Osteological Analysis

Alveston Manor Hotel

Stratford-upon-Avon

Site Code: SAM02
NGR: SP 2087 5473

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Prepared for

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Summary

York Osteoarchaeology Ltd was commissioned by Warwickshire Museum Field Services to carry out the osteological analysis of two partial skeletons, two disarticulated bone assemblages and two assemblages of cremated bone. The skeletal remains were recovered during an archaeological evaluation in 2002 at Alveston Manor Hotel, Stratford-upon-Avon (NGR SP 2087 5473) in advance of the construction of a new health club. The skeletons and cremated remains are thought to date to the Anglo-Saxon period.

The excavated area was located immediately to the south-west of two previously excavated areas that contained a densely packed Anglo-Saxon inhumation and cremation cemetery. The evidence suggested that burial was much less dense in the recently excavated part of the site. Four burials were recovered, including a mature adult male interred with weapons, who was of slightly shorter stature than the average Anglo-Saxon man. He had suffered from an unusual painless cyst in the skull, minor muscular trauma and a dental cavity. A second skeleton was very badly preserved. Only the lower limbs of this adult were recovered. The grave goods suggested that the skeleton's gender was female.

Two cremation burials contained very small quantities of human bone of adults. The bone from both burials was much better preserved than that of the inhumations. It had been burnt at a high temperature and was well-calcined.

Acknowledgements

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1.0 INTRODUCTION

In February 2007 York Osteoarchaeology Ltd was commissioned by Warwickshire Museum Field Services to carry out the osteological analysis of two incomplete skeletons, two disarticulated and two cremated bone assemblages from Alveston Manor Hotel, Stratford-upon-Avon (NGR SP 2087 5473). The remains were recovered in 2002 during an archaeological evaluation prior to the construction of a new health club.

The burials derived from an area immediately to the south-west of an Anglo-Saxon cremation and inhumation cemetery excavated in 1934 and 1971. The burials from the previous phases of excavation contained mostly children and young adults and were poorly preserved (Stirland forthcoming).

The two inhumation burials (Skeletons 425 and 198) from the 2002 excavations were also thought to date to the Anglo-Saxon period. Both burials contained grave goods dating from the period. The date of the cremation burials was less certain, but they are also thought to date to the Anglo-Saxon period (Table 1).

Table 1 Summary of excavation areas and skeletal remains recovered

Skeleton No	Type	Position	Orientation	Grave Goods
116	Cremation burial	In pit	-	-
146	Cremation burial	Urned in pit	-	Urn
198	Inhumation	supine extended	SW-NE	Penannular brooch, a glass bead, knife
425	Inhumation	supine extended	SE-NW	Shield boss, 2 knives, spear heads, buckle

Following initial assessment of the bones, the two disarticulated assemblages (114 and 169) were excluded from further analysis, as these contained fragments of animal bone. The cremated contexts both contained recognisable fragments of human bone.

1.1 AIMS AND OBJECTIVES

The aim of the skeletal analysis was to determine the age, sex and stature of the skeletons, as well as to record and diagnose any skeletal manifestations of disease and trauma.

Initially, the assessment of the cremated bone aimed to identify whether all cremated bone recovered from the site was human. Examination of the cremated human bone aimed to determine age and sex, as well as identify any manifestations of disease from which the individuals may have suffered. Additionally, information was sought regarding the cremation techniques.

1.2 METHODOLOGY

The skeletons were analysed in detail, assessing the preservation and completeness, calculating the minimum number of individuals present as well as determining the age, sex and stature of the individuals (Appendix A). All pathological lesions were recorded and described.

The cremated bone was first analysed to determine whether it was human or non-human. The human bone was subsequently sieved through a stack of sieves, with 10mm, 5mm and 2mm mesh sizes. The bone recovered from each sieve was weighed and sorted into identifiable and non-identifiable bone. The identifiable bone was divided into five categories: skull, axial (excluding the skull), upper limb, lower limb and long bone (unidentifiable as to the limb). All identifiable groups of bone were weighed and described in detail.

2.0 OSTEOLOGICAL ANALYSIS

Osteological analysis is concerned with the determination of the identity of a skeleton, by estimating its age, sex and stature. Robusticity and non-metric traits can provide further information on the appearance and familial affinities of the individual studied. This information is essential in order to determine the prevalence of disease types and age-related changes. It is crucial for identifying gender dimorphism in occupation, lifestyle and diet, as well as the role of different age groups in society.

2.1 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.

The surface preservation of the inhumed skeletons was poor, with considerable erosion on some parts. The bones were also fragmentary, especially in the case of Skeleton 198 (Table 2), making identification of the bone elements more difficult.

