap between these two dates, the early Anglo-Saxon period, is lacking information.

Another gap in the literature that this research fills, is a close up look at a singular, isolated cremation burial from the Anglo-Saxon period. Previous studies have focused on cremation cemeteries as a source of information regarding the funerary practices of the period. It is argued in this paper that isolated burials should not be so easily neglected as they hold information regarding the smaller communities and allow a more complete understanding of the funerary practices being undertaken in this period.

1. Introduction

1.1. Project background

In 1954, a funerary urn was excavated from the village of Otford, Kent. It was excavated at a depth of two feet from the rear of house No. 19, The Charne, Otford, by the Otford and District Archaeology Group (ODAG) (Figure 1) (Grid reference TQ 5221 5897, OD 60-65m[1]) (Kent County Council, 2008; Ward, 2022). The urn was then stored by ODAG until 2022 when it was moved to The University of Southampton for further analysis (Ward, 2022).

Several issues were identified when trying to study neighbouring areas, as discussed in the brief provided by Cliff Ward (Chairman of the ODAG). He stated that an adjacent building may have had "some bones" removed by an exorcist which could not be traced. Difficulties were also encountered in gaining access to construction work happening in nearby houses, where further archaeological finds may have been missed (Ward, 2022).

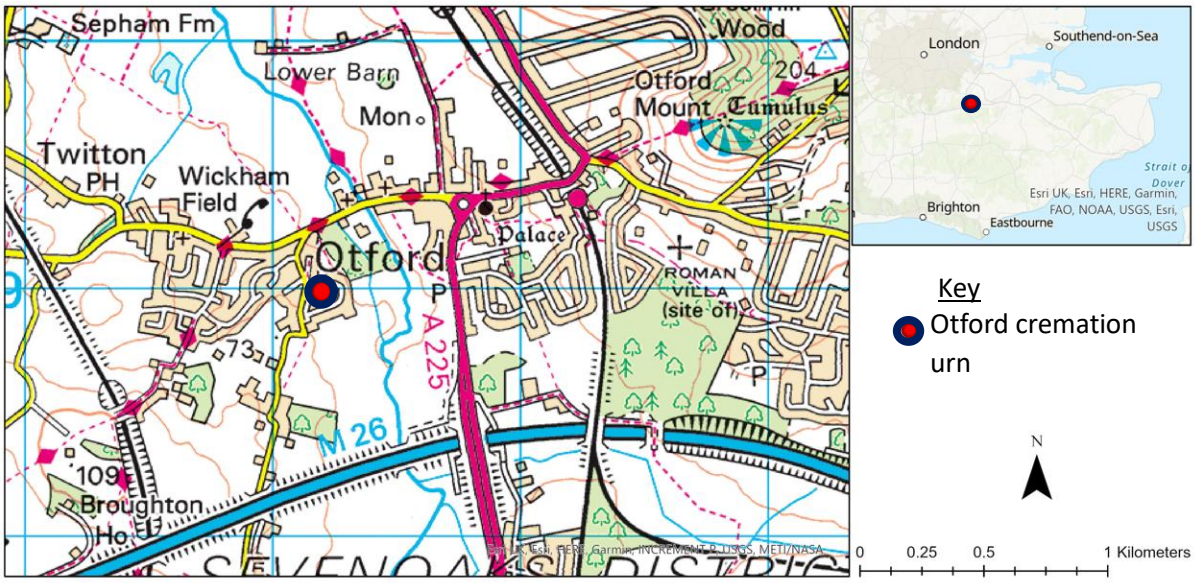

Figure 1. Map of Otford (left) marked with the location of the cremation urn, with key and scale. Map to the right shows the location of Otford within the wider Kent area (authors own, made with ArcGIS Pro (Esri Inc, 2022; The University of Edinburgh, 2022))

1.1.1. A background of Otford

Otford lies on a bedrock of mudstone and chalk with superficial deposits of gravel, clay, silt and sand (British Geological Survey, 2020).

[1] OD stands for Ordinance datum, or hight above mean sea level.

The village can be dated back to the Roman period, as several Roman stone walls were found during a watching brief at No. 42 in the same year as the urn. (Kent County Council, 2008).

After the Roman period in Britain, the next known record of occupation comes from 821, when a large area of land was gifted to the Archbishop Wulfred by Offa, King of Mercia. This land was later made into the Archbishop's Palace, one of the largest palaces in England, in 1514. After being sold to Robert Sydney in 1601, the majority of the building fell into disrepair. Some repair work took place in the 1960s and 2010s by the Sevenoaks District Council and is now under the care of the Archbishop's Palace Conservation Trust.

This urn predates most of the surrounding architecture of The Archbishop's Palace, and likely fills this missing gap between the preceding Roman period and the construction of The Archbishop's Palace.

1.1.2. Aims

This study aims to excavate, and analysis the cremated material within the Otford urn and, to a lesser extent, the urn itself. The findings will then be related to other early Anglo-Saxon cremations to identify how this cremation fits within the context of current knowledge. They will then be related back to the history of Otford and the Archbishop's Palace, to gain a deeper insight into the Anglo-Saxon way of life in Otford. The results will be used to create a biological profile of the individual to understand who they were and how they may have fit into the society.

The terms 'pyre-goods' and 'grave-goods' will be used throughout this paper. Both refer to the objects that were placed in the funeral urn along with the cremated remains. The distinction is that 'pyre-goods', as the name suggests, accompanied the body on the funeral pyre, whilst the 'grave-goods' did not (McKinley, 1994; Squires, 2012).

1.2. A brief background of the Anglo-Saxon Period

1.2.1. Who were they?

Cremation burials discovered in the 17th and 18th centuries were first thought to date from the Roman period (Williams, 2005). The antiquarian James Douglas (Williams, 2005) was the first to categorise them as distinct from Roman cremations by examining the different forms of decoration on the pottery. It was this that opened up the first questions as to who these individuals were, and so jump-started the interest into their society and social practices. Since the 1970's, major developments have occurred in the quantity of well-preserved cremations being excavated and the quality of methods used, which has given a deeper insight into Anglo-Saxon life (Williams, 2005).

Current understanding is that, at the beginning of this period, raiders arrived at the eastern and southern coasts of Britain from areas across mainland Europe, such as Scandinavia and Germany. These new settlers would later form a part of the amalgamation of peoples, including the Angles, the Saxons and the Jutes, that make up the Anglo-Saxons (Morris, 2021). This became a cultural group of people inhabiting England after Roman Britain had come to an end in the 5th century, spanning into the early 11th century, and ending in 1066 with the Norman Conquest of Britain (Hamerow, Hinton and Crawford, 2011; Morris, 2021). Many old Roman settlements were later reused as a part of the new Anglo-Saxon settlements (Hamerow, Hinton and Crawford, 2011).

Religion

This period of British history saw a major transition in belief systems. In the earliest period from the fifth to the sixth centuries, ritualistic practices were led by pagan beliefs, but by the end of the period they had become focused on Christianity (Chaney, 1960; Hamerow, Hinton and Crawford, 2011). These pagan beliefs would have been strongly influenced by the amalgamation of migrating populations, and many links have been found with the ritualistic practices seen in contemporary Scandinavia, north Germany and the eastern Baltic (Hamerow, Hinton and Crawford, 2011). There is limited evidence on the beliefs that motivated the rituals, and what evidence we do have comes from examination of the funerary practices (Hamerow, Hinton and Crawford, 2011).

During this time, social factors such as sex, age, status, and circumstances of death appear to have played a major role in the choices of mortuary ritual used at the time (Hamerow, Hinton and Crawford, 2011; Squires, 2013). Decorated funerary vessels, large quantities of grave goods and animal sacrifices were common in these early practices, but varied between individuals (Hamerow, Hinton and Crawford, 2011; Meyers Emery and Williams, 2018; Morris, 2021).

The later 6th century and early 7th century saw an expansion of the Christian belief, led by Roman missionaries, with a major shift in ritualistic practices and funerary behaviour (Meaney, 1985; Hamerow, Hinton and Crawford, 2011; Morris, 2021). This shift, however, would have been an ongoing change and did not fully take hold until the 8th century, so there was a large overlap between the pagan rituals and the Christian rituals taking place at the time (Hamerow, Hinton and Crawford, 2011).

Social identity

For the early Anglo-Saxon period, social ranking was less of a widespread phenomenon, as seen in the later Anglo-Saxon period, but contained within separate social groups (Reynolds, 2009). Individuals have been assumed to be of high rank within their community when burials were lavish, with large quantities of grave or pyre goods, along with animal sacrifices, as most notably seen at Sutton Hoo[2] (Leyser, 2016).

Age also appeared to play a role in an individual's social identity, as the number of grave goods has been found to increase with age (Hamerow, Hinton and Crawford, 2011). Age may have played a role in how an individual was perceived in terms of social status, with older individuals generally obtaining a higher rank than younger individuals within each social group (Hamerow, Hinton and Crawford, 2011).

1.2.2. The transition from cremation to inhumation

In the Anglo-Saxon period, three main types of cemetery are found: cremation, inhumation[3], and mixed cemeteries[4] (Williams, 2005; Hamerow, Hinton and Crawford, 2011; Barber, 2018; Meyers Emery and Williams, 2018).

