Osteological Assessment
Wasperton
Warwickshire

Site Code: WN81-84
NGR: SP 265 585

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Summary

York Osteoarchaeology Ltd was commissioned by Field Archaeology Specialists Ltd to carry out the osteological assessment of the entire skeletal assemblage from a cemetery at Wasperton, Warwickshire (NGR SP 265 585). The skeletal remains were excavated between 1980 and 1985 and included both cremation burials and inhumations.

The site's importance is based on it being one of the few cemeteries that have been in use from the late Roman to the middle Anglo-Saxon period. It is also completely excavated and therefore provides a good comparative sample.

Osteological assessment revealed that skeletal remains were recovered from 58 of the original 215 inhumation burials; the lack of bone from the majority of burials is probably the result of the very poor preservation of the skeletons. The bones are extremely eroded and fragmented and many skeletons are solely represented by teeth. The remains are still unwashed and disintegrate upon handling. Because of the poor condition of the assemblage, most of the osteological information has been lost. In light of this, it is proposed that a biocultural approach, using targeted isotope analysis and radiocarbon dating, together with analysis of the site archive, might lead to additional information on pathology, stature, skeletal position, diet, questions of migration, phasing and continuity.

Unlike the inhumed skeletons, 24 of the 26 original cremated bone assemblages have been recovered and are well preserved. The assemblages are generally substantial and contain large fragments of bone, suggesting that full analysis of these remains would be worthwhile and add considerable information to our current understanding of the site. Targeted radiocarbon dating could also be carried out and comparisons between rites of inhumation and cremation could be drawn.

Following the skeletal analysis, the final stage of the project constitutes the formation strategy for the disposal of the human remains, which could take the form of monitored long-term storage for further research, or permanent reburial.

Acknowledgements

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1.0 INTRODUCTION

In January 2005 York Osteoarchaeology Ltd was commissioned by Field Archaeology Specialists Ltd to carry out the osteological assessment of cremated and inhumed skeletal remains from a large Anglo-Saxon cemetery. The skeletal assemblage had been excavated between 1980 and 1985 in advance of gravel quarrying at Wasperton, Warwickshire (NGR SP 265 585).

Wasperton is one of the few Anglo-Saxon cemeteries that has been fully excavated. On the basis of the grave goods, it is thought that the excavated burials date from the early fourth to the seventh century (Wise 1991, 256), therefore making Wasperton one of the few cemeteries that spans the late Roman to middle Anglo-Saxon periods (*ibid*). Its importance is also based on it being one of the most westerly cemeteries to contain Anglo-Saxon grave goods.

A total of 215 inhumations and 26 cremation burials were originally excavated. The burials were archaeologically recorded *in situ*, but only a limited number of the skeletons could be recovered and are now curated in Warwickshire Museum. The variable recovery of bone was partly due to the poor condition of some of the bone on site, and also the result of the excavation circumstances, which did not permit careful removal and recovery of all the skeletons. For example, some of the skeletal remains were damaged during topsoil stripping of the site. As a result, only 60 inhumations contained any bone and 24 of the 26 cremation burials contained bone; all of these are currently stored at Warwickshire Museum.

Until January 2005, none of the human remains from the site had been processed. This meant that both the cremated bone and the inhumed skeletal remains were encased in soil and gravel. In January 2005, Warwick Field Services processed the cremated bone, which is now both washed and sorted. The inhumed remains have not received any post-excavation treatment so far.

The human remains from the site have not undergone any osteological analysis, although they have been examined as part of an assessment for a PhD thesis by Jonathan Scheschkewitz (2004). The presence of human remains was catalogued using the excavation records and any obviously identifiable bones, such as skulls and teeth. The gender of the individuals was determined using the grave goods and the age was indicated in those cases, where lack of long bone fusion or size of burial suggested that it was the burial of a child.

1.1 AIMS AND OBJECTIVES

Following over twenty years of storage, the skeletal remains from Wasperton were to be osteologically assessed in order to establish the research potential of the collection.

The aim of the skeletal assessment was to locate any human remains from Wasperton in Warwickshire Museum and to assess the entire assemblage. The assessment sought to determine the condition and completeness of the skeletal remains and the potential for full osteological analysis of the assemblage, including determination of sex, age, stature and recording any skeletal manifestations of disease and trauma. Additionally, it was aimed to determine the potential for isotope analysis and radiocarbon dating of the collection.

The assessment also provided the opportunity to evaluate the current state of storage of the collection and to make recommendations for the future.

1.2 METHODOLOGY

A site plan and skeleton catalogue were provided, but the site archive, including plans, sections, photographs or contextual information were not available to the osteologist at the time of assessment. No dating evidence or information on phasing was provided for the skeletal material.

Each box containing skeletal remains was investigated, thus assessing all the skeletal remains from the Wasperton cemetery that are curated at Warwickshire Museum. Any non-human remains were separated from the human bone.

The skeletal remains were visually examined, assessing the preservation and completeness, as well as the possibility of determining age, sex and stature and recording pathological lesions. The cremated bone was weighed and the size of the fragments and their condition was assessed. Measurements were not taken with the exception of the largest bone fragment from each cremated bone assemblage, which was used to estimate general bone fragmentation.

The data gathered during the assessment is presented in Appendix A. Unfortunately, it was not possible in all cases to obtain information on excavation area, cut, context or skeleton number from the boxes or bags. It is possible that analysis of the site plans and contextual information might lead to clarification of these numbers in the future.

