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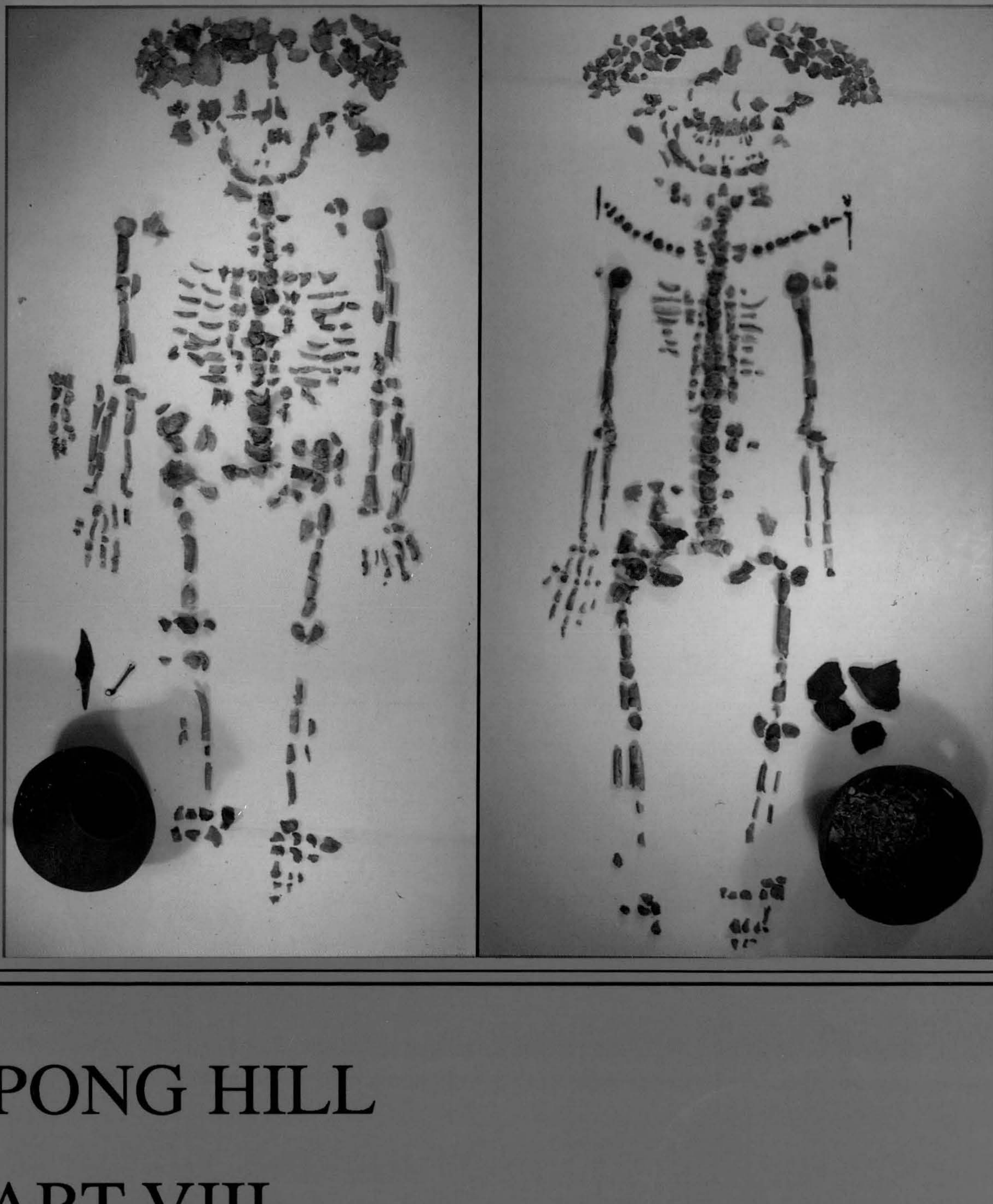

SPONG HILL
PART VIII
THE CREMATIONS

East Anglian Archaeology

Field Archaeology Division, Norfolk Museums Service 1994

EAST ANGLIAN ARCHAEOLOGY

The Anglo-Saxon Cemetery at Spong Hill, North Elmham Part VIII: The Cremations

by
Jacqueline I. McKinley

with contributions from
Julie M. Bond,
Neil Garland and Peter Murphy

illustrations by
Robert Rickett,
Jacqueline I. McKinley and reconstruction by
Kenneth Penn

and photographs by
David Wicks,
Robert Rickett and Neil Garland

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Cover photograph:
Cremations no.1665 (younger mature adult female) and no.1647 (younger
mature adult male), laid out anatomically, with their grave-goods and urns.
Photo: David Wicks

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Distribution of thanks is wide, but the first must be made to Dr Keith Manchester, without whose encouragement the writer would never have started this project. Invaluable help has been given over the years by the other members of the Spong Hill project, the project director Dr Catherine Hills, Kenneth Penn and most especially by Robert Rickett, who has patiently answered a torrent of queries with respect to the site.