Early Anglo-Saxon Period

The early Anglo-Saxon period (around the 5th to 6th centuries) had many influences from southern Scandinavia and continental north-west Europe (Hamerow, Hinton and Crawford, 2011). The graves and funerary practices of the Anglo-Saxons have often been compared to Germanic examples, which is where many of the funerary rites and rituals are thought to have originated (Williams, 2005). These continental European influences likely lead to the high percentage of cremation burials concentrated across eastern England during this time (as they arrived in eastern England first), represented by the large cremation cemeteries, such as Spong hill and Elsham (Hamerow, Hinton and Crawford, 2011; Squires, 2012). The reasoning behind the use of cremation as a funerary rite has been highly debated. The cremation process would have involved the preparation of the body, building of the pyre, the burning stage, cooling, examination of pyre debris, selection and collection of remains and then the subsequent deposition into a funerary urn. After this stage, the remains may be buried, though some evidence suggests that they may have been placed within the home for a short period of time before deposition within a grave (Hamerow, Hinton and Crawford, 2011). This

[2] With excavations carried out between 1938 and 1997, these burials dated to the seventh-century AD. It is well known for having the richest Anglo-Saxon ship burial yet found across Northern Europe (Leyser, 2016).
[3] Inhumation refers to the burial of the body without prior burning of the remains.
[4] Including a mix of cremation and inhumation in the same cemetery.

whole process would have required the community to dedicate time and resources to the ritual and it is therefore an interesting question as to why this method would have been chosen over less demanding options such as inhumation (Bond and Worley, 2006; Hamerow, Hinton and Crawford, 2011). It has been theorised that death was seen as a transition, perhaps from one world to the next, rather than a simply physical process; and the destruction of the physical remains helped aid this spiritual transition (Hamerow, Hinton and Crawford, 2011). Grave goods and pyre goods such as weaponry, or personal possessions, were a common occurrence in funerary practices at this time to further assist the dead in this spiritual transition (Hamerow, Hinton and Crawford, 2011).

The use of cremation has also been suggested to be motivated by grief, as an attempt to deny the death of a loved one, by accelerating the decomposition and disappearance of the body (Tarlow and Stutz, 2013). Death and burial are traumatic events for the living relatives and for the society. Tarlow and Stutz (2013) mention that prolonging the funerary processes prolongs the visual reminder of one's own mortality, which people throughout time have found difficult to face. Speeding up the funerary process can ease this trauma on the society and the relatives of the deceased (Tarlow and Stutz, 2013).

Animals were an important part of society at this time, demonstrated by how frequently they appear in the art and traditions of the period (Bond and Worley, 2006; Tarlow and Stutz, 2013). Animals were also commonly included into the funerary practices at the time (Bond and Worley, 2006; Tarlow and Stutz, 2013). These were originally thought to be food offerings, but later interpretations added further possible roles, such as being companions in death, or charms and tokens (Bond and Worley, 2006).

Late Anglo-Saxon Period

Moving into the later Anglo-Saxon period, from the later 6th century to 11th century, cremations appeared to go out of fashion. The influx of Christianity at this time meant that by the end of the 7th century cremations had disappeared entirely, moving instead towards inhumation practices (Hamerow, Hinton and Crawford, 2011). Grave goods were often still included in burials, although they were generally fewer and often taking the form of Christian images instead (Hamerow, Hinton and Crawford, 2011). Animal remains drifted out of fashion in these later burials (Hamerow, Hinton and Crawford, 2011).

The change in religious beliefs away from pagan practices towards the dominance of Christianity, is a leading theory as to why this transition in funerary practice occurred. The gradual disappearance of

animal remains in the later Anglo-Saxon periods, along with the transition to inhumation, provides evidence for a change in attitude towards death and burial (Bond and Worley, 2006; Hamerow, Hinton and Crawford, 2011). Moving away from the prior pagan belief in a transitional phase at death, towards the Christian belief where death is seen less as a transition, and more a continuation of the mind and soul, with the body ceasing to have significance (Bond and Worley, 2006; Hamerow, Hinton and Crawford, 2011; Mays, 2017).

Given the rapid decline in cremation practices in the later Anglo-Saxon period, it is most likely that the cremation found in Otford was from the early Anglo-Saxon period.

1.2.4. Anglo-Saxon cinerary urns

Un-urned cremations were rare during the early Anglo-Saxon period, with remains deposited in various containers, ranging from re-used domestic pots to specially made funerary urns (Hamerow, Hinton and Crawford, 2011; Perry, 2020). These were often decorated with stamps, lines or dots in repeating patterns, with many stamps being reused for multiple urns within one cemetery (Myres, 1937; Hamerow, Hinton and Crawford, 2011). Pottery decorations used in this period are suggested to have originated in the Roman Empire, with particular stamps and forms of decorations going in and out of fashion and trends spreading across the country (Myres, 1937).

Material culture had a large influence on methods of commemorating the dead, representing memories, recreating scenes and providing visual aids of remembrance (Hamerow, Hinton and Crawford, 2011). The funeral experience would have been a full sensory experience. Dramatic visual scenes, the heat and smell of the flames, elaborate foods served at the ceremonies may all have contributed to the full experience of the ritual (Nugent and Williams, 2012). The use of decorated urns would also have played a role in this, by providing an element of beauty to the event. Nugent and Williams (2012) also suggested the occasional incorporation of ‘faces’ or ‘eyes’ in the design was intended as a way for the dead to ‘watch over’ the living.

1.3. Previous studies and methods

Since fewer excavations of cremated remains have been carried out, the methods are not as refined as those for inhumation studies and very few detailed descriptions on the analysis or excavation of cremation burials have been published. That was, until the recent work by Jacqueline McKinley in 1994 (McKinley, 1994). McKinley’s work has provided a defined set of methods for studying cremation, involving the wet sieving and subsequent weighing of remains, followed by the

osteological analysis, looking into the maximum fragment size, minimum number of individuals, percentages of bones present; recording morphological changes such as fracturing and colour, and pathologies (McKinley, 1994; Squires, 2012). This, together with preceding work from her studies on several other cremation cemeteries in England, has built a large body of knowledge as a basis for future works (McKinley, 1994, 2013; Squires, 2012; Tarlow and Stutz, 2013).

Cremation studies prior to McKinley's have either provided very brief descriptions of the appearance of bone, or neglected to provide any such information on the human remains altogether, instead choosing to focus on the grave goods associated with the funerary urn to provide information on the individual (Leeds, 1924; Faull, 1976; Timby *et al.*, 1993; Squires, 2012). Using grave goods to interpret information about the individual's life is highly imprecise, and therefore any reports using these methods will be excluded for purposes of comparison in this report (Arnold and Wicker, 2001).

Kirsty E. Squires has since followed some of McKinley's work, using the same methods for similar Anglo-Saxon cremations and adding to the ever-growing body of knowledge on cremation practices (Squires, 2011, 2012, 2013). The use of consistent methods is significant as cremations are widely spread but harder to study and compare due to the poorer preservation of remains than inhumations. Therefore, standardised methods are essential to enable the most thorough cross-examination of these finds (Squires, 2012).

Spong Hill and Sancton were both studied by Jacqueline McKinley, employing the same methods and therefore enabling direct comparison of results and demography. Squires (2012) acknowledged the importance of standardised methodologies and demographic categories in order to allow direct inter-site comparisons. Therefore, the methods and demographic categories used in McKinley's studies will also be followed in this study of the Otford cremation.

1.2.3. A brief background of the cremation cemeteries used for comparison.

Spong Hill

There have been a number of cremation cemeteries unearthed across Britain (Squires, 2012). Spong Hill is one widely-known Anglo-Saxon cremation cemetery, studied by Jacqueline McKinley in 1994, with some of the best surviving material (McKinley, 1994; Squires, 2012; Hills and Lucy, 2013). This site lies in the east of Britain and was first excavated in 1711, with many subsequent excavations and analyses, the last of which took place between 1972 and 1981 (McKinley, 1994). All the cremated materials were re-examined by Jaqueline McKinley, and a minimum number of individuals (MNI) was estimated at 2284 (McKinley, 1994; Hills and Lucy, 2013). McKinley's paper details some of the most

thorough methods for excavating and analysing cremated remains and thus have since been reused in many following research papers. It is these methods that will be followed in this paper.

Sancton

Archaeological excavations on Sancton were conducted between 1976 and 1980. Although originally analysed by K. Manchester in 1980, it was later restudied in 1993 by J. McKinley, who provided more detailed analysis of the remains as well as the funerary urns across the site (Timby *et al.*, 1993). This site encountered issues with storage and collection of information of many of the urns, as many were lost and unavailable for study, leading to a significant reduction in the available information (Timby *et al.*, 1993). Despite this, there were still a large number of cremations available for further study, although any estimations for the MNI were deemed too unreliable to use for comparison in this report (Timby *et al.*, 1993).

Cleatham

Cleatham remains were discovered in 1856 and excavations were directed by Kevin Leahy. This site experienced some damage by ploughs that disturbed some of the burials, but many cremation urns were still found complete (Squires, 2011, 2012). The first osteological analysis of the urns was carried out by Kirsty E. Squires in 2012, following McKinley's methods, and the MNI was estimated at being around 1009 (Squires, 2011, 2012).

Elsham

Elsham was excavated by Freda Berisford and Chris Knowles in 1975 (Squires, 2011). It was estimated that at least 564 individuals were recovered, and many more may remain as the site was never fully excavated. Initial analysis of the cremated material was undertaken by Mary Harman, but the final report was never published. This was then further studied in depth by Kirsty E. Squires, following McKinley's methods (Squires, 2011, 2012).