Any human remains stored in boxes that were in a very poor condition were re-boxed during the assessment by the osteologist in new boxes provided by Warwickshire Museum. Additionally, the majority of bones were bagged and labelled during analysis, with the exception of the few assemblages, which were already bagged. Skulls had usually been placed in boxes without any padding and these were placed on several layers of acid-free tissue to prevent further deterioration of the remains. It is anticipated that re-boxing and bagging of the remains will prevent further damage to the bones.

2.0 OSTEOLOGICAL ASSESSMENT

2.1 QUANTIFICATION

A total of 60 inhumed bone assemblages could be identified during the assessment. This represents 28% of all inhumation burials originally excavated. The burial number of seven of the assemblages could not be identified (Appendix A, Table 1). However, it is possible that some of these represent bone from those burials that are thought to have been recovered from the site, but could not be located in the museum (such as Burial 215).

Of the 60 skeletal assemblages, two consisted entirely of animal bone (from Burial 39 and an assemblage lacking any burial number). The bone from Burial 39 had been recovered from an accessory vessel and probably represents unburnt animal offerings included with a cremation burial.

A total of 24 cremated bone assemblages were identified at Warwickshire Museum. Four of the assemblages were lacking any burial numbers (Appendix A, Table 2). All but one of the assemblages had been processed and sorted. The bone from Burial 4 was still contained within the soil matrix and parts of the urn and had been previously identified as a skull.

2.2 PRESERVATION

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human skeletal remains is assessed subjectively, depending upon the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using a grading system of five categories: very poor, poor, moderate, good and excellent. Excellent preservation implied no bone surface erosion and very few or no breaks, whereas very poor preservation indicated complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

None of the inhumed bone assemblages had been processed. This meant that they were still encased within the soil matrix and in fact, frequently the greater majority of material in the boxes represented soil and gravel, rather than bone. This was most notable in the case of the skulls, which were filled entirely with soil (Plate 1).

Plate 1 Skull of Burial 174 filled with soil

The fact that the majority of burials were not bagged, but were loosely contained in the boxes meant that the adhering soil and gravel had produced further post-depositional fragmentation and erosion of the already fragile bone. However, despite the fact that the skeleton boxes had been stored in a damp basement for a number of years, only one of the assemblages (Burial 41) was actually mouldy. The remaining assemblages were dry and stable.

Of the 58 human inhumed bone assemblages, the majority (78%) were in a very poor condition (Appendix A, Table 1). The bone was so severely eroded in these cases that little of the bone surface and cortex survived, making them largely unidentifiable. The bones were additionally fragmented into pieces which were usually no larger than 80mm, but often smaller than 5mm. The teeth were similarly affected, causing total destruction of the tooth roots and dentine and only leaving the enamel of the tooth crowns intact (Plate 2).

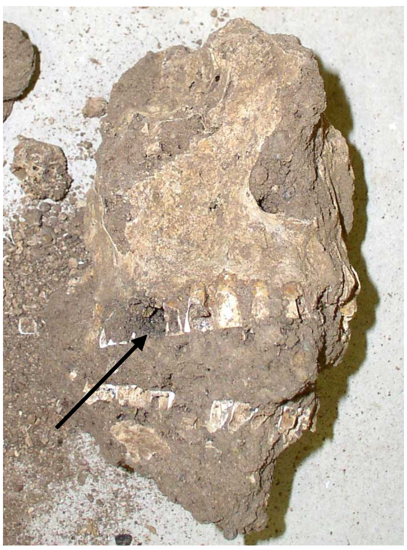

Plate 2 Skull with preserved and deteriorated teeth

Six of the burials (10%) were in a poor condition (Appendix A, Table 1), which meant that the bone surface survived to such an extent that at least some of the remains could be identified. However, the bone from these assemblages was also very fragmented and often lacked the bone surface or cortex.

A further six assemblages (10%) were moderately well preserved. These assemblages suffered from less surface erosion, but were fragmented (Plate 3). The bone from these assemblages was largely identifiable.

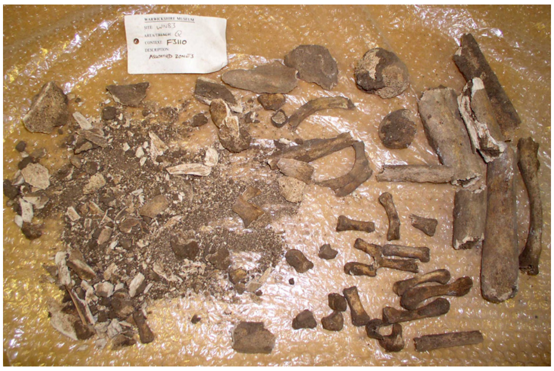

Plate 3 An entire moderately well-preserved assemblage (Burial 169)

Only one assemblage (2%) was in a good condition (Burial 153). This assemblage consisted entirely of teeth, which were almost intact.

None of the skeletons were complete. Only one skeleton (Burial 1) was more than 25% complete; approximately 35% of this skeleton had been recovered. The remaining skeletons were less than 25% complete and the majority were in fact represented by 10% or less of the original skeleton. This implies that even if the bone surface preservation had been better, the majority of anthropological information was simply lost as a result of the incomplete nature of the skeletons.

It was attempted to clean a moderately well preserved unburnt bone using a soft brush and cold water with the aim of establishing whether it would be possible to clean the inhumed bone assemblages. Sadly, the bone disintegrated rapidly, despite the fact that cleaning was carried out with great care and the bone was not immersed in the water. It is therefore unlikely that it would possible to wash any of the inhumed bones or teeth. Similarly, it was attempted to dry brush a tooth, but the slightest amount of pressure caused disintegration of the dental enamel.