Philip Williams set up the computer programme by which the mass of data has been recorded. Linda Williams set up the database programmes for the tabulation of results and she, together with Joan Daniells, was responsible for keying-in most of the data. Thanks are due to all three for their assistance with the computing, and also to Susan Robinson for her advice.

The figures are mostly by Robert Rickett (Figs 1–7, 12, 15, 20–28), and the writer (Figs 8–11, 13, 14, and 16–18). The reconstruction was drawn by Kenneth Penn (Fig. 19). The photographs are all by David Wicks except for Plate XVI by Robert Rickett and Plate XXXIII by Neil Garland.

I am grateful to Julie Bond for taking on the awesome task of identifying the cremated animal bone. Thanks are extended to other specialists who have contributed to the report: Peter Murphy for the botanical evidence and Michael Heyworth and Ann MacSween, both of whom ran X-ray fluorescence tests on some of the material. Michael Heyworth, Gerry McDonnell and Catherine Mortimer all advised on various points connected with the glass and metal-work. Michael Heyworth, Gerry McDonnell and Mark Pollard all assisted on points of bone mineralogy, and the chemical and structural changes to cremated bone. Tony and Margaret Mathews, Simon Mayes and David Wilson provided translations of some of the German papers cited for which the writer extends appreciation.

Numerous colleagues in the sphere of palaeopathology have been kind enough to share with me the benefit of their knowledge and experience. Especial thanks are due to Janet Henderson, Keith Manchester, Ann Stirland and Charlotte Roberts for their help and advice. I am particularly grateful to Neil Garland, who was good enough to undertake the histological analysis of some of the bone.

Several crematoria have kindly allowed access in order to observe the processes of modern cremation. The writer is indebted to the people involved at all levels for their interest and assistance. Thanks also to J.G. Shelton and Co. Ltd for information regarding their Cremators.

The writer is obliged to colleagues who allowed access to as yet unpublished data, which contributed towards this volume: Frieda Berisford, Margaret Cox, Barbara Green, Gerry McDonnell, Keith Manchester, Mark Pollard, Andrew Rogerson, Leonard Wilkinson and David Whittaker.

Comments and advice on sections of the text have been received from colleagues, to whom the writer is most grateful for their time, expertise and patience: Julie Gardiner, Michael Heaton, Catherine Hills, Mark Pollard, Keith Manchester, Gerry McDonnell, Kenneth Penn, Robert Rickett and Ann Stirland.

All of the material has been placed on loan to the Norfolk Museums Service, and is stored at the Field Archaeology Division offices at Gressenhall, Norfolk. Records, including the exhaustive details of cremation identifications for the volume, are stored at Gressenhall. The archive details of cremation identification are available on computer disc.

Summary

This volume is the eighth in the series relating to the multi-period site of Spong Hill, North Elmham, Norfolk (Site 1012 ELN). It deals specifically with the cremated remains, both human and animal, from urns in the Anglo-Saxon cemetery. In addition to the 2,334 numbered cremations recovered during the main excavations in the years 1972 to 1981, a further fifty numbered cremations, from excavations undertaken in 1954 and 1968, have also been included.

Discussion of methods of identification is followed by tables of basic results on number of individuals, age, sex and pathology, together with animal species represented and grave-good types where appropriate. Subsequent chapters deal with the process of cremation and what may be discovered about Anglo-Saxon cremation ritual and technology, using knowledge of modern cremations and ethnographic/anthropological records.

The final draft of the text was submitted by the writer in June 1991.