Collingbourne Ducis

The last site to be examined is Collingbourne Ducis in Wiltshire, near the site of Stonehenge, discovered in 1974 but not fully excavated until 2006-2009 (Egging and Stoodley, 2016). The

cremated material was not studied until 2016 also by Jacqueline McKinley. This area of the Salisbury Plains holds a long and well-documented Neolithic and Bronze age history, with many early barrows being found around the area (Pearson *et al.*, 2007; Heritage Gateway, 2012). This specific Anglo-Saxon site has far fewer cremations than the other sites mentioned in this report, with an MNI of only four. However, McKinley estimates this number to be closer to nine, as a few graves were disturbed by the later inhumation burials, (Egging and Stoodley, 2016).

All five of these sites will be compared to the Otford cremation. By comparing it to the large variety of similar cremations established in the literature it will give insight into the Anglo-Saxon life at Otford, as well as the potential differences in quality of preservation. It will also help to further understand where the Otford findings fit within the wider context of early Anglo-Saxon cremation practices.

2. Methods

Methods used for both excavation and analysis followed Jackeline McKinley's (1994) research methods and demographic categories to allow for direct comparison between sites which have since been used and reproduced in Brickley *et al* (2004), Squires (2011, 2012, 2012) and Tarlow and Stutz (2013). Further guidance on methods were provided by Emma Van Der Velden (Museum of London Archaeology, and PhD student at the University of Southampton) and Elizabeth Aubin (PhD student at the University of Southampton).

The cremation examined here was provided by the Otford and District Archaeological Group in Kent. The British Association for Biological anthropology and Osteoarchaeology (BABAO) and Historic England guidelines on the ethical practice for archaeological examination and excavation of human remains were followed throughout the process (Mitchell, 2017; Mays *et al.*, 2018; Redfern and Jones, 2019).

2.1. Tools

Wooden clay sculpting tools were used to excavate the cremation urn. These were selected due to the range of sizes and shapes available as well as the soft wooden material helping to avoid damage to any finds. These soft wooden implements often needed reshaping after heavy use to restore the edge profile.

As the urn had been removed from the ground and kept indoors for a long time before excavation of the contents, the soil inside the urn had dried significantly and was highly compacted, thus requiring wetting using a household spray bottle to loosen some of the material. This is not unusual, and similar cases were found by Squires (2011) on her excavation of cremations from Elsham and Cleatham. Due to the brittle nature of cremated materials, it was not advisable to attempt to excavate without loosening the soil for fear of accidental breakage of bone. It was found that dampening the soil and allowing time for the soil to soak up the water proved the most effective method.

2.2. Excavation

The material was excavated in 1.5cm increments using a stepped method, so that the cross section could be examined for each incremental layer. There were six overall layers, sections of which are

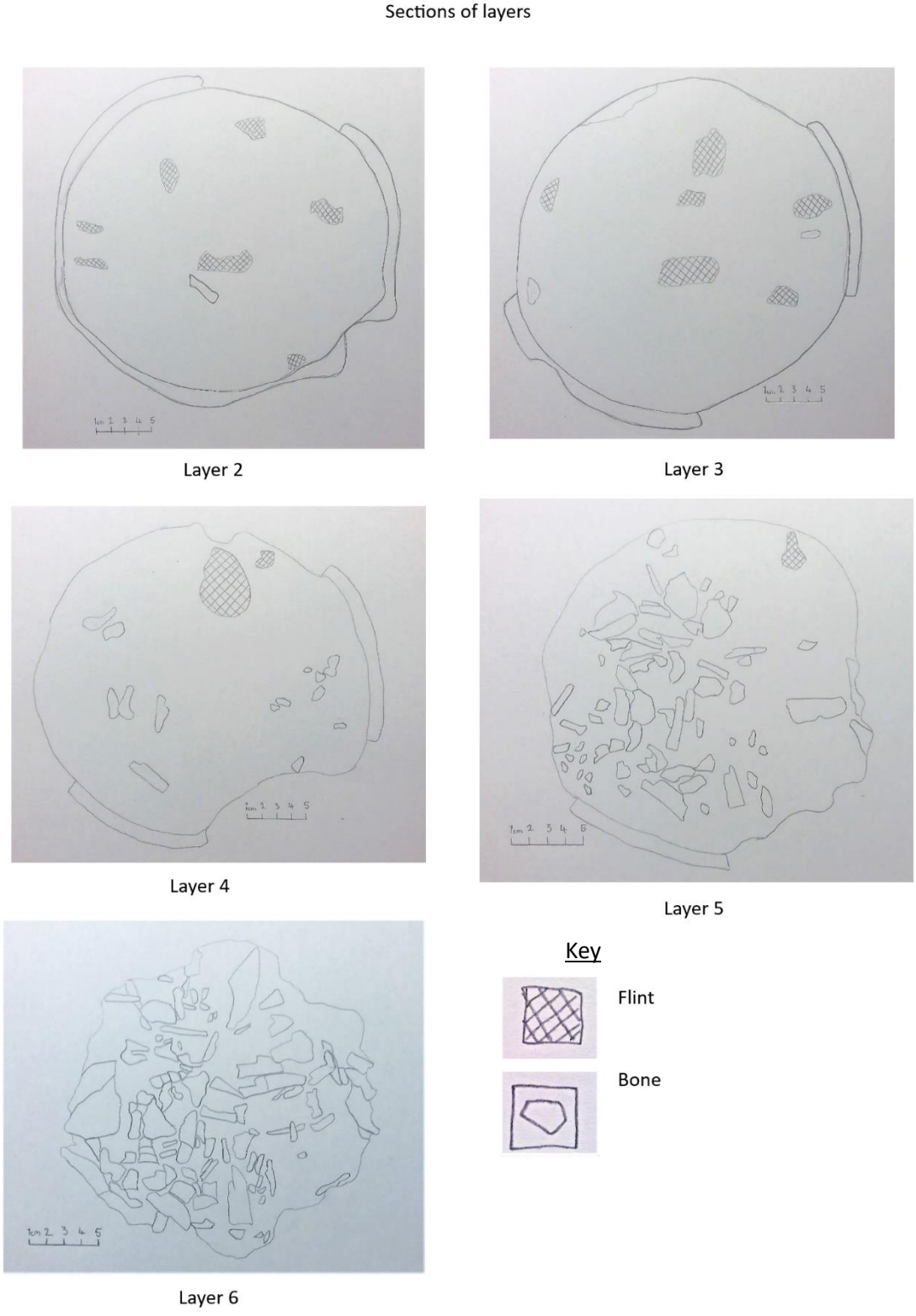

Figure 2. Sections from excavation of the urn for each layer with key.

displayed in Figure 2, excluding layer 1, which focused on removal of the sides to create a flat surface. Layers 2-5 then used the 1.5cm incremental stepped method, continuing down until bone contents became highly dense, and it was deemed unwise to excavate using this method any further owing to the increased potential for damage to the remains. At this final stage, the remaining contents of the urn (the base layer), measuring 4.2cm thickness, could be lifted out of the ceramic container to be wet sieved as one whole layer. The approximate location of bone fragments is displayed in Figure 3.

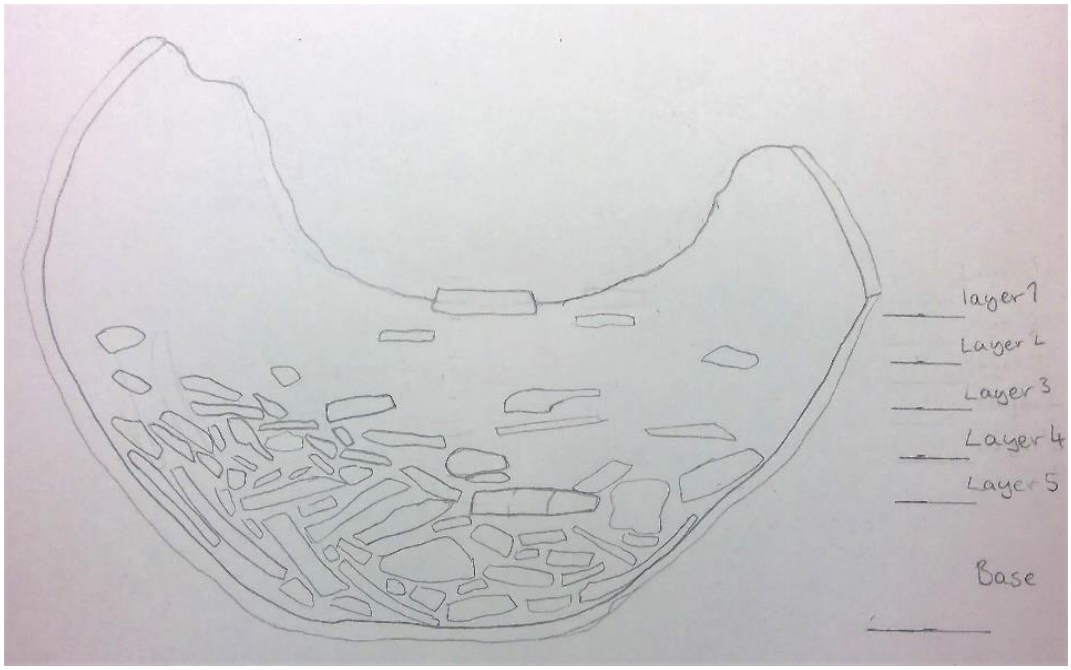

Figure 3. Cross section plan of the urn, with estimated guide for the location of bone fragments

Due to the nature of the soil and cremated remains, the bone fragments were highly susceptible to breakage. Therefore, cleanly excavating individual fragments was not the goal; instead, larger areas of material containing bone were excavated.

After each incremental layer was excavated, the urn was photographed, together with a scale, to maintain a record of the layers as well as the shape and collapse of the urn (these can be found in appendix 1).