It might be possible to 'chisel' some of the soil off the bones and then attempt to dry brush these. However, it is likely that the bone will also break up due to its fragile state (Plate 4). Consequently, no safe, feasible method of cleaning the bones could be determined.

Plate 4 Fragile state of skull from Burial 1

In contrast to the poor preservation of the inhumed skeletons, the cremated bone was largely well-preserved. One assemblage (Burial 4) had not been processed at the time of assessment and its state of preservation could therefore not be determined.

Of the 23 assemblages that could be assessed, 48% were in an excellent condition (Appendix A, Table 2). The bone showed no evidence of surface erosion and the fragment size was large. A further 30.5% of cremated bone assemblages were well-preserved, with little or no erosion and contained moderately-sized to large fragments. Seventeen percent of the assemblages were in a moderate condition, which was usually the case in those burials that contained a residue of <2mm sized bone fragments. Only one assemblage (4.5%) was in a poor condition; the bone from this burial (X2) was exclusively in the <2mm category.

All cremated bone was weighed with the aim of establishing the quantity of bone recovered. The weight varied considerably from 4.8g (Burial X2) to 879.7g, with an average weight of 268.9g. The amount of bone retrieved from the burials weighed considerably less than that produced by modern crematoria, which tends to range from 1000.5g to 2422.5g with an average of 1625.9g (McKinley 1993). Wahl (1982, 25) found that archaeologically recovered remains of cremated adults tend to weigh significantly less, as a result of the commonly practised custom of selecting only some of the cremated bone from the pyre for inclusion in the burial, thereby representing a symbolic, or token, interment. The weight of the assemblages from Wasperton corresponds well with that suggested by Wahl for archaeological cremation burials (*ibid*).

Compared with other archaeological cremated bone assemblages, the fragment size of the Wasperton burnt bones was relatively large. The apparently largest fragment from each burial was measured and this varied in size from <2mm to 72mm, with a mean of 38mm. This meant that many cremated bone fragments were clearly identifiable.

2.3 MINIMUM NUMBER OF INDIVIDUALS

A count of the 'minimum number of individuals' (MNI) recovered from a cemetery is carried out as standard procedure in osteological reports on inhumations in order to establish how many individuals are represented by the articulated and disarticulated unburnt human bones (without taking the archaeologically defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements recovered. The largest number of these is then taken as the MNI. The MNI is likely to be lower than the actual number of skeletons which would have been interred on the site, but represents the minimum number of individuals which can be scientifically proven to be present.

In this case, it would be impossible to establish the MNI through further analysis of the Wasperton assemblage, because the majority of long bone ends were either missing or were severely eroded, making it unfeasible to establish the side of the body they derived from.

2.4 ASSESSMENT OF AGE

It was attempted to determine age using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young to old middle adult (m; 26-45 years), mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen).

In this instance, it was possible to estimate the age of 44 inhumed individuals (76% of the assemblage). Age could not be estimated accurately in any of these cases and was solely based on tooth wear, rather than the more reliable pelvic ageing criteria, which had not survived in any of the skeletons. Of the 44 individuals whose age could be determined, seven individuals (16%) were young adults, thirteen (30%) were aged between 26 and 45, five (11%) were mature adults (Table 1) and eight (18%) were adults whose age could not be estimated with any greater accuracy. Eleven children were identified; these included nine (20.5%) adolescents, aged between thirteen and seventeen years and two (4.5%) juveniles, aged between one and twelve years.

Table 1 Summary of age and sex distribution of inhumed skeletons

Sex	Infant	Juvenile	Adolescent	Young Adult	Middle Adult	Mature Adult	Adult	Age Undetermined
Child	-	2	9	-	-	-	-	-
Undetermined	-	-	-	6	12	3	6	15
Female	-	-	-	1	1	-	-	-
Male	-	-	-	-	-	2	2	-
Total	0	2	9	7	13	5	8	15

The age distribution suggests that individuals of all ages were interred at Wasperton, with the exception of young infants. However, it is possible that taphonomic factors, rather than cultural motives were responsible for the lack of infant skeletons in this assemblage. The poor preservation may have also caused loss of further juvenile skeletons, explaining the relatively low number of children in the assemblage.

It is unlikely that further analysis would be able to enhance age determination of the inhumed remains significantly. Cleaning of the teeth or bones, with the aim of revealing ageing characteristics, would lead to the destruction of the skeletal material.

Age determination was not attempted in the cremated individuals, as each whole assemblage would have to be fully examined for this purpose and this would be too time-consuming for the assessment stage. However, the assessment of the cremated bone indicates that it would be possible to estimate age in the majority of cremated individuals.

2.5 SEX DETERMINATION

Sex determination is usually carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex in both males and females relies on the preservation of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood.

It was possible to estimate sex in six individuals (10% of the assemblage), based on the sexing characteristics of the skulls. Sex estimation was only certain in two of these cases, in the remaining four individuals it relied on eroded skulls, and was therefore only approximate. Two individuals were thought to be female, while a further four were male (Appendix A, Table 1). The number of individuals whose sex could be established was too small to draw any conclusions from the data.

It is improbable that cleaning and full analysis of the bones would lead to a greater number of individuals being sexed. However, during any further analysis comparisons could be carried out of sex, where it could be established, with gender (as defined by the grave goods).

Sex determination was not carried out in the cremated individuals, as each complete assemblage would have to be fully analysed to identify any sexing criteria. It is probable that sex could be established in some of these individuals during full analysis of the bones.

2.6 METRIC ANALYSIS AND NON-METRIC ANALYSIS

Stature depends on two main factors, heredity and environment. However, stature can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present.