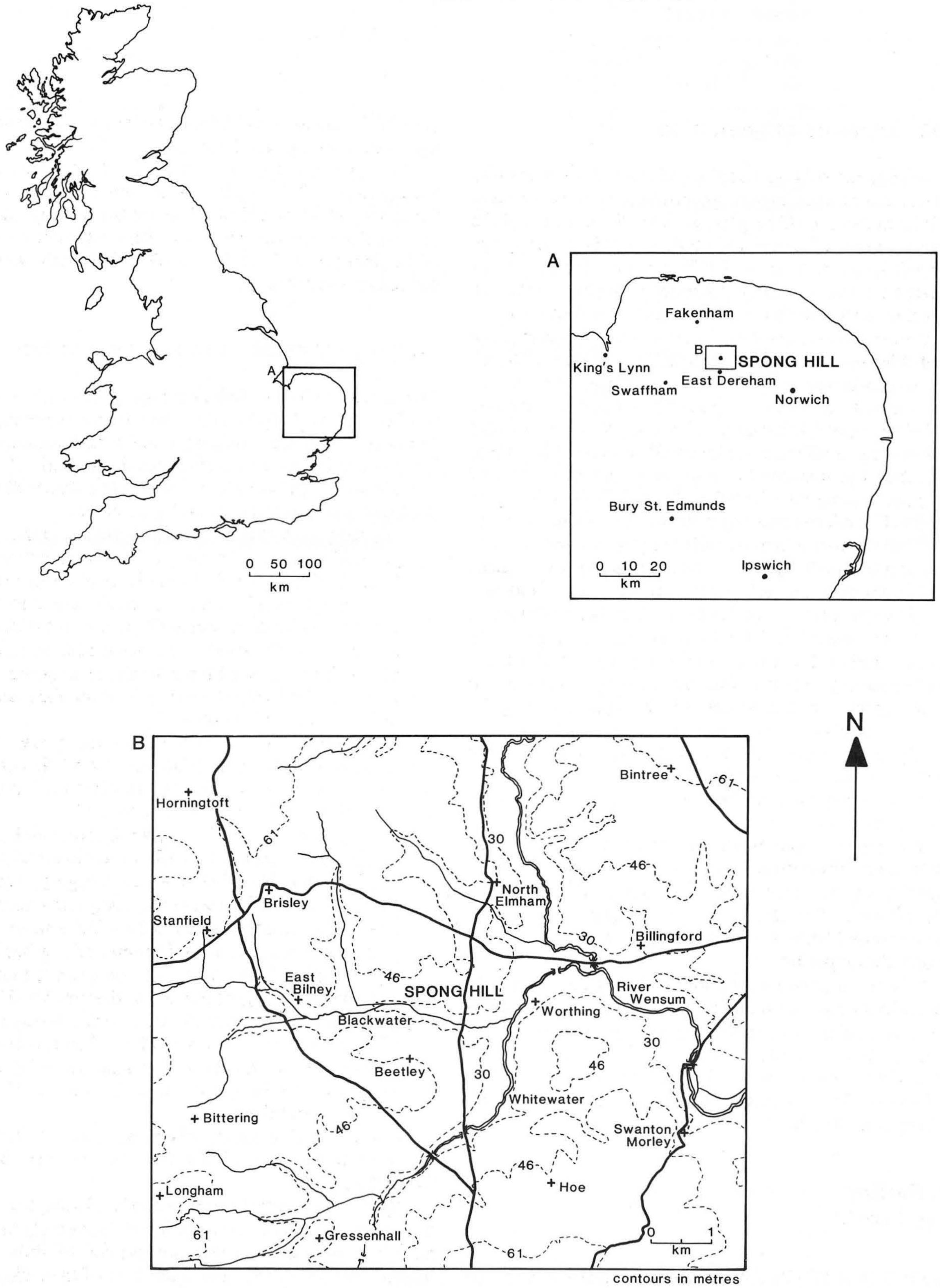


Figure 1 Location maps of Spong Hill. A) Showing relationship of Spong Hill to the principal towns in the region. B) Contour map with rivers, roads and nearby settlements.

Chapter 1. Introduction

I. Background to cremation

Until fairly recently, archaeological cremations excavated in this country were largely ignored because it was thought no information could be gleaned from them. Some of the early pioneers of cremation studies in this country, *e.g.* Wells (1960) and Spence (1967), attempted to dispel this impression but were largely unheeded in practical terms. This dismissive attitude still persists in some quarters.