All the excavated material was then bagged, and fully labelled with site, contents, layer, and side. All the material removed, including the soil, was held for wet sieving at a later stage.

2.3. Wet sieving

Once all the material was fully excavated, the bagged material was wet sieved in warm water using a 1mm and 2mm sieve. This deviated from J. McKinley's methods, as many of the remains in this cremation were too fine for the 10mm sieve (McKinley, 1994).

During sieving, all layers were kept separate and labelled. To prevent any damage to the material, the sieving was done with a brush alone and no harsh movements of the material were performed. Clean removal of all soil around each fragment was not a goal, as some soil had to be left to prevent breakage of remains.

The remains were then left to dry for a few days, with layer and side labelled on each tray, before being bagged for analysis.

2.4. Analysis

The remains were recorded using cremation recording forms created by Elizabeth Aubin, a PhD student from the University of Southampton, which can be found in appendix 2. This included recording the percentage of each bone present, total weight of cremated remains, preservation, and the mean size of fragments (taken from a random sample of twenty bones from a mix of layers). The total weight of remains were used in MNI estimations, following Goncalves *et al* (2015).

Where identification of the cremated remains was possible, the fragments were divided into categories consisting of cranial, axial, and appendicular skeleton. Where possible, these were then further divided if the specific bone was identified. This was aided by diagrams and descriptions by White, Black and Folkens (2012) along with reference material held at The University of Southampton. Where possible, siding of fragments was also undertaken, however, the vast majority of fragments could not be sided due to poor preservation.

Heat induced colour changes were noted using Goble's (2021) criteria and any non-heat induced colour changes were also noted. Other heat induced changes, such as fracturing and warping, were recorded using guidance by Symes *et al* (2015).

Any available measurements were taken, including measurements of any pathological changes. Pathological changes were also recorded, photographed with a scale, and sketched.

Age was assessed using dental eruption[5] (Ubelaker, 1989 (Reproduced in: Buikstra and Ubelaker, 1994) and cross sectional suture closure[6] (Åkesson, 2019). For suture closure, only the coronal and sagittal sutures were used, and the lambdoid suture was excluded due to the variation in timing of obliteration. These sutures were differentiated by the presence of meningeal grooves on the parietal, and the variation in thickness of the occipital (Åkesson, 2019). A final age range based on these was then devised using categories produced by McKinley (1994).

Estimations of sex were not undertaken due to the poor preservation and incompleteness of the remains. Estimations based on weight of the remains were deemed inappropriate due to the poor state of preservation and incompleteness of the remains.

2.6. Inter-site comparisons

The results were compared to Anglo-Saxon cremations from a similar time period. These were selected based on the similarities in methods and demographic categories, all of which reflected the methods first devised by Jaqueline McKinley (1994). This provided a more reliable comparison of results and reduced the number of factors which could produce significant differences between the sites (Squires, 2012). The sites used for comparison were Collingbourne Ducis, Spong Hill, Sancton, Elsham and Cleatham (as mentioned in a previous chapter), along with a brief comparison to modern cremation and a cemetery from Cuxton, Medway, where osteological analyses have yet to be undertaken (Timby *et al.*, 1993; McKinley, 1994, 2013; Mackinder *et al.*, 1999; Squires, 2011; Hills and Lucy, 2013; Egging and Stoodley, 2016).

[5] Looking at the linear stages of eruption for each tooth, and the age range when each is expected to occur (Buikstra and Ubelaker, 1994).
[6] This examined what percentage of each suture was fully fused. This was only used on fragments where fracturing occurred along the suture line, revealing the suture cross section (Åkesson, 2019).

3. Results

3.1. Skeletal inventory

The overall preservation of the remains was poor. 20% of the cremated remains were unidentifiable, involving fragments <5mm. For the 80% of identified material, Table 1 shows the percentages of each type of bone present. Siding was not possible on any of the remains, except the patella and one mandibular molar (table 1).

Table 1. Skeletal inventory with percentage of each bone present. Bones that have not been identified as present are absent from the table. All bones were un-sided unless otherwise stated.

Bones present	Percentage present	Additional information
Cranium	20%	No landmarks used in sexing were present.
Mandible	10%	
Dentition	5%	2 molars: third, right, mandibular molar, and unidentified molar fragment
Humerus	10%	
Radius	40%	
Ulna	50%	
Carpals	>10%	
Metacarpals	>10%	
Hand phalanges	10%	Including one complete intermediate hand phalange
Femur	>10%	
Patella	25%	50% of the left patella present
Tibia	>10%	
Fibula	>10%	
Calcaneum	>10%	
Tarsals	>10%	
Metatarsals	>5%	

Due to the brittle nature of cremated remains, many of the fragments, despite best efforts, either separated across fracture lines during the excavation stage, or dissolved during the sieving stage.

A point worth noting, is that the poor preservation of material makes differentiation between human and non-human bones less reliable; although, it is unlikely that many animal bones were present due to the low weight of the remains. The ornamentation on the urn along with the fact that no other urns or remains were found alongside this one also makes it significantly unlikely that this was an accompanying cremation of solely animal remains that would have been placed alongside a human cremation urn. However, it cannot be ruled out that some of the more poorly preserved remains may have been animal bones, as this is a common practice in Anglo-Saxon cremations (Bond, 1996; Squires, 2012).

3.2. Weight of remains and MNI.

Measurements for the weight of cremated bone were only undertaken after the sieving process. As would be expected, the densest quantity of bone was excavated from the base of the urn, with significantly less in the topmost layers. Layer 2 (the first level layer) had only 5g, while layer 5 was measured at 50g and the base of the urn had 91g of bone removed.

The total weight of the material was 686g. As the total weight was already significantly below the expected for one individual, weight alone was not used for MNI estimations (Goncalves *et al.*, 2015).

Turning instead to duplicates and size differences as a means of estimating MNI, the lack of repeated elements or any major size differences in the bone leads to an estimation of one individual being present. However, due to the poor preservation and small size of fragments, duplicates are less easily identifiable, and any conclusions should be made with caution.

3.3 Size of remains.

The maximum fragment size was measured to be 41.2mm, taken from a fragment of an un-sided ulna found in the base of the urn. However, the mean size of fragments, from a random sample of 20, was 18.9mm, which classifies the remains as small. As would be expected, fragments found at the base of the urn were larger than those in the top layers.

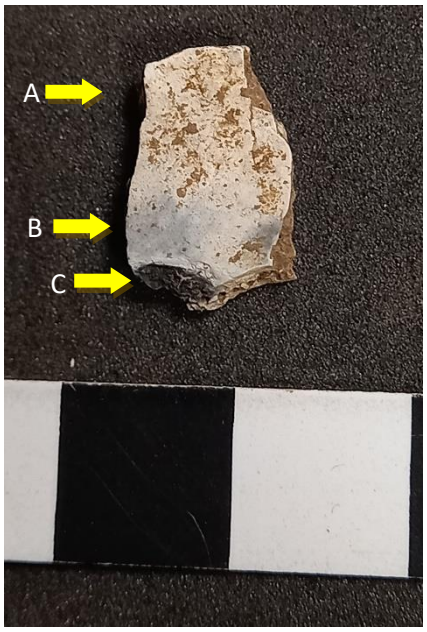

Figure 4. Colour changes in a fragment of flat bone, with A: white, B: blue, and C: black. photographed with 10mm scale.

3.4. Colour Changes

White was the predominant colour, representing a high proportion of remains experiencing complete combustion and calcination (Figure 4) (table 2). Smaller areas of blue to black bone were also noted (Figure 4), where combustion was incomplete. This darker colouring of the bone was apparent mostly in the flat bones, and cranial fragments. The percentage of each colour found is displayed in table 2.

Poor preservation of remains must be considered, as the darker colours, containing a higher proportion of organic material, fragmented more easily during the excavation and sieving stages (Devlin and Herrmann, 2008). These darker areas of bone may, therefore, have been underestimated in their frequencies.

Table 2. Percentage of remains displaying each colour stage (categories taken from Goble (2021)

White	Grey-white	White-Beige	Light grey	Dark grey	Blue	Black/ Grey	Black	Grey/ Brown	Brown	Ivory/ Yellow
65%	5%	0%	5%	5%	15%	0%	5%	0%	0%	0%

3.5 Morphological changes

The fractures present include longitudinal, step, transverse, patina, delamination, and curved transverse fracture; this fracturing was classified as severe overall. However, the sample was dominated by long bones, all of which had severe fracturing, predominantly curved transverse fractures. Conversely, the smaller bones, such as the phalanges, had very minor fractures, and curved transverse fractures were absent, although significantly fewer of these elements were identified.

Figure 5. The complete intermediate hand phalange displaying warping. With 10mm scale.

Minor warping was also present, most noticeably on the intermediate hand phalange which was found complete (Figure 5). No other noticeable warping was

identified on other fragments, however, due to the small fragment sizes, this could have been less visible, resulting in an underestimation.

No shrinkage was noted for any of the remains, although this may not have been noticeable due to the size of fragments and poor preservation.

3.6. Ageing

Analysis of suture closure revealed roughly 50% closure on all sutures identified, suggesting an age range of 35-60 (Åkesson, 2019). Lambdoid sutures were difficult to exclude from analysis due to the difficulty in differentiation between sutures in the small fragments available, so this age category may not be reliable, but will still be used as a guide.

Dental eruption used the mandibular, right, third molar which was fully erupted, found still within the mandible. This suggested an age of over 21 (Buikstra and Ubelaker, 1994). Overall, the age range was estimated as being 31+, categorised as an older mature adult according to the age categories devised by McKinley (1994).