In this instance, the lack of any complete long bones meant that it was not possible to estimate stature in any of the individuals (Plate 5). Full analysis of the assemblage would only permit extremely limited metric analysis, due to the poor preservation and severe fragmentation of the skeletal remains.

Plate 5 The largest surviving bone in the collection (Feature 606)

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978).

Non-metric traits were not observed in any of the individuals. It is possible that a small number of non-metric traits might be identified during any potential full analysis of the skeletons.

2.7 CONCLUSION

Osteological assessment of the skeletal remains from Wasperton established that the inhumed individuals recovered were poorly preserved, fragmented, dirty and incomplete. The assemblage included the remains of 44 individuals whose age could be estimated and six individuals whose sex could be determined.

The assessment suggests that individuals of both sexes and all ages were buried at Wasperton, with the exception of very young children. However, it is probable that post-depositional deterioration of the skeletons has led to the loss of some infant and juvenile skeletons.

It is unlikely that cleaning of the bones would improve the results gained from the assemblage during the assessment; on the contrary, it is probable that any attempts at cleaning would cause complete disintegration of the bones and teeth. It is therefore improbable that much more information could be gained from the inhumed skeletal remains themselves.

The cremated human bone, on the other hand, was largely very well preserved. The considerable bone weight and large fragment size of the cremated bone assemblages means that full analysis of these remains would advance the information we have on both osteology and cremation techniques considerably. This is especially important in the cremated bone assemblages, as limited information on gender and age can be gained from the grave goods and funerary urns.

3.0 PATHOLOGICAL AND DENTAL ANALYSIS

Pathological conditions (disease) can manifest themselves on the skeleton, especially when these are chronic conditions or the result of trauma to the bone. The majority of pathological lesions tend to manifest in the bone surface. Considering the poor preservation of the inhumed skeletal remains, with complete loss of the bone surface in the majority of individuals, it was not surprising to observe no skeletal pathology at all.

No pathological lesions were identified in the cremated individuals, as scanning the cremated assemblages for pathology would be very time-consuming. However, it is anticipated that it would be possible to identify some evidence for disease in these assemblages if they were fully analysed.

Analysis of the teeth from archaeological populations provides vital clues about health, diet and oral hygiene, as well as information about environmental and congenital conditions. In this case, two teeth with evidence for cavities were recorded. The poor preservation of the jaw bones and tooth roots meant that the majority of the information on dental pathology would have been lost.

Teeth tend to shatter during the cremation process and it is therefore not anticipated that full analysis of these assemblages would reveal any dental pathology.

4.0 ASSESSMENT

The assessment of the complete retained skeletal assemblage from Wasperton has provided significant information regarding the research potential and limitations of the human remains from this archaeologically important site.

4.1 THE INHUMATIONS

When the Wasperton cemetery was excavated in the early 1980s, it was found that topsoil stripping had worsened the condition of the already severely deteriorated inhumed skeletons. The teeth were in a slightly better condition, but only the tooth enamel remained in most cases, rendering the teeth fragile as well. As a result, bone or teeth was only recovered from 58 of the 215 inhumations.

The full assessment of the Wasperton skeletons has shown that the collection includes almost no well-preserved skeletons. This means that determination of age was largely based on criteria, which tend to be relatively unreliable, resulting in age estimates of 76% of the assemblage. Sex estimation was largely unfeasible and could only be undertaken in 10% of cases. It was not possible to carry out measurements of any of the bones, as the remains were too fragmented. As a result, stature could not be established in any of the individuals.

The loss of the surface of the majority of bones meant that no pathological lesions could be identified. Two cavities in the teeth of one of the skeletons could be identified due to the slightly better preservation of teeth compared with bones. However, it is likely that the majority of dental pathology was also lost to post-depositional factors, as these lesions would render the teeth more fragile.

Many of the skeletons were lifted together with the adhering soil, presumably to avoid further deterioration of the bone. Since the 1980s, none of the skeletal remains from Wasperton have been processed. Although the soil adhering to the bones has not worsened the bone condition over the past 20 years significantly, the soil has hardened to a degree that means it is unrealistic to attempt to remove it without completely destroying the remaining bone. It was attempted to test the fragility of the bone by washing one bone fragment carefully; this caused its disintegration. The surviving skulls are equally fragile: all the skulls are filled entirely with soil and disintegrated as soon as they were touched. The original deterioration of the bone has meant that the bone surface and much of the bone cortex are lost. The bone is also extremely fragmented and prone to further fragmentation.

In conclusion, it is unrealistic to attempt cleaning of the bone for the purpose of carrying out a full osteological analysis of the inhumed skeletons, as this would destroy the bone. Additionally, full analysis of the remains without cleaning the bone is unlikely to provide further information on the skeletons than the assessment has already gathered. It is therefore advised that no further osteological or palaeopathological information could be gained from the inhumed skeletons from Wasperton.

The greatest potential of further study of the inhumed skeletal remains from the site lies within comparisons of the site archives, artefacts and environmental information and the osteological data gathered during this assessment. It is believed that comparisons of this data by an osteologist could expand the information so far gained from the Wasperton inhumations.

4.2 THE CREMATION BURIALS

The cremation burials were assembled and processed by Warwickshire Field Services in January 2005. Consequently, the cremated bone was clean and sorted at the time of the assessment, with the exception of the bone from one burial (Burial 4). This meant that 23 of the assemblages could be assessed in detail, while the unprocessed assemblage was examined briefly.

Unexpectedly, it was found that the majority of cremated human remains (78%) were well-preserved. Although the condition and quantity of cremated bone varied considerably, none of the assemblages showed evidence for bone surface erosion and fragment size was generally large. This implies that the majority of bone fragments from the burials were identifiable.