Table 2 Summary of osteological and palaeopathological results

Skeleton No	Preservation	Completeness	Age	Sex	Stature	Dental Pathology	Pathology
198	Very poor	5%	Adult	-	-	-	-
425	Poor	55%	Mature adult	Male	169.7	Caries, severe dental wear	Cist, bone excavation

Skeleton 198 was only 5% complete, whereas Skeleton 425 was 55% complete (see Table 2).

Both cremated bone assemblages were well-preserved (Table 3), although warping and cracking of bone fragments, particularly the larger ones, was evident.

Table 3 Summary of cremated bone assemblage

Burial No	Feature Type	Period	Bone Colour	Preservation	Species	Weight (g)
116	Pit	Anglo-Saxon	white	Good	Probable human	6.8g
146	Pit	Anglo-Saxon	white	Moderate	Human	28.3g

The fragment size of cremated bone is frequently attributed to post-cremation processes. This is because skeletal elements retrieved from modern crematoria tend to be comparatively large before being ground down for scattering or deposition in the urn. Bone is also prone to fragmentation if it is moved while still hot (McKinley 1994). However, it is believed that post-depositional, rather than post-burning disturbance of the bone caused the fragmentation and erosion of the human remains from this site.

Both cremation burials contained fragments over 10mm in size, particularly Burial 116, where 94% of the fragments were larger than 10mm (Table 4).

Table 4 Summary of cremated bone fragment size

Context	10mm		5mm		2mm		Residue	Weight	Max. Fragment Size
	(g)	(%)	(g)	(%)	(g)	(%)	(g)	(g)	(mm)
116	6.4	94	0.4	6	-	-	-	6.8	20.7
146	14.4	51	10.6	37	3.3	12	-	28.3	26.3

The quantity of cremated bone recovered per burial ranged from 6.8g (Burial 1223) to 28.3g, with a mean weight of 17.6g. The amount of bone retrieved weighed considerably less than that produced by modern crematoria, which tends to range from 1000.5g to 2522.5g with an average of 1625.9g (McKinley 1993). Wahl (1982) found that archaeologically recovered remains of cremated adults tend to weigh less (between 250g and 2500g), 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 burials produced only 1.1% of the quantity of bone expected to remain following burning.

The cremated bone was generally very well burnt, causing the complete loss of the organic portion of the bone and producing a buff to white colour in both burials. According to McKinley (1989), the body requires a minimum temperature of 500° Celsius over seven to eight hours to achieve complete calcination of the bone.

Due to the presence of relatively large fragments, it was possible to identify skeletal elements in both burials. The proportion of bone that could be identified ranged between 61% and 100% (Table 5). The majority of identifiable bones were unspecified shaft fragments from the limbs. One skull fragment was recovered from Burial 146; it was part of the upper jaw with surviving tooth root sockets.

Table 5 Summary of identifiable elements in the cremation burials

Context	Skull		Axial		Upper Limb		Lower Limb		UID Long Bone		Total ID		Total UID	
	(g)	(%)	(g)	(%)	(g)	(%)	(g)	(%)	(g)	(%)	(g)	(%)	(g)	(%)
116	-	-	-	-	-	-	-	-	6.8	100	6.8	100	-	-
146	0.4	2.5	0.4	2.5	0.2	0.5	-	-	16.3	94.5	17.3	61	11.0	39

2.2 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 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.

A minimum of two individuals overall were present in the Alveston inhumation burials, the same as the number of individuals identified archaeologically.

It is not possible to calculate the MNI for the cremation burials, because only a token selection of bone from the pyre tends to be buried. Double burials can be identified only if skeletal elements are duplicated, or if skeletons of different ages are represented in the burial. In this instance, no double burials were identified.

2.3 ASSESSMENT OF AGE

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000a). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual. 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 middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years, mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen). The categories defined here should perhaps be taken as a general guide to the relative physiological age of the adult, rather than being an accurate portrayal of the real chronological age; no doubt many of those aged '46+' would in actuality have been in their sixties, seventies or eighties when they died.

It was not possible to determine age in Skeleton 198, because of the fragmentary nature of the bones and the lack of ageing characteristics. However, it was possible to suggest that this individual was an adult from the size of the bones.

The age of Skeleton 425 was ambiguous, as the teeth were severely worn, suggesting that this individual was a mature adult. The surviving fragments of the pubic symphysis, the anterior part of the hip used for ageing, on the other hand, suggested that this individual was between 19 and 34 years old. Although normally teeth are not as accurate age indicators as the pubic symphysis, their severe wear in this case coupled with the fragmentary

nature of the pubic symphysis meant that more emphasis was placed on the teeth as identifiers and it is assumed that this individual was a mature adult, aged 46 years or older.

Because none of the criteria normally used for age determination were represented in the cremation burials, age determination was based on less reliable criteria. The general size and robusticity of the bones suggested that the individuals were adults or adolescents.