3.7. Pathologies

On an unidentified fragment of long bone, there was a protuberance on the surface, with expansion of the cortical bone. A portion of this protruded region was fragmented in a non-heat-induced fashion, with no evidence of healing (Figure 6) (Symes *et al.*, 2015).

The expansion of the cortical bone could represent an infection. It is unlikely that the almost circular fracture line was once a cloaca, as the edges are sharp, not rounded as they would be if formed by the drainage of pus (Buikstra, 2019; Mays, 2021). If the unusual shape of the fracture line is excluded, then this could be the result of the non-specific infection, osteitis, which is characterised by the expansion of the cortical bone (Buikstra, 2019; Mays, 2021). For a firm diagnosis, more evidence would be required from the rest of the skeleton and, as this is not possible, it cannot be conclusively stated to be the result of infection.

Although, this could have been a foramen in the long bone, which a heat-induced, curved, transverse fracture line radiated towards, this would not explain the protuberance found on the surface of the bone.

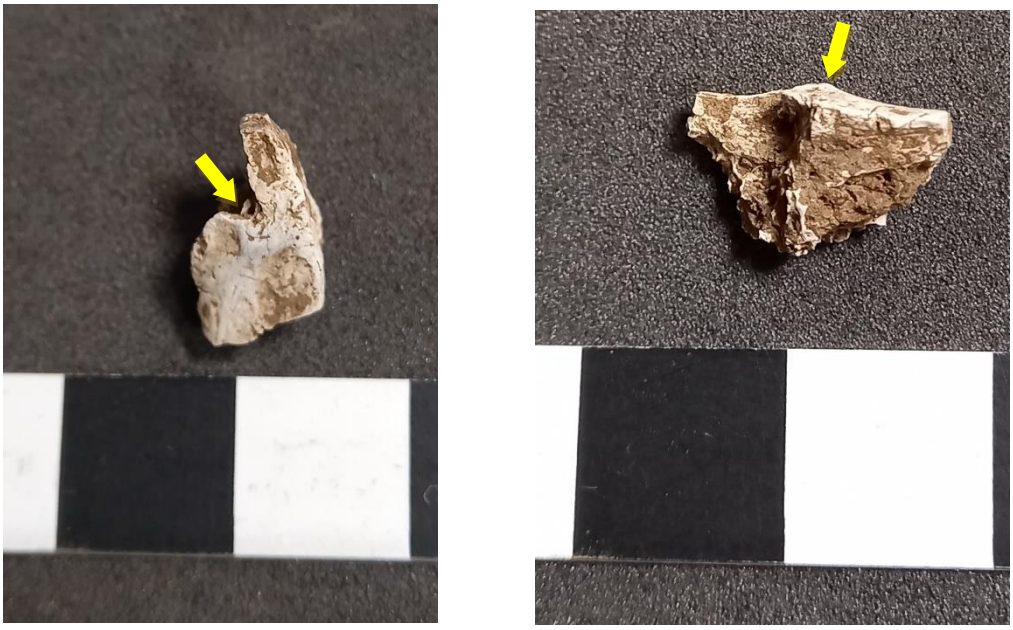

Figure 6. Long bone fragment with surface protuberance and non heat-induced fracturing (marked with arrows. Right: side view showing the protruding surface, left view of the surface of the bone showing the non heat-induced fracturing. with 10mm scale bar.

Non heat-induced fracturing was also identified on a rib fragment (Figure 7); the shape of which was not consistent with the expected shape of heat-induced fractures and is likely the result of trauma instead. The groove on the rib fragment (Figure 7) measured 2.5mm across. The rib fragment also displayed possible radiating fracture lines, as well as three minor, shallow grooves running parallel to the main indentation. This, along with the almost triangular shape of groove, tapering to a point, suggests a form of sharp force trauma (Christensen and Passalacqua, 2018; Waldron, 2020). The edges of the fracture are sharp, and the colour of the bone does not differ, suggesting perimortem or post-mortem fracturing (Ortner, 2003). As the fragment was found at the base of the urn, and the wooden tools used to excavate the urn would not have been able to create such a cut mark, excavation damage can be ruled out as a possible cause (Ortner, 2003; Buikstra, 2019). Alternatively, these fractures could result from funerary practices, occurring either just before the cremation, as a part of preparation of the body, or post cremation, as part of the collection and burial practices (Hamerow, Hinton and

Figure 7. Rib fragments displaying non heat-induced fragmentation (marked with arrow), with 10mm scale bar.

Crawford, 2011).

3.8. Artefacts

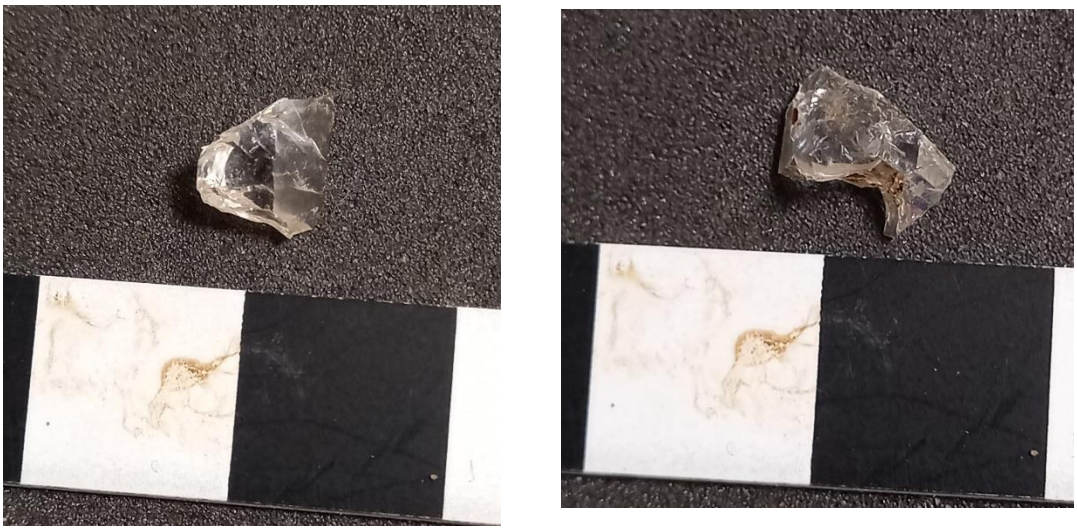

Figure 8. Glass fragments found at base of the urn, with 10mm scale bar.

No artefacts were found alongside the cremated remains that appear to have been placed post cremation. A large quantity of flint was, however, found within the urn, predominantly in the top four layers. This flint is local to the area, and does not appear to have either heat damage or any sign of manual working to produce stone tools, and is therefore likely to have been included with the infill after the remains were placed within the urn (British Geological Survey, 2020).

Two small, fractured glass fragments were found in the base of the urn with a maximum measurement of 5mm and 8mm (Figure 8). The location of these makes the interpretation of them being intrusive unlikely, and their highly fractured nature indicates they may have been on the pyre with the remains. Their size suggests they were once glass beads, as these have previously been found in several cremations of the time, such as in Elsham and Cleatham (Squires, 2011). However, these fragments are too fractured to precisely deduce their origin.

One small fragment of red pottery, not matching the material of the urn, was also found, measuring 3mm thickness (Figure 9). This was located in layer 3b, making it possible that this was an intrusive fragment. It may also represent the remains of another pot or urn, however, the presence of only one makes this is unlikely.

Figure 9. Red pottery fragment from layer 3b, with 10mm scale bar.

It is possible that these pottery and glass fragments, were intrusive in the pyre. If the burning of the body took place close to the settlement, waste material already present at the site may have been accidentally included upon collection of the cremated remains for deposition into the urn.

4. Discussion

4.1. Site comparison

The results from Otford have been compared to the cremation cemeteries of Collingbourne Ducis, Spong Hill, Sancton, Elsham, Cleatham, and Mucking, along with a brief mention of the differences with modern day cremation practices. The results are displayed in table 3, and only represent the cremated material from each site, unless otherwise mentioned.

4.1.1. Weight

For each site used in comparison, only the mean weight of undisturbed, urned cremations was taken. The total weight of material from the Otford urn was slightly above, but close to the mean weight of material from Spong hill, Sancton, Elsham, Cleatham and Collingbourne Ducis, as well as being well within the range for all of these (table 3) (Timby *et al.*, 1993; Squires, 2011; Hills and Lucy, 2013; Egging and Stoodley, 2016). A significant point made by McKinley (1994) is that a modern cremation would be expected to weigh between 2500g-3000g for an adult where all material was able to be collected, whereas the mean weight of material from all of the aforementioned Anglo-Saxon cemeteries never passed 1000g (Timby *et al.*, 1993; McKinley, 1994; Squires, 2011; Hills and Lucy, 2013). This signifies how, in a typical Anglo-Saxon cremation ceremony, not all the material from a funeral pyre was collected for deposition within an urn (McKinley, 1994). Modern day cremations occur in a controlled, sealed environment and therefore have fewer external factors influencing the proportion of remains that could be collected, such as the weather, scavengers or the identification of relevant remains (McKinley, 1994; Squires, 2017).