Cremation was practised in Britain during parts of the Neolithic, Bronze Age, Late Iron Age, Romano-British and Anglo-Saxon periods. The rite disappeared in the sixth–seventh centuries AD, possibly to some extent under the influence of Christianity (Thomas 1985), and was not to re-emerge until the late nineteenth-century. Since then, cremation has increased in popularity and about 70% of the population now choose to be cremated rather than inhumed. Modern cremations in Britain are carried out in gas-fired cremators but examples of pyre cremations may be found from ethnographic and anthropological sources.

Cremation is the *deliberate* burning of a body as part of a ritual for disposal of the dead. The chemical process is one of *oxidation*. The final product is a complete skeleton reduced to the mineral component of the bone. The bones may vary in colour from mostly white through to blue/grey or sometimes black; they are slightly shrunken, broken and twisted but the individual bones are usually recognisable. The weight of bone from the average adult is about 2500–3000g. The variables which will affect the cremation process and the final product are outlined in Chapter 5:I.

Archaeological cremations may be contained in urns, pits or stone-lined cists. They may be found as individual deposits or in cemeteries, the largest of which are Anglo-Saxon. The cremations may contain grave-goods and/or animal bone, the latter being most common in the Anglo-Saxon period.

With a complete cremation it should be possible to ascertain the age and sex of the individual, and to identify any pathological lesions (lesions are changes to the bone as a result of disease or trauma). With archaeological cremations there are limits set by the incomplete collection of the remains after cremation for burial and any subsequent disturbance to the site.

II. Setting

(Figs 1 and 2)

Spong Hill, at TF 981 195, lies on the southern edge of the parish of North Elmham, overlooking the River Blackwater to the south. The cemetery is situated on the southern end of a low ridge, and extends part-way down the steep dip into the Blackwater valley.

The underlying geology of the site is sand and gravel on the edge of the boulder clay, which predominates over the area of mid-Norfolk (Fig. 2; Healy 1988). These Hungry Hill gravels (Straw 1973, 337–341; Philips 1976, 226–227) consist of cobbles with finer sub-angular flint gravel in an orange sand matrix.

The present soil is extremely flinty and fairly homogeneous. The depth of soil varies across the site, being very shallow, about 15cm, on the hill top north of the cemetery, increasing to about 30cm in the northern part of the cemetery itself, and up to 80cm deep in the southern portion on the hill slope.

III. History of the cemetery excavation

The existence of the cemetery at Spong Hill was first noted in 1711. At least 120 urns, then thought to be Roman, were found by labourers repairing a fence and subsequently investigated by Peter Le Neve, a local antiquarian (details in Hills 1977). In his letter printed in the Transactions of the Royal Society 1713, 257-260, he notes:

> As for the Contents (by what I can hear) they were generally the same. I have open'd several of them, and found in all of them plenty of pieces of broken Bones, some Black with burning, and some turned to Ashes with some pieces of coarse Glass run and sticking to the bones; which whether it proceeded from anything of that kind burnt with the Body, or only the sandy Earth vitrified with the strength of the Fire (as I am inclined to think) is doubtful.

The notebook of a 19th-century antiquary, James West, containing a diagram of an urn, states 'This urn was dug up at N.Elmham in Norfolk 11 May 1718 out of a place where several more are daily found.'

Tom Martin's Church Notes, Vol.II (Norfolk Records Office, Rye Manuscript 17) for 1746, mentions a trip made

> ... with the Rev. Mr Thomas Gregory, vicar of Elmham, to the close where so many urns have been lately dug up...Mr Gregory had a middle-sized urn by him never before opened. I found nothing but bones and gravel in it, so hard and compacted, that with difficulty I could get them out of the urn. Mr Gregory gave me a Pile made of the same earth...he says many of them stood in rows about 12 to 14 inches distance, upon a pavement, hard, of the same material and he imagined was the place where the funeral pile was used all about them.

Gurney (forthcoming) discusses these 'Pile(s)' in more detail, his suggestion being that they may be kiln firebars.

More urns were recovered in 1852 and a single urn was ploughed up in 1926. All but a few of these early urns are now lost; the contents were considered of little or no interest and were discarded at the time of their discovery (see Chapter 4).