2.4 SEX DETERMINATION

Sex determination was 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.

The skull and pelvis of Skeleton 425 indicated that this individual was a male. It was not possible to determine sex in Skeleton 198.

Neither of the cremated bone assemblages contained skeletal elements that were sexually dimorphic.

2.5 METRIC ANALYSIS

Stature depends on two main factors, heredity and environment; it 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, but preferably using the combined femur and tibia. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature (Trotter 1970). Leg measurements were obtained from the femora and tibiae and used to calculate robusticity (*meric* and *cnemic* indices). Standard measurements of the cranium and mandible were taken where preservation allowed.

Stature could be calculated for Skeleton 425 (see Table 2) and was 169.7cm. The Anglo-Saxon mean stature calculated by Caffell (1997) for males (172.3cm) is slightly taller that that of Skeleton 425.

The *meric* index is a method of calculating the shape and robusticity of the femoral shaft. The femora fell into the *platymeric* range (broad and flat). The *cnemic* index of the left tibia (the right bone was incomplete) was calculated in order to establish the degree of tibial shaft flatness. The tibia was *eurycnemic* (not flattened).

The single surviving skull of Skeleton 425 was too fragmented for measurements to be taken.

Cremated bone shrinks at an inconsistent rate (up to 15%) during the cremation process and it was therefore not possible to measure any of the bones from these burials.

2.6 NON-METRIC TRAITS

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). A total of thirty cranial (skull) and thirty post-cranial (bones of the body and limbs) non-metric traits were selected from the osteological literature (Buikstra and Ubelaker 1994; Finnegan 1978; Berry and Berry 1967) and recorded.

Cranial non-metric traits were not observed; probably because the skull was incomplete, fragmentary and very eroded.

In the post-cranial skeleton *medial tibial squatting facets* were noted. These extensions to the joint surfaces of the ankle are often more prevalent in populations where squatting is common. Several traits likely to be associated with pronounced muscle development, such as *third trochanters* (additional nodules of bone at the top of the femur shaft), and *exostosis of the trochanteric fossae* (small spicules of bone at the top of the femur shaft). An *Allen's fossa* (a small 'honeycombed' area of bone on the neck of the femur) was also noted.

Non-metric traits were not identified in the cremated individuals.

2.7 CONCLUSION

Osteological investigation has shown that unlike the previous excavations at the site, where mostly children or young adults were found, all four burials contained the remains of adults. Skeleton 425 was the only skeleton complete enough to determine sex, which was male. His stature could be assessed and was slightly shorter than the Anglo-Saxon average. The presence of squatting facets on his ankles could suggest participation in a task that involved frequent squatting.

The cremation burials only contained a tiny proportion of what is normally expected to remain following burning. The bone had been well-calcined, suggesting sufficient temperature and length of cremation process for the organic portion of the bone to be lost.

3.0 PATHOLOGICAL 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 bone elements to which muscles attach can also provide information on muscle trauma and excessive use of muscles. All bones were examined macroscopically for evidence of pathological changes.

3.1 CONGENITAL CONDITIONS

Heredity and environment can influence the embryological development of an individual, leading to the formation of a congenital defect or anomaly (Barnes 1994). The most severe defects are often lethal, and if the

baby is not miscarried or stillborn, it will usually die shortly after birth. Such severe defects are rarely seen in archaeological populations, but the less severe anomalies often are, and in many of these cases the individual affected will have been unaware of their condition. Moreover, the frequency with which these minor anomalies occur may provide information on the occurrence of the more severe defects in the population involved (Barnes 1994).

Skeleton 425 showed evidence for a dermoid cyst in the right temporal bone, just posterior to the ear. The lesion was circular, with smooth walls and 7mm in diameter. The cyst did not penetrate the skull bone, but this area was very eroded post-mortem and it was thus difficult to determine the extent of the lesion accurately. Dermoid cysts form within the diploe (bone) of the skull and result when surface ectodermal cysts become trapped during foetal development (Barnes 1994, 56). The cysts contain dermoid tissue, such as hair, hair follicles or gland tissue. Hair does not tend to grow over these, but they do not cause pain (*ibid*).

3.2 TRAUMA

Bone is a dynamic material which can change its morphology, size and robustness in response to prolonged activity (Knüsel 2000, 383). As a result, greater activity and mechanical stress causes the bone to become shapelier, with ridges and depressions caused by muscle action. Constant stress can cause *enthesopathies* (bony processes) or cortical bone defects at the site of muscle or ligament attachments when they lose the capacity to properly absorb the stress imposed (Hawkey and Merbs 1995, 329). *Enthesopathies* are frequently caused by constant microtrauma, but may also be the result of inflammatory disease, endocrine or degenerative diseases as well as severe sudden trauma (Resnick and Niwayama 1983).