Additionally, it is also possible that a small portion of bone was kept by mourners, and later buried elsewhere (Squires, 2012). However, from analysis of the percentage of each bone recovered from the Otford site, a small proportion of all the expected bones were present. This excludes bones with a higher proportion of trabecular bone, such as the vertebrae, which are less dense and more prone to disintegration, and therefore unlikely to remain (Mitchell, 2017). The poor preservation and small sizes of remains inhibited the ability to side these fragments, making the study of post-pyre removal unreliable. It is unlikely that whole bones were removed for this purpose before the pyre took place as the remains were likely to still be fleshed at the time of the pyre, as will be discussed later. However, there remains the possibility that a more random selection of fragments were collected by mourners that would not be revealed by this analysis.

4.1.2. Minimum number of individuals

One major point of contrast between these sites is the number of individuals present. This site from Otford provides a significant difference to the other site examples due to it containing only one individual. The MNI for this site is most similar to the site from Collingbourne Ducis, Wiltshire, which saw only four individuals. Both of these sites show a marked difference to that from Spong hill, the largest Anglo-Saxon cremation cemetery yet discovered (Squires, 2012; Hills and Lucy, 2013; Barber, 2018). The Spong hill cremation cemetery, however, may not be typical for the Anglo-Saxon period, as typically only 10% of Anglo-Saxon cremation cemeteries were found to have over 50 burials (Barber, 2018). This makes these smaller cemeteries not so unusual. However, the solitary nature of this urn from Otford is still noteworthy. The isolation of the urn may be due to the issues encountered upon excavation from the site, and problems in accessibility to the surrounding area where more burials may yet be discovered (Ward, 2022). Similar cremation burials within the area may only be identifiable with excavation. There also remains the problem of access to neighbouring houses which has so far limited further investigation.

4.1.3. Fragment size

The largest fragment size found at Otford was from part of the ulna and measured 41.2mm. This is significantly below that from other sites compared here. The majority of sites, including Spong hill, Sancton, Elsham and Cleatham, were close to 100mm for maximum fragment size (table 3). The fact that the Otford site is less than half of this hints to the poor preservation apparent at this site. This sizable difference strongly reduced the ability to identify many of the fragments here and has led to 20% unidentifiable material.

The small fragment size may be a result of the pyre technology and many heat-induced fractures apparent on the bone, which will be discussed further in this chapter. On the other hand, it may be a result of the soil type at this site, which has hindered the preservation of bone in this area and led to a higher incidence of disintegration (Baxter, 2004). However, the soil type at this site has yet to be analysed in this context.

4.1.4 Age and Sex

Table 3 shows the proportion of different sex and age categories for each site. The same demographic categories were used as by Jaqueline McKinley (1994), however, for ease of

comparison, the categories were simplified. Sex categories have been summarised so that all males, probable males, and possible males are categorised as 'male', and again for the females. Age categories have also been summarised down to infant, child, sub adult, young adult, older adult, and adult (where more exact ageing was not possible).

Sex could not be analysed for this individual due to the poor preservation and absence of skeletal markers used in sexing. Cremation makes standard osteological processes difficult to use for determining age and sex due to the poor preservation, and elements such as the pelvis, commonly used for ageing as well as being the most sexually dimorphic skeletal element, are also often one of the most poorly preserved elements, especially in cremations (Nugent, 2010; White, Black and Folkens, 2012). To exemplify this, less than 30% of the adults from Collingbourne Ducis, Elsham and Cleatham could be sexed (table 3) (Squires, 2011; Egging and Stoodley, 2016). Even for Spong hill and Sancton only around half of the individuals could be sexed (table 3) (Timby *et al.*, 1993; McKinley, 1994). Therefore, the lack of material to sex this individual from Otford is not unusual and would be expected for the majority of cases.

As for age, the Otford cremation would fall into the older adult category, which also saw the highest proportion of individuals from Spong hill and Sancton (table 3) (Timby *et al.*, 1993; McKinley, 1994). Elsham and Cleatham, however, found that the highest proportion of individuals were classified as young adult, and the older adult category only accounted for under 5% of individuals (Squires, 2012). As both of these categories involve adults, it is likely that this difference could be the result of the difficulties in ageing adult skeletons (White, Black and Folkens, 2012; Åkesson, 2019). In adults, the ageing methods become far less reliable than in juveniles and infants as stages of growth can no longer be used (White, Black and Folkens, 2012). The age categories for adults become broader than that for juveniles, and therefore, the category to select for each individual may become more subjective.

4.1.5. Pathologies

Evidence of trauma and an infection was identified in two small fragments of bone. Infections are a fairly common find in palaeopathology. 3.21% of individuals from Elsham had indicators of periostitis (a non-specific infection resulting in formation of woven bone overlying the cortical bone) (Ortner, 2003; Squires, 2011; Mays, 2021). However, no more information can be obtained regarding the nature of this infection.

Trauma is slightly less common to find, especially in cremated material where the distinction between heat-induced and non-heat-induced fracturing is made difficult (Squires, 2011).

Cremation is known to severely hinder the amount of palaeopathological data that can be recovered and often distorts what information remains (Reinhard and Fink, 1994). It is impossible to tell the precise cause of death in individuals based solely on the bone, and the effect of the cremation further reduces what information can be acquired about the events that played out around the time of death (Reinhard and Fink, 1994). Nevertheless, it may be possible that this individual suffered from an infection severe enough to affect the bone and experienced some form of trauma around their time of death (Wood et al., 1992).

4.1.6. Grave and pyre goods

Cremation burials are often rich with grave or pyre goods (Barber, 2018). However, no significant grave/pyre goods were found within the Otford urn. The absence of grave goods may be due to any perishable materials, such as wood, not surviving decomposition as well as the generally poor preservation at the site. Nevertheless, any metallic or similarly robust objects would be expected to remain.

Whilst it is possible that pyre goods were present for this cremation, it is difficult to infer from the material excavated. Not all pyre goods may be included into the urn and some artefacts, such as wooden artefacts, would not survive the heat. The fragments of the glass found may represent glass beads or glass ornaments that were included in the pyre, which fractured as a result of the intense heat, though very few remain (Squires, 2011, 2012). Similarly, the fragment of red pottery found may represent some small artefact placed with the remains, though interpretations of the nature of this artefact cannot be made due to its size (Squires, 2011).

The lack of significant grave/pyre goods may represent the social standing of this individual. The inclusion of these goods can be influenced by age, sex, and social status, as was found at Cleatham (Squires, 2013). It has been suggested that the inclusion of these grave/pyre goods is expected to increase with the increase in age, especially after the transition into adulthood (above the age of 20 in this case) (Hamerow, Hinton and Crawford, 2011). Therefore, this individual being an older adult, makes the absence of artefacts in the urn unusual. Alternatively, sex may have played a role in the inclusion of artefacts, which could not be determined at this site, as the individual remained unsexed (Squires, 2013).

Another explanation is that the community were unable to part with many resources due to limited materials available to them (Hamerow, Hinton and Crawford, 2011). This site may have been a small community with limited resources at hand, and even fewer that could be spared for the dead. This

interpretation would be strengthened if the absence of other nearby burials is confirmed, representing a small and less prosperous community (Hamerow, Hinton and Crawford, 2011).

4.1.7. Geographical location

The Otford urn is not unusual in its location within Britain. Cremation dominated cemeteries are predominantly found in eastern England, and although this burial has not yet been found to be a part of a larger cemetery, it still fits with the trend in cremation v inhumation choice found in this part of England (Hamerow, Hinton and Crawford, 2011). Looking at the Historic Environment Records, many smaller cremation cemeteries or singular cremation burials also appear to predominate the east of England, in areas such as Suffolk, Norfolk, Essex, Sussex, Kent and Yorkshire, making this an expected location for this cremation (Heritage Gateway, 2012).

One question arising from the location of this cremation pertains to why only one cremation has been found. One possible explanation is that most archaeological cremation burials, especially those lacking grave or pyre goods, can only be found by excavation, and geophysical methods are unlikely to identify these burials (Hamerow, Hinton and Crawford, 2011). The excavation of this site experienced difficulties in accessing other areas, as it was found within a residential area and excavations could not be carried out to test whether other graves are located nearby. As mentioned in the brief, 'some bones' may have been removed from a neighbouring house around the same time this cremation was found, but this was not confirmed or traced (Ward, 2022). Therefore, this burial could be perceived as isolated due to limited area excavation (Sofield, 2015).

Alternatively, this singular burial could represent a deviant burial, where one individual has been isolated from the main burial site, either as an execution burial, or due to more minor differences in social identity that have led to this individual being outcast (Reynolds, 2009; Sofield, 2015). It could also be an opportunistic burial as a result of a sudden act of violence (Reynolds, 2009; Sofield, 2015). However, deviant burials would normally be found at the edges of burial plots and so more graves would still be expected to be found in the surrounding area. The fact that this is a cremation instead of inhumation makes an opportunistic burial as well as a deviant burial unlikely, as cremation practices take time and are of higher cost to those undertaking the ritual (Reynolds, 2009; McKinley and Tech, 2015).

Another Anglo-Saxon cemetery approximately 23km away from this site, was found at Cuxton, Medway, during construction for the Channel Tunnel Rail Link (Figure 10) (Mackinder *et al.*, 1999; Heritage Gateway, 2012). This was a mixed cemetery with only two cremations, and thirty-six

inhumation burials (Mackinder *et al.*, 1999; Heritage Gateway, 2012). Both cremations were found in urns alongside inhumation burials; however, neither of these have undergone evaluation (Mackinder *et al.*, 1999). This cemetery is both the closest in terms of location as well as date to the Otford cremation. However, the distance between the sites makes it unlikely that these burials are linked.