Age, sex and pathological conditions were not determined in the cremation burials during the assessment stage, as this type of osteological analysis is time-consuming in cremated remains. However, the potential of gaining further data from the assemblages is significant, considering the relatively large size of the assemblages, as well as the large size of the bone fragments. If the cremated bone assemblages were fully analysed, it would be possible to determine age in the majority of burials and sex in some of these. Any pathological manifestations could be identified and recorded in view of the high quality of the assemblages.

Additional information could be gathered on the presence of double burials and cremation techniques, as well as methodologies applied for collecting bone from the pyre for burial. If the osteological data was coupled with that gained from the site archive and environmental and artefactual analysis, the potential for further research and interpretation of the cremation burials is significant.

4.3 DESTRUCTIVE ANALYSIS

The skeletal remains were assessed for their potential of further, destructive analysis, including radiocarbon dating and stable isotope analysis. Currently, samples from two burials (Burials 1 and 28) are being radiocarbon dated with the aim of establishing, whether dating of the skeletal remains is actually possible despite their poor preservation. The samples have not yet been processed.

The burials that are being tested for radiocarbon dating are in a poor and very poor condition. This implies that if the bone from both burials is datable, some of the other skeletons could also be radiocarbon dated. The assessment identified ten further burials, where radiocarbon dating should be possible (Appendix A, Table 1). Depending on the results of the current radiocarbon dating, more candidates for radiocarbon dating might be identified. Many of the other skeletal remains cannot be dated, simply because they only contain teeth and no bone. AMS dating of the cremation burials would be possible in all but one assemblage (Burial X2).

Stable isotopes can offer a valuable insight into those aspects of an individual's background, which cannot be examined using visual analysis of human remains. Carbon isotopes and nitrogen isotopes can provide evidence for diet, including marine, plant or meat-based food intake. Strontium and oxygen isotopes can contribute information on origin and migration.

Isotopes can be gained from the dental enamel (for childhood diet and place of origin) or from the bones (illustrating diet up to the age of around 25 years.). However, it has recently been found that origin is more difficult to determine using isotope analysis than previously thought and it is only when individuals originated from very different geological areas compared to where they were buried, that origin and possible migration can be suggested (Collins *pers. comm.*).

For bone isotope analysis, 300 to 500 milligrams of bone are required (Schutkowski *pers. comm.*). This suggests that the potential for isotope analysis in this assemblage is good, despite the poor preservation of the bones. Similarly, only a small amount of dental enamel is needed for dental isotope analysis, implying that the majority of burials could potentially undergo isotope analysis. A possible 51 inhumation burials have been identified for potential isotope analysis. Because the cremation burials are well-calcined, it would not be possible to carry out isotope analysis of any of these assemblages (*ibid*).

It would not possible to gain DNA from the skeletal remains from Wasperton, with the aim of establishing sex in those individuals whose sexing criteria are lost, as the remains are too poorly preserved.

Scheschkewitz (*pers. comm.*) suggested that tooth ageing could be carried out with the aim of estimating age in those individuals whose teeth are the only surviving part of the skeleton. Destructive dental ageing is established by thin-sectioning the teeth and microscopically analysing these. However, this is not possible to carry out when only the tooth enamel survives, as is the case at Wasperton. A new method is currently being developed at the University of York using amino acid racemization to determine age and this method only uses a tiny sample of dental enamel. Unfortunately, the method is still being tested and it is currently unclear whether it will be successful (Griffin *pers. comm.*).

4.4 FUTURE STORAGE OF THE ASSEMBLAGE

Following further analysis of the cremated bone collection from Wasperton and chemical analysis of the inhumed remains, a decision should be made regarding the future of the collection. Three options may be scientifically supported, including reburial, storage for research, or partial reburial with curation of the cremated remains for teaching or research purposes.

Reburial of the collection would have certain advantages, as it would be the least costly option, avoiding the provision of storage facilities and curation of the collection and would provide the remains with a final permanent resting place. However, considering that quarrying has destroyed the original cemetery site and that the individuals were largely pagan, an appropriate location for reburial should be sought carefully if this option should be decided upon.

Storage for future research would entail long-term curation of the collection in a location that is accessible to researchers. The material would require adequate packaging and boxing under accepted conditions and accessibility for research and education. Additionally, the single mouldy burial would require cleaning and drying out. Although costly, it would enable future researchers to use newly developed techniques of chemical skeletal analysis that are not currently available.

An alternative option may include the reburial of the inhumed skeletal remains and the retention of the cremated skeletal assemblages with the aim of using these for teaching or research purposes.

5.0 FUTURE RECOMMENDATIONS

The assessment of the full Wasperton skeletal collection has illustrated the inherent research potential of the cremated bones. Unfortunately, evaluation of the collection has also highlighted the problematic nature of further osteological analysis of the inhumed material.

Wasperton is an intrinsically important site on two counts; it is one of only a few cemeteries which span the Roman and Anglo-Saxon periods, and only rarely have Anglo-Saxon cemeteries undergone complete excavation. Although the analysis of the inhumed remains would yield little further information, the site archive offers a great potential for osteological data and research. It is therefore proposed that osteological research should focus on a comparative study of the site archive, (especially photographs and skeleton sheets), environmental and artefactual evidence and Scheschkewitz's thesis. Such an approach would maximise the potential for the interpretation of the cemetery.

The success of such analysis would depend on the quality of the site archive. However, if drawings of the skeletons, as well as good quality photographs and burial recording sheets were available, the information that could be gained may well be substantial. Recent work at the Anglian cemetery of West Heslerton, where skeletal preservation was also poor, has been able to establish a significant amount of the information discussed here through thorough examination of all the available contextual data (Haughton and Powesland, 1999).