In 1954, following the discovery of yet another urn early in the year, the Dereham and District Archaeological Society, under the direction of Dr Puddy, conducted a series of small-scale excavations on Spong Hill. At least eight urns were recovered with fragments of many more. The few restored urns and grave-goods are on display in Dereham Museum, but unfortunately, as was standard

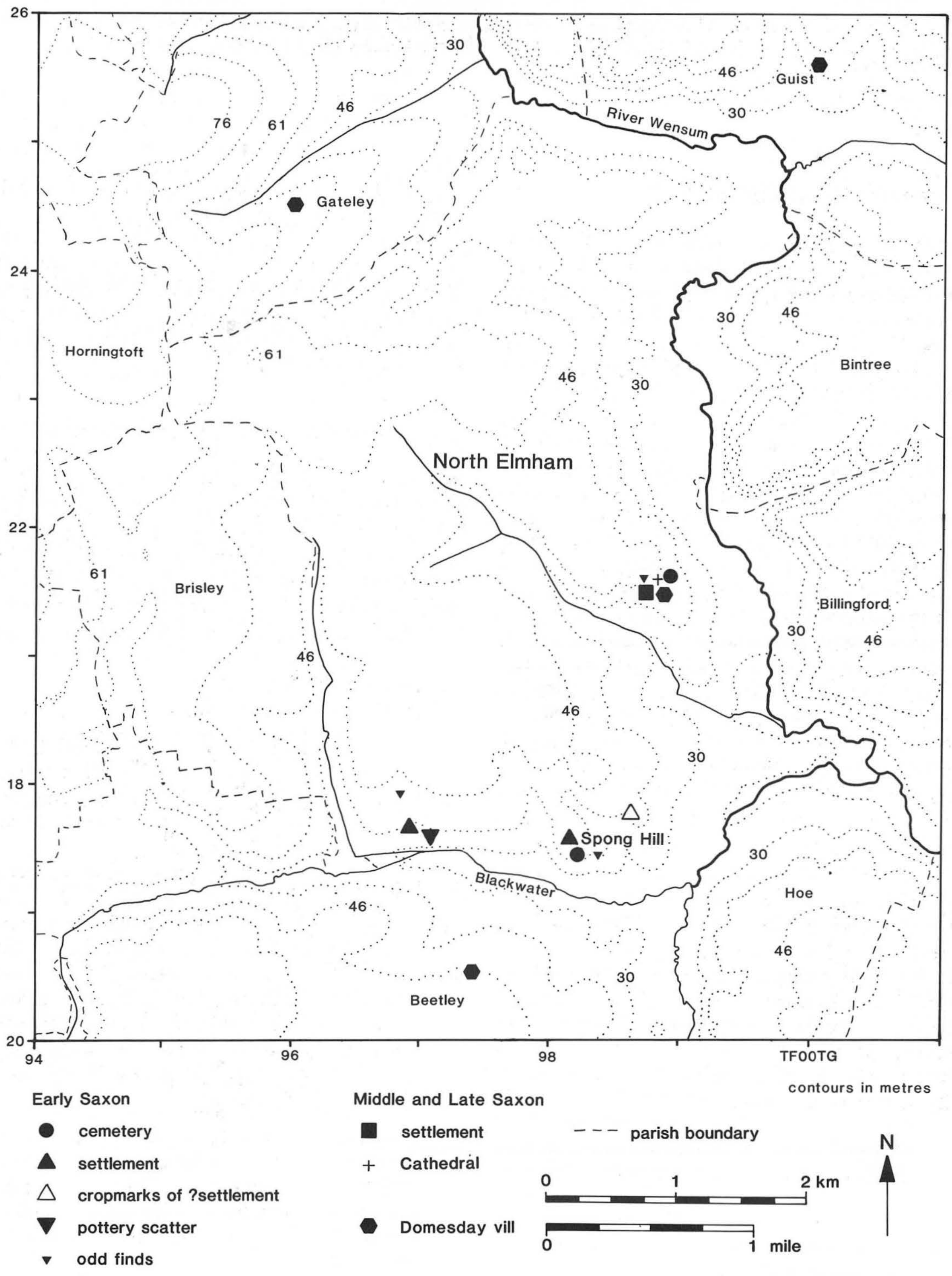


Figure 2 Location map of Spong Hill, showing rivers, parish boundaries and evidence of Saxon occupation.

procedure at that time, the vast majority of the bone was discarded. It has been possible to retrieve from the museum (thanks to Mrs M. Cook) part of two cremations, numbers 3 and 14.

The threat of possible destruction to the site in 1968 prompted further investigation by the Norfolk Museums Service, under the direction of Barbara Green and Peter Wade-Martins. The intention was to ascertain the extent and degree of survival of the Saxon cemetery. Forty-seven urns, numbers 20–67, were excavated in that season.