Roman walling found nearby indicates that this area was an occupied settlement during the Anglo-Saxon period (Heritage Gateway, 2012; Ward, 2022). Anglo-Saxon settlements were often found to be either on or adjoining previous Roman towns, making the location of this burial more unusual (Hamerow, Hinton and Crawford, 2011; Sofield, 2015). Most cemeteries are separate from contemporary dwellings, with burials only becoming closer to the settlement later in the Anglo-Saxon period when Christianity took its hold (Sofield, 2015). Sofield's (2015) research looked at 16 isolated graves that were found in settlement contexts. He suggested that the location of these burials may be the result of the individual demanding exclusion, or instead, serve a purpose in the settlement, by providing ancestral ties to the community and a permanent connection to the household (Sofield, 2015). Either of these explanations could hold true for the Otford cremation, as the decorated urn and effort put into the cremation practices lends weight to the idea of strong social ties between this individual and the community involved (Sofield, 2015).

While it is possible that this individual was buried as an isolated burial, perhaps as a part of a household, the limited area of study and availability of data on the area means that no clear answers can be given as to why only one has been found. More research on the surroundings would be needed to rule out the possibility of other cremation burials being located nearby.

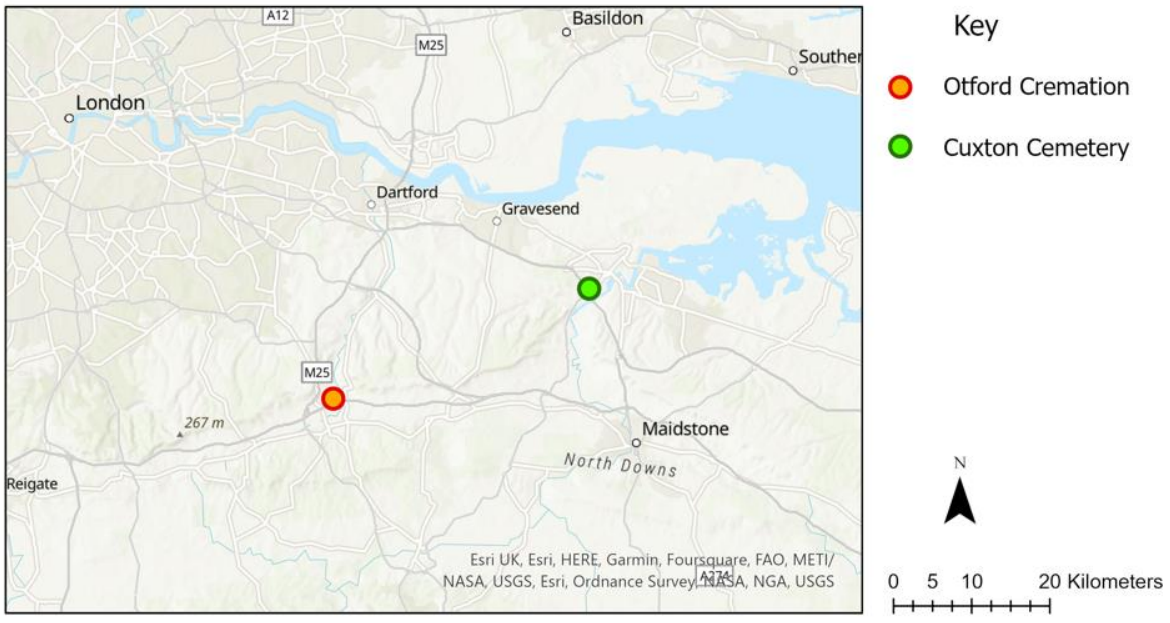

Figure 10. Map of the Kent and London area showing the location of the Cuxton cremations in relation to the Otford cremation, with key and scale bar (authors own, made using ArcGIS Pro (Esri Inc, 2022)

Table 3. Collection of results from similar cremation cemeteries using McKinley's (1994) methods, used for comparison with the Otford urn as well as information on modern cremations.

Site location	Urned cremations / MNI	Weight (mean)	Fragment size (Maximum)	Colouration	sex ratio	age ratio	Studied by	Reference
Otford, Kent	1/1	686g	41mm	predominantly White, some blue/black	-	Adult	Author	-
Collingbourne Ducis, Wiltshire	3/4	260g	60mm	predominantly white, slight blue/grey.	1 female, unsexed (75%)	1 juvenile (5-6), 1 infant, 1 subadult (>13), 1 adult (18-25)	Jacqueline McKinley	(Egging and Stoodley, 2016)
Spong hill	177/2284	514g	120mm	predominantly white, few black/ blue/ grey.	Male (38.8%), Female (61.2%) Unsexed (44%)	Infant (12.8%), Child (21.1%), Young adult (18.9%), older adult (32.7%), adult (14.5%)	Jacqueline McKinley, Catherine Hills.	(Hills and Lucy, 2013)
Sancton	n/a	882g	100mm	predominantly white, few black/ blue/ grey.	male (42.4%), female (57.6%) unsexed (54%)	Infant (17.3%), Child (6%), Subadult (4.7%), Young adult (15.4%), Older adult (29.6%), Adult (27%)	Jacqueline McKinley	(Timby, 1993)
Elsham	535/564	535g	89mm	white, some bluish black. A few yellow/ brownish yellow	male (32.9%), female (51.1%), intermediate (15.9%) Unsexed (73%)	Infant (8%), Child (6.9%), Subadult (8.9%), Young adult (43.6%), older adult (4.9%), adult (14.9), undetermined (12.9%).	Kirsty E. Squires	(Squires, 2012)

Cleatham	996/1009	527g	106mm	white to black, some yellow	male (25.1%), female (54.6%), intermediate (20.4%), Unsexed (70%)	infant (12%), Child (8.4%), Sub adult (21.7%), Young adult (40.2%), Older adult (3.1%), Adult (14.6%)	Kirsty E. Squires	(Squires, 2012)
Modern	-	2500- 3000g	250mm		-	-	-	(Squires, 2011)

4.2. Pyre technology

A complete cremation would have fully oxidised and dehydrated the bone (McKinley and Tech, 2015). This requires a sufficient amount of oxygen, fuel, time and a high enough temperature to reach this fully combusted state. This is possible using modern cremation practices, where energy efficient and tightly controlled conditions are possible (McKinley and Tech, 2015). The use of experimental pyres has suggested that most of these conditions could have been met using the fuel from historical settings, but the problems of time availability and containment of heat energy to prevent loss to the atmosphere remain (McKinley and Tech, 2015).

Using the colouration and heat-induced fracture patterns present on the bone, it is possible to interpret the conditions and temperatures of the pyre in question. Using these methods, it is also possible to determine whether the bone was fleshed or not at the time of cremation, which will be mentioned further (Alunni *et al.*, 2014; McKinley and Tech, 2015; Symes *et al.*, 2015; Squires, 2017).

4.2.1. Colour

The pyre technology can be interpreted using the colouration and fracture patterns evident on the remains as the bone dehydrates (Symes et al., 2015; Squires, 2017). At the different temperatures, bone progresses through a gradient of colour changes (Symes et al., 2015). The colours noted on the remains from Otford ranged from predominantly white, to a small portion of blue and even less black. These observations are not uncommon, and is reflected in the results from Spong hill, Sancton and Collingbourne Ducis (Table 3) (Timby *et al.*, 1993; Hills and Lucy, 2013; Egging and Stoodley, 2016).

Black colouration of bone can result from the bone becoming charred from direct contact with flames (Symes *et al.*, 2015). However, as the black colouration on the remains from Otford were largely found within the bone, it is likely this was not the cause here. In modern day forensic experiments, it was found that the black occurred between 300-350 °C , grey colours at 550-600 °C, and above 700 °C, bones were found to be white (Devlin and Herrmann, 2008; Alunni *et al.*, 2014). As bone burns from the outside in, it could be that these inside fragments of bone were not able to reach above 350 °C, and thus remained this black colour, with blue colouration on the outside of the bone where temperatures reached higher levels (Alunni *et al.*, 2014; Ubelaker, 2017). This was also dependent on the presence of soft tissue and the anatomical area in question (Alunni et al., 2014).

This suggests that oxidation of the bone was largely complete, with only a small portion remaining under 700 °C, and experiencing partial combustion (Alunni *et al.*, 2014; Symes *et al.*, 2015).

4.2.2. Heat-induced fracturing

As for fracturing of bone, the only heat-induced fracture not present from the Otford urn was burn-line fractures. These fractures occur along the border between burnt and unburnt bone (Symes *et al.*, 2015). This suggests that there were no unburnt bones, all experiencing at least partial combustion.

A large portion of bone also displayed curved transverse fractures. These fracture types were common on the long bones from Otford, and many had split along these fracture lines upon excavation. These fracture types indicate that the bone was likely to be fleshed when placed on the pyre, as they are caused by the shrinkage of the soft tissue and periosteum (Symes *et al.*, 2015).

The highly fractured nature of these bones may also be of note, as Symes *et al* (2015) has suggested that fully calcined bone often experiences significant fracturing, and breakage upon excavation as a result. This high level of fracturing was also noted on the Otford remains and implies a very near level of complete combustion for these remains. Fracturing may also be a result of soil acidity, which can influence the preservation of remains (Baxter, 2004). Acidity can vary in different soil types, and a more acidic soil can cause further erosion and breakage of the bone (Baxter, 2004).

Overall, the colouration and fracture patterns on the bone suggest that the cremation was almost complete, and the body was fleshed at the time of cremation (Alunni *et al.*, 2014; Symes *et al.*, 2015).