Burial positioning might be established from plans, photographs and records, including whether the body was in a prone or supine position, extended, crouched or flexed. Burial positioning and grave good arrangements might provide indications of costume and therefore the possibility of gaining information on migration and ethnicity. Analysis of the grave catalogue together with the osteological information will permit comparisons of sex and gender, and of age and grave goods, providing a further insight into the society that used the Wasperton cemetery.

An approximate stature could be calculated using *in situ* skeleton length measurements and body mass might be estimated using grave width. Pathology can occasionally be identified from the position of the skeleton in the grave, including decapitation, paralysis or severe osteoarthritis. This would also rely on the existence of photographs of the skeletons *in situ*. The identification of pathology and trauma, such as decapitations, would not only aid in providing anthropological information, but would also increase the funerary and phasing information, including 'deviant' burial rites and possible further identification of burials likely to be of Roman origin.

Full analysis of the cremation burials, gathering osteological, palaeopathological, funerary and cremation technique information would permit comparisons of the inhumed and cremated bone data. Additionally, it might shed light on the reasons for practising different funerary rituals. Analysis of the artefactual information recovered from the cremation burials with the skeletal material might advance our current understanding of cremation funerary behaviour in the Anglo-Saxon period.

It is also recommended that targeted radiocarbon dating is carried out on the better preserved skeletal remains, which would aid the assigning of groups of burials to specific phases and could therefore substantiate continuity and use of the site. It is important that selection of burials for radiocarbon dating should be carried out by someone with a thorough knowledge of the cemetery and chronology of the Anglo-Saxon period, such as Scheschkewitz, so that the full potential of this avenue of scientific examination can be realised. It is hoped that this will aid in confirming the dates for the late Roman burials, therefore supporting the concept of continuity.

Analysis of the cemetery plans, Scheschkewitz's thesis, artefactual, environmental and osteological data together with targeted radiocarbon dating of the skeletons might also establish, whether the cemetery was developed in a polyfocal manner, as has been suggested for other Anglo-Saxon cemeteries. The distribution of early burials across the cemetery site with later infilling of the gaps might suggest the possibility of family or household plots, which were used over a period of time (Fern *pers. comm.*).

Stable isotope analysis could be carried out on the majority of the surviving inhumed skeletons. The reliability of isotope analysis regarding origin and migration is currently debatable, and it is therefore recommended that this form of isotope analysis is carried out with a degree of caution (Collins *pers. comm.)*. However, targeted isotope analysis with regards to origin might identify burials of individuals who have migrated from areas where the geology is sufficiently distinct to allow interpretations of migration and ethnicity.

Isotope analysis concerning diet could be successfully carried out on many of the inhumed skeletons. Evidence for differences in diet can aid in determining status, which would be particularly interesting when compared with the quality of grave goods and indication of status through their analysis.

The importance of the collection is based on its continuity from the late Roman to the middle Anglo-Saxon period. A biocultural approach, using the excavation records, analysis of artefactual and environmental evidence, and the anthropological data from the burials at Wasperton, as well as comparisons with contemporary sites would greatly enhance our understanding of the cemetery's continuity.

It is recommended that a strategy is developed regarding the disposal of the human remains, once the skeletal analysis is complete. It is possible that future generations will develop techniques, which will enable more information to be acquired from the inhumed skeletal remains. A good example of this is the recently developed method of age determination through amino acid racemization. It must therefore be decided whether the collection should be curated long-term for further research, or whether it should receive reburial.

6.0 RESOURCE REQUIREMENTS

The resource requirements depend very much on the future project research design. They are based on the assumptions that the site archive is of adequate quality to carry out comparative research of this, together with the osteological data so far gathered. The resource requirements, listed below represent estimates, based on the assumption that the site archive is complete and of good quality.

Table 2 Summary of estimated potential resource requirements depending on the project design

Task	**Requirements**	**Estimated Days**	**Estimated Cost**
Full osteological analysis and reporting of cremated human bone (24 burials)	Burial 4 requires processing	14 days	£1960.00
Analysis of Skeletal catalogue, osteological assessment, site archive, artefactual and environmental data with the aim of gaining a greater understanding of the inhumation burials	Provision of full site archive and any other information that has been gathered on the cemetery	5 days	£700.00
Comparisons of cremated bone data and inhumation data together with radiocarbon dating results	Radiocarbon dating of targeted burials and provision of phasing	1 day	£140.00
Radiocarbon dating	Positive results from the material currently being dated	Carried out by specialist laboratory	Usually ~ £300.00 per sample
Isotope analysis	-	Carried out by specialist laboratory	Usually ~ £30 per sample of carbon and nitrogen isotope analysis and at least £300.00 per sample for strontium and oxygen isotope analysis
Cost of travelling to Warwickshire, if any of the analysis was carried out at Warwick Museum	If the skeletal remains and site archives were not provided to the osteologist and remained in Warwick	Depends on number of visits to be made	£120.00 per trip for mileage

Cost of overnight stay in Warwickshire, if the remains had to be analysed there	Only if the skeletal remains and site archives would not be taken to the osteologist	Depends on project design	£50.00 expenses per night

The costs are calculated for the financial year of 2005 to 2006. If the full work was to take place after April 2006, the costs would have to be re-calculated.