This was the prelude to the total excavation of the cemetery, which was conducted annually between 1972 and 1981, in the first year under the auspices of the Norfolk Research Committee and thereafter by the Norfolk Archaeological Unit. During the first three seasons, Warsaw University contributed a team of excavators and carried out some of the post-excavation work. Results are presented in Hills (1977), Hills and Penn (1981), Hills *et al* (1984), Hills *et al* (1987), Healy (1988), Rickett (forthcoming) and Hills *et al* (forthcoming).

IV. The osteological investigations

Dr Calvin Wells examined and produced a preliminary report on the cremations excavated in 1968 (unpublished). In order to maintain consistency with the rest of the report, these cremations have been re-examined by the writer and are presented in this volume.

It was originally intended that work on the cremated bone would be done by osteologists in Poland, at the University of Warsaw. To this end, the cremations from the 1972 and 1973 excavations (about 340), together with their grave-goods, were shipped to Poland. The University did not find it possible to complete their investigations however, and the bone was returned in 1978.

Glenys Putnam examined some of the cremations as part of her doctoral thesis at Cambridge between 1979 and 1984. A sample of about 500 cremations were analysed and results from 100 are in archive (unpublished).

In 1984, the director (Dr Catherine Hills), the Norfolk Archaeological Unit, and the funding body (H.B.M.C.E.) decided that a full-time osteologist should be employed, to undertake the full examination of the cremated bone. In 1985, the writer commenced work, analysing and re-examining the entire collection of 2,384 cremations. The results of this work are presented in this volume.

V. Aims of the study

The writer was employed in order to identify all the cremations recovered from Spong Hill and to produce a report. It was not originally intended that the report would form a research document and time has been limited. However, with a collection of this size it was inevitable that during the examination certain research possibilities would become apparent.

An assessment is given of the reliability and practicality of the various methods of identification when applied to cremated bone. The usefulness of examination of modern cremated remains, as a test of these methods, is emphasised.

It is important to understand the process of cremation. The large number of variables which may affect it become glaringly apparent on a visit to a modern crematorium. By studying the processes and examining the final product, a greater understanding of pyre technology and the rituals followed by the Anglo-Saxons during the cremation of their dead may be achieved.

A surprising number of pathological lesions and morphological variations were noted during the examination of the Spong Hill bone, including some not previously noted in cremation burials.

The analysis of such a great number of cremations with the attendant detail of information has proved to be time-consuming and it was not possible to explore all the research potential in any depth, or to express with the desired clarity the information in some areas. However, enough is presented here to show that future work on this and other cremation cemeteries in Britain should be of great interest to the archaeologist. The attitude of Tom Martin (1746), that urns contained 'nothing but bones and gravel' and therefore may be ignored, which has persisted for so long, may at least be revised.

VI. Note

Early in 1992, after submission of the final draft of the volume (June 1991), additional cremated bone from three cremations already included in the data (contexts 1644, 1651, and 1828) and one cremation previously missing (1829) was found (see IV above).

The writer has analysed this additional bone, the findings from which are included in Table 2 and Table 7 (microfiche). In view of the fact that the information would make little difference to the general discussion and conclusions, it was not felt necessary at this advanced stage to include the information in the overall text. The reader should note, however, that one less cremation is now missing, one more infant identified, one other cremation includes animal bone (1829) and one other includes grave-goods (1651).

Chapter 2. Methods

I. On-site and post-excavation treatment

Although recorded like contexts, the urns have a separate number sequence (see below: bone from contexts). During excavation, each urn received an 'urn number'. Some 'urns' consisted of scattered spreads of sherds and/or bones not easily distinguished as an individual burial. Co-ordinates, associations (other urns mostly), condition of urn, decoration and grave-goods, were noted on the 'urn sheets' where appropriate (see 'Catalogue(s) of Cremations', Hills 1977, Hills and Penn 1981, Hills *et al* 1987 and forthcoming). Each urn was planned and most were sectioned. The on-site treatment varied slightly depending on the condition of the individual urns, all of which were originally deposited upright. Urns which had been substantially damaged and could not be lifted intact were excavated *in situ*. Those urns which could be moved were excavated, bandaged, then lifted and taken into the finds shed. The urn fills were then excavated in 10mm spits, a section drawing being produced in each case (see Chapter 6 and *'Catalogue(s) of Cremations'*). In this way the distribution of bone within the urn, and the position of grave-goods or stones, were illustrated.