Muscle trauma was noted in Skeleton 425 and was concentrated on the lower limbs. Cortical bone defects were noted at the attachment for *semitendinosous*, a muscle those muscles that flexes and medially rotates knee, extends thigh at hip joint and at the attachment of *soleus*, a muscle that moves the tip of the foot to downwards.

3.7 CONCLUSION

Little pathology could be observed in this cemetery assemblage, possibly because the bones were so fragmented and eroded. The mature male, Skeleton 425, showed evidence for muscular trauma and an unusual cyst in the skull.

4.0 DENTAL HEALTH

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.

Only two teeth (molars) of the usual 32 were found with Skeleton 425 and no teeth were recovered from the other burials. The jaw bone had not survived in the case of Skeleton 425, so it was not possible to determine, whether the remaining teeth had been lost ante- or post-mortem.

Dental wear tends to be more common and severe in archaeological populations than in modern societies, and is

caused by a much coarser diet. The wear of the teeth was severe, suggesting that this individual was mature (Appendix A).

Dental caries (tooth decay) forms when bacteria in the plaque metabolise sugars in the diet and produce acid, which then causes the loss of minerals from the teeth and eventually leads to the formation of a cavity (Zero 1999). Simple sugars can be found naturally in fruits, vegetables, dried fruits and honey, as well as processed, refined sugar; since the latter three contain the most sucrose they are most cariogenic. Complex sugars are usually less cariogenic and are found in carbohydrates, such as cereals. However, processing carbohydrates, including grinding grains into fine powders or cooking them, will usually increase their cariogenicity. One of the teeth showed a moderate sized cavity.

5.0 FUNERARY PRACTICE

The burials recovered during the 2002 excavation at Alveston Manor Hotel were the south-western part of a cemetery that was partly excavated in 1934 and 1971. According to the grave goods, the cemetery dated to the Anglo-Saxon period and was a mixed cremation burial and inhumation cemetery. The recently excavated burials are similar to those previously excavated in burial orientation, which was generally north-east to south-west. The skeletal position of the female in the grave could not be ascertained at the time of excavation. The male skeleton lay in a supine extended position.

Both inhumation burials contained grave goods. The male was interred with a shield boss, spearheads, two knives and a buckle, while the other adult was buried with a single bead, a knife and a brooch, suggesting that this individual's gender was female.

One of the cremation burials was interred in an urn, while the other was buried in a pit. The urn was fragmentary and incomplete and it's shape could not be reconstructed. Charcoal had not been included in either of the burials, nor were grave goods recovered.

6.0 DISCUSSION AND SUMMARY

The skeletal assemblage from Alveston Manor Hotel was generally in a poor condition, with much surface erosion and severe fragmentation of the inhumed bones. The cremated skeletons were much better preserved and large fragments survived.

The group consisted of adults, unlike the previously excavated skeletons, which mostly consisted of young children, adolescents and young adults (Stirland, forthcoming). Age could only be accurately determined in one skeleton, a mature male. This individual was interred with weapons. He had suffered from a painless cyst behind his right ear, muscular trauma and a dental cavity. His stature was slightly shorter than the Anglo-Saxon male average. The second inhumation burial was incomplete and very poorly preserved. This was an adult, and according to the grave goods, the gender was female.

The two cremation burials also contained adults of undetermined sex. One of the assemblages was interred in

an urn. Both burials were probably disturbed, as they only contained small, though well-preserved quantities of cremated bone that was well-calcined.

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APPENDICES

Individuals Catalogue of Inhumations

Skeleton Number	**198**
Preservation	Very poor
Completeness	5%, parts of legs
Age	Adult
Sex	-
Stature	-
Non-Metric Traits	-
Pathology	-
Dental Health	No teeth

Skeleton Number	**425**
Preservation	Poor
Completeness	55%, most of lower skeleton and arms, parts of skull
Age	46+ ,Mature adult
Sex	Male
Stature	169.7cm
Non-Metric Traits	Allen's fossa (right), exostosis in trochlea fossa (bilateral), third trochanter (bilateral), medial tibial squatting facet (bilateral)
Pathology	Dermoid cyst, bone excavations for soleus and semitendinosous
Dental Health	2 teeth, caries 1/2

	Right Dentition								Left Dentition							
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P	P
Calculus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Ld
Wear	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	7

KEY:
Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; p (u) – tooth present but unerupted - - jaw not present
Caries - Calculus; F - flecks of calculus; S - slight calculus; M - moderate calculus; H - heavy calculus; a - all surfaces; b - buccal surface; d - distal surface; m - mesial surface; l - lingual surface; o - occlusal surface
DEH - dental enamel *hypoplasia*; l - lines; g - grooves; p - pits
Caries - caries; s - small lesions; m - moderate lesions; l - large lesions
Wear - dental wear; numbers from 1-8 - slight to severe wear