4.3. The urn

Mortuary practices have played a large role in the construction of memories shared between the community to commemorate the dead (Hamerow, Hinton and Crawford, 2011). These mortuary practices involved the funeral pyre, and included the cinerary urn as a way to create memorable scenes and evoke memories of the departed (Williams, 2014; Meyers Emery and Williams, 2018). Cinerary urns would have played an important role in the ritualistic process, as it is rare to find cremation without these urns; even domestic pots have been reused as funerary urns in several cases (Hamerow, Hinton and Crawford, 2011; Squires, 2012; Perry, 2020).

The Otford urn was constructed from a dark grey pottery which was highly decorated. The neck of the pot was broken off from the main urn before arrival at The University of Southampton and was bagged separately. These neck and rim fragments still displayed a typical urn shape (likely similar to Figure12) but it was difficult to reconstruct with precision due to the fragmentation.

The Urn was embossed with a number of stamps, engravings and three repeated projections. These projections framed the three faces of the urn, all of which were depicted with repeated, circular decoration. These three projections appear to represent an animal, with two eyes looking out from the urn, and linear markings running down its back (Figure 11).

Figure 12. One of three embossments dividing the three faces of the urn, with a protuberance on the superior surface. Left: photo taken before excavation, right: hand drawn reproduction of the design (Authors own)

Figure 11. An urn displaying a similar form of projecting decoration at a different angle, from Thurmaston, Leicestershire (Nugent and Williams, 2012)

An urn from Thurmaston, Leicestershire, had bosses highly similar to the ones found from the Otford urn, with the diagonal markings being described as 'fur' projecting from a 'spine' (Figure 12) (Nugent and Williams, 2012). This description may not be the best representation of this design, as describing the linear markings as 'fur' may be a stretching the imagination. The projection does resemble a form of animal, with two eyes; however, the patterning on the Otford urn is suggested as possibly also resembling a fish.

Nugent and Williams (2012) suggested that the use of 'eyes' and animal shapes was commonly used, possibly as a way for the ancestors to watch over their living relatives (Nugent and Williams, 2012). This may serve the same purpose on the Otford urn, as the regular projections framing each of the three faces would be seen from every angle, aiding in the perception of the ancestors overlooking their relatives.

The repeated shapes and patterns found on the urn (Figure 6b,c,e), were likely to be produced with the use of stamps, which were often made of bone, wood or metal (Myres, 1937). Initial analysis on the urn suggested that stamp b (Figure 13) was made using a five-point comb (Kent County Council, 2008).

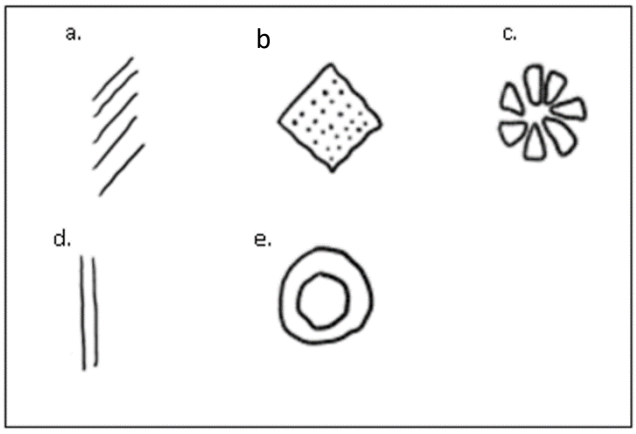

Figure 13. Sketched representation of the collection of stamps and engravings on the urn from Otford.

Although not identical, these patterns show stark similarities to those found on urns from other Anglo-Saxon sites. Stamp e (Figure 13), a circular design with two rings, is one of the most popular designs found, with variations including single or multiple rings found in many different sites across Britain, including Sancton (Timby *et al.*, 1993). The second most popular design, suggested by Timby (1993), was a circular floral design, which has significant similarities to stamp c from the Otford urn (Figure 13). Although found in very different parts of Britain, and made from different stamps, the similarities in these designs suggests these pot designs were influenced by the ongoing spread of trends (Timby *et al.*, 1993). This clear spreading of ideas in urn design has led some researchers to suggest that urn patterning could be used to trace migration of cultural groups (Perry, 2013). Although there are still issues with the reliability of this, as some trends can spread without the agency of migrating peoples, instead spreading through word of mouth and sight (Perry, 2013).

The different designs on these urns could also have been used as a way to portray the deceased's social identity, as a way to stimulate a memory of the deceased (Nugent and Williams, 2012; Squires, 2013; Williams, 2014). However, Perry (2020) mentioned how most cremation urns were reused domestic pots, and therefore would not have been specially made for an individual. So, while some pots may have used decorations to represent an aspect of an individual's life, in most cases (likely including the Otford urn) the design of the pot would not specifically represent the deceased individual and instead were pre-existent on the domestic pot (Perry, 2020). The designs may be used to further understand the spread of ideas and links between different communities at the time, but this is beyond the scope of this research.

4.4. Issues

As mentioned previously, there were limitations with the extent of the excavations and investigations in the neighbouring areas of Otford which may have led to other burials being missed. As cremations

are typically significantly poorer in preservation than inhumations, these remains may be harder to notice and easier to miss. This may have hindered interpretations regarding the location of this burial relative to other contemporary burials. However, it is likely that, if other cremations were yet to be found in this area, they would be few in number, as it is located in a residential area, and therefore many excavations would have taken place in the construction of the homes. Therefore, it is unlikely that this site represents a large cemetery, as seen in Spong hill, Elsham and Cleatham, and if more were to be found it is more likely to resemble that found at Collingbourne Ducis, which would have little impact in these results (McKinley, 1994; Squires, 2011; Egging and Stoodley, 2016).

The poor preservation of the remains has significantly restricted the interpretations possible for this cremation. One of the key aspects that could not be analysed due to this is the sex of the individual, which has limited the analysis that could be made on social identity. However, many contemporary cremations have also been unable to be sexed, as is expected for cremations where little can be done without the use of destructive analysis of the bone.

This study may also be limited by the inexperience of the observer in relation to the analysis of cremated remains, which pose more challenges than the analysis of inhumations. However, this observer error was mediated with the use of visual aids and models, as well as by assistance from Elizabeth Aubin, a PhD student from The University of Southampton with years of prior experience handling cremated remains.

4.5. Future studies

Future studies should further this investigation with the use of Genomic analysis to determine the sex of this individual to aid in the understanding of their social identity (Buonasera *et al.*, 2020). This would involve the destructive analysis of the molars, where ethical considerations need to be taken into account due to the scarcity of dentition available (Brickley *et al.*, 2004; Buonasera *et al.*, 2020). However, there is a possibility that the high temperatures often reached in many areas of the skeleton have reduced or completely obliterated any DNA for sex estimation to be possible (Buonasera *et al.*, 2020).

The addition of geospatial analysis using GIS software would provide an understanding of the significance of location in the choice of funerary practices (Williams, 2005). A wider analysis of the relationship between MNI, location and settlement distribution would aid in answering the question of why particular locations are chosen, and finding out which practice appears most dominantly

across England (Sayer and Wienhold, 2013). This would be similar to the work done by Sayer and Wienhold (2013), looking at using Ripley's *K*-function to analyse clusters of Anglo-Saxon cemeteries.

Analysis of the soil acidity levels and exact soil type present would further the understanding of environmental factors at play in the preservation of remains at this site (Baxter, 2004). Areas of bone containing a large proportion of trabecular bone can experience more severe disintegration in acidic environments (Mitchell, 2017). To understand the pyre technology and causes of the morphological changes occurring on the cremated remains, environmental factors such as soil acidity need to be ruled out as factors influencing the preservation of remains (Baxter, 2004).

To progress the understanding of the pyre conditions further, the use of histomorphometry and Fourier Transform Infrared Spectroscopy (FTIR) could be used, based on the work by Squires *et al* (2011) looking at the Elsham collection. The use of histomorphometry would benefit the understanding of the position of the body on the pyre based on the differential burning patterns, while the use of FTIR would increase the precision of estimates for the temperature of the pyre (Squires *et al.*, 2011). This would ultimately aid in understanding the length of time this cremation took, and help the progression of knowledge on how the funerary practice took place in Otford (Squires *et al.*, 2011).

5. Conclusion

Discoveries and studies of cremation cemeteries have blossomed since the early antiquarian research into Anglo-Saxon burials in the 17th and 18th centuries, with old sites being re-examined using updated methods (Timby et al., 1993; Squires, 2011, 2012, 2013; Hills and Lucy, 2013). Recent methods for examining cremations, devised by Jaqueline McKinley, have shed new light on the social identity of those cremated and the cremation practices being undertaken (McKinley, 1994).

Still, these papers have focused on cremation cemeteries as a whole, and fewer papers have focused on isolated burials, such as this one. This research into the Otford cremation, has broadened our knowledge of Anglo-Saxon cremation burial methods and geography, and provides a focus on isolated cremation burials.

Analysis suggests that this urn contains the remains of a single individual, aged 31+, of unknown sex, cremated in the early Anglo-Saxon period. The use of cremation makes it likely that this individual was still an important part of the community as considerable resources would be needed to perform

such as ceremony. In general, the cremation method and content findings are consistent with similar sites researched in Britain.

Analysis of the remains found evidence of trauma that was likely to have occurred close to the time of death. Although this could be related to the individuals death, or the funerary practices undertaken, there is insufficient evidence to prove this is the case.

The application of methods produced by Jaqueline McKinley allowed a rigorous examination of the find and a formal record to be produced. Further research into Otford, and other early Anglo-Saxon sites using the same methodology, will provide a deeper understanding of early Anglo-Saxon funerary traditions.

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