The bone from each urn was collected using a standard kitchen sieve (mesh size 1–1.5mm) and dry brushed. Any obvious finds were removed at this stage. Some of the cremations were re-sieved once or twice more at a later stage, to recover further grave-goods (see below and Chapter 6).

Extensive post-excavation work followed to reconstruct broken urns. During this process sherds of what were thought to be adjacent urns, were sometimes found to be one-and-the-same vessel. Conversely, what had been excavated and numbered as a single urn, occasionally proved to contain sherds of two or more vessels.

A number of 'un-urned' cremations were found, *i.e.* deposits of cremated bone only. These were treated in exactly the same way as the other, urned, cremations and allocated numbers in the urn sequence during excavation.

In addition to the individual cremations excavated, two groups of material were recorded, neither of which yielded much useful information.

During excavation, the entire site was divided into five metre grid squares, for ease of recording and reference. A mixture of cremated human bone and animal bone (mostly burnt) was recovered from 165 of the grid squares across the site. This was all surface material (see Rickett forthcoming, for details of excavation), and could be of any date from Roman to modern.

The bone from each grid-square was weighed and sorted. A brief analysis was made of each collection to extract any finds, note whether animal or human bone was present and if present, whether cremated or not.

Bone was also collected from other excavated contexts. Most of the bone in post-medieval contexts is there as a result of the 19th-century 'urndigger' disturbances. The context bone is much more of a mixture of cremated and unburnt animal bone than is the bone recovered by grid square, with an emphasis on the animal. 146 of the contexts contained some cremated bone. The bone was weighed and sorted in the same manner as the grid-square bone.

II. Osteological procedure

Standard procedures must be followed in order to produce a workable data base, regardless of the size or condition of a cremation. The basic procedure used with the Spong Hill cremations aimed to produce the maximum amount of useful data, within the allotted time and resources. As some time and money had already been spent on osteological studies (1972–1984, see Chapter 1) which subsequently had to be abandoned, cost-effectiveness was an important consideration; this work was not intended to be a research project.

It is likely that, had more time been taken to examine the cremations, some additional information would have been gleaned; this is particularly true with respect to the pathology. It is also likely that if the writer had the opportunity to re-examine some of the cremations looked at early in the project, more fragments could now be identified, the ability to identify small fragments of cremated bone having increased with four years practice on such a large number of cremations. However, it is doubtful that the basic identification of number of individuals, age and sex would vary; it would be the 'research' aspect which would benefit.

For the purpose of this particular study, the procedures outlined below were followed.

Each cremation was passed through a stack of three sieves of 10, 5 and 2mm mesh size. The weight of bone present in each sieve was calculated as a percentage of the total weight of the cremation (Table 7, microfiche). This enabled an assessment of the degree of bone fragmentation in each cremation. The usual measurements of maximum fragment size of skull and long bones were also taken (Table 7, microfiche). The writer believes that the *percentage fragmentation* provides a more representative, overall view of how fragmented each cremation is. If only maximum fragment size were recorded, a biased view would be presented if, for example, only a few large fragments were present in a cremation where the majority of bones had suffered heavier fragmentation. A subjective comment on fragmentation, such as 'well' or 'moderately fragmented', is insufficiently exact, and leads to problems in comparing data from different sites/specialists.

The size of each collection is represented by weight rather than by volume or number of fragments. It was felt that either volume and or number of fragments alone could be misleading. A heavily fragmented cremation would have less volume than one of equal weight but with larger fragment size. Likewise, the number of fragments in two collections of the same weight may vary considerably, depending on how large the fragments are. Though no method is necessarily ideal, the procedure used in this case was felt to give the most representative indication of both size and fragmentation. Weight and number of fragments would be best, but time consuming.

After sieving, the identifiable fragments of bone were extracted for further examination, together with any recognisable animal bone and grave-goods.

The animal bone was relatively easy to distinguish, though made slightly more difficult by cremation. There are the obvious differences in size and form of most animal bones from their human equivalent. Animal bone, even when closely comparable to human bone, will appear heavier and denser in structure. It will often fissure and break differently in cremation to the human counterpart, as a result of different bone density and musculature (see Chapter 5). In animals, the medullary and spongy bone formation