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APPENDIX A: OSTEOLOGICAL AND PALAEOPATHOLOGICAL CATALOGUE

Table 1 Summary of assessment data of preserved inhumed remains

Burial	Area	Feature	Context	Condition	Bones Apparently Present	Bones Present	Complete	Age	Sex	Box	C14	I
1	-	56	-	Poor	Skeletal remains good with right radius and hand missing. Pelvis not fused	Left foot, left femur, parts of right femur, tibiae, pelvis, arms, most of skull	25-50%	YA	F?	1-2	X	X
3	B	61	1008	Very poor	Small fragment (?humerus)	1 long bone fragment	1-25%	-	-	25	-	X
6	-	237	1238	Very poor	Teeth	3 tooth crown fragments	1-25%	YA	U	25	-	X
8	L	240	1303	Very poor	Teeth	Tooth fragments	1-25%	AD	S	25	-	X
10	L	246	1328/4	Very poor	Teeth	3 tooth crowns	1-25%	J	S	25	-	X
16	-	344	1270	Very poor	None identified, although dark streaks were noticed in backfill. Possibly some fragments were recovered, uncertain if they are belonging to this context	Few eroded long bone fragments	1-25%	-	-	25	-	X
24	L	302	1230/2	Very poor	Preserved bones were recovered. Including 13 teeth, jaw (mandible) and other fragments	20 tooth crowns, 1 skull fragment, few eroded long bone fragments	1-25%	YA	U	25	-	X
26	L	308	1286	Very poor	Surviving bones recorded as left and right femur, and tibiae, humeri, left radius and ulna, traces of pelvis, lower vertebrae, skull	Eroded femoral, tibial and pelvis fragments	1-25%	-	-	24	-	X
27	-	309	1259	Very poor	Surviving bones recorded as stains, skull, fragments of left and right femora, fragments of	Left mastoid, right petrous temporal, 1 premolar, few eroded long bone fragments	1-25%	YA	U	25	X	X

					left tibia							
28	L	325	1294	Very poor	Bones surviving as a stain: skull, right humerus and tibia	Left temporal, small fibula and femur fragments, 1 molar crown	1-25%	M	U	4	-	X
33	L	340	1251	Very poor	Teeth not recovered	Several tooth crown fragments	1-25%	Ad	S	25	-	X
34	L	346	1265	Poor	Surviving bones include parts of skull, left humerus and radius, both femora and tibiae	Femoral tibial and humeral shaft fragments	1-25%	YA	U	5/25	X	X
35	L	347	1266	Very poor	Skull and two teeth were recovered	Few eroded skull fragments, several tooth crowns	1-25%	M	U	6/25	-	X
37	-	362	1269	Very poor	Very fragmented parts of right humerus, right femur and both tibiae	1 fragment of humeral shaft	1-25%	-	-	25	-	X
38	L	363	1271	Very poor	Skull, humeri, part of the pelvic area, femora and tibiae	Eroded fragments of skull and long bones	1-25%	A	U	8	-	X
39	-	365	1267/2	-	Skull and teeth fragments. Recovered bones probably out of fill of pot	ANIMAL	-1-25%	-	-	2	-	-
40	L	366	1305	Very poor	Skull and bone fragments	Eroded long bone shafts and tooth fragments	1-25%	M	U	23	-	X
41	L	368	1307	Very poor, mouldy	Skull, some vertebrae and ribs, part of sacrum, left and right clavicles, fragmented left scapula, left and right humeri, left radius and ulna, right radius, right and left femora, right and left tibiae	Eroded parts of the majority of skeleton, mostly unidentifiable	1-25%	-	-	9/25	-	X
42	-	373	1319	Very poor	Skull, right humerus and radius, part of the pelvic girdle, left and right femora	Skull, teeth, eroded long bone fragments	1-25%	M	U	10/25	-	X

					and tibiae, some foot bones							
43	L	377	1324	Very poor	Skull and teeth, part of pelvis, both femora and tibiae, fragments of right fibula. Only skull recovered	Eroded skull and tooth fragments	1-25%	-	-	11	-	X
44	L	378	1325	Very poor	Teeth, part of pelvis, both femora and tibiae	Eroded long bone shafts and fragments of femur	1-25%	A	U	25	-	X
46	L	382	1335	Poor	Teeth, mandible, cervical vertebrae, clavicles, left scapula, right and left humeri, fragments of right and left radii plus ulnae, some ribs, part of pelvis, right and left femora, fragments of right and left tibiae and fragment of right fibula	Mandible and teeth, long bone fragments, pelvis, ribs	1-25%	Ad	S	12/25	X	X
48	L	385	1344	Very poor	Skull	Eroded skull and teeth	1-25%	MA	U	11	-	X
54	L	413	1414/5	Very poor	Skull	Eroded skull, few long bone fragments, arms, tibia shaft	1-25%	A	U	13	X	X
55	L	419	1421	Very poor	Described bones were recovered	Skull, tooth crowns, eroded long bone fragments	1-25%	MA	U	14	-	X
70/71?	-	1036	2331	Very poor	Skull	Eroded skull	1-25%	A	M	15	-	X
85	Q	1524	3100	Very poor	One tooth	1 tiny tooth fragment	1-25%	-	-	26	-	-
87	Q	1529	3122	Very poor	Teeth	Tooth fragments	1-25%	Ad	S	26	-	X
104	-	1558	3214	Very poor	One tooth	1 tooth	1-25%	-	-	26	-	-
108	Q	1570	3228	Poor	Teeth	Tooth crowns	1-25%	Ad	S	26	-	X
115	Q	1582	3266	Very poor	Teeth.	2 tooth crowns	1-25%	M	U	26	-	X
119	Q	1598	3297	Very poor	Teeth	14 tooth crowns	1-25%	Ad	S	26	-	X
138	Q	3043	-	Moderate	Skeleton almost complete with	Foot and wrist bones, arms	1-25%	A	U	26	X	X

					good bone preservation. Teeth, arm and leg bones	and legs, parts of skull and teeth						
140	Q	3046	3371	Very poor	Teeth	1 tooth fragment	1-25%	-	-	26	-	-
143	Q	3054	3399/13	Very poor	Teeth	13 tooth crowns	1-25%	Ad	S	26	-	X
153	Q	3080	3472	Good	Teeth	20 teeth	1-25%	Ad	S	26	-	X
155	Q	3085	-	Very poor	Teeth	9 tooth crowns	1-25%	M	U	26	-	X
161	Q	3098	3542/3	Very poor	Teeth	10 tooth crowns	1-25%	YA	U	26	-	X
166	-	3106	3615	Moderate	Skull	Skull	1-25%	MA	M	18	-	X
167	Q	3107	-	Very poor	Teeth	11 teeth	1-25%	M	U	26	-	X
169	Q	3110	-	Moderate	Skeletal condition good including crushed and decayed bones	Both femora, whole left hand, ribs, left clavicle	1-25%	A	U	26	X	X
173	Q	3120	-	Moderate	Skull	Skull, teeth	1-25%	M	F	19/26	X	X
174	-	3122	3683	Moderate	Skull and teeth	Skull and teeth	1-25%	MA	M	20/26	X	X
180	Q	3142	3795	Very poor	Skull. Full set of milk teeth, second teeth forming within jaw	Mandible, teeth	1-25%	J	S	26	-	X
190	-	3159	-	Very poor	Skull and teeth	Eroded skull and tooth fragments	1-25%	MA	U	21	-	X
191	Q	3161	3965	Poor	Teeth	Teeth	1-25%	M	U	26	-	X
193	Q	3163	3970/1	Very poor	Skull	Eroded skull and teeth	1-25%	A	M?	22	-	X
194	Q	3166	3877	Very poor	Teeth	21 teeth	1-25%	M	U	26	-	X
195	Q	3171	8148	Very poor	Teeth	2 tooth crowns	1-25%	YA	U	26	-	X
199	AE	4204	-	Very poor	Teeth	Tiny tooth fragments	1-25%	Ad	S	26	-	-
200	-	4205	-	Very poor	Teeth	Tooth fragment	1-25%	-	-	25	-	-
205	AE	4205	-	Very poor	None identified	4 tooth fragments	1-25%	M	U	26	-	X
216	U	1351	5297	Very poor	-	Tiny tooth fragments	1-25%	-	-	26	-	-
-	J3	549	1649	Very poor	-	Eroded long bone fragments	1-25%	-	-	25	-	X
-	J3	606	1610	Poor	-	Eroded parts of femur, pelvis and skull, humerus, left femur	1-25%	A	U	16/17	-	X
-	-	6561	-	Very poor	-	Tiny tooth	1-25%	-	-	26	-	-

						fragments						
-	-	-	1259	Very poor	-	1 tooth crown	1-25%	-	-	25	-	-
-	L	-	1286	Very poor	-	Eroded skull and teeth	1-25%	M	U	7	-	X
-	J	-	Salvage strip	Moderate	-	Skull and fibula fragments, 3 tooth crowns	1-25%	M	U	25	X	X
-	-	-	-	Very poor	-	ANIMAL	-	-	-	25	-	-

Key:
Age: A – adult; YA – young adult; M – middle adult; MA – mature adult; Ad – adolescent; J – Juvenile
Sex: M – male; F – female; U – undetermined sex; S – subadult
I – Isotope analysis
C14 and Isotope analysis: X – analysis should be possible

Table 2 Summary of assessment data on preserved cremated remains

Burial No.	**Area**	**Feature**	**Context**	**Condition**	**Weight**	**Largest Fragment Size**
1A	L	51	1000/2	Good	378.8g	42mm
1B	L	51	1000/3	Excellent	640g	72mm
2	-	-	-	No bone recovered	-	-
3	-	76	3209	Excellent	12.2g	35mm
4	-	80	-	NOT YET PROCESSED	?	?
5	L	267	1308	Good	468.3g	49mm
6	L	371	1311	Good	63.2g	21mm
7	-	-	-	No bone recovered	-	-
8A	Q	1500	3000	Excellent	134.4g	29mm
8B	Q	1500	3000	Good	501.8	43mm
9	-	1501	3005	Excellent	252.3g	45mm
10	Q	1502	3004	Moderate	332.2	54mm
11A	Q	1503	3006	Moderate	4.4g	27mm
11B	Q	1503	3007	Excellent	266.5g	63mm
12	-	1504	3008	Moderate	27.7	25mm
13	Q	1505	3011	Moderate	63.7g	28mm
14	Q	1506	3013	Excellent	592.8	42mm
15	Q	1565	3223	Excellent	879.7	37mm
16	-	-	-	No bone recovered	-	-
17A	Q	1567	3225	Excellent	292.5g	47mm
17B	Q	1567	3254	Moderate	2g	22mm
18	-	1594	3290	Good	36.4g	27mm
19	Q	1599	3298	Excellent	566.5g	63mm
20	-	3006	3308	Moderate	228.2	24mm
21	-	-	-	No bone recovered	-	-

22	Q	3021	3336	Good	228.9g	37mm
23	-	-	-	No bone recovered	-	-
24	AA	3180	8190	Good	14.3g	24mm
25	-	-	-	No bone recovered	-	-
26	Q	1589	3279	Excellent	104.3g	54mm
X1	Q	1552	3198	Excellent	8.6g	35mm
X2	L	-	1307	Poor	4.8g	<2mm
X3	-	-	-	Good	69.1g	35mm
-	-	342	1260	Good	11.4g	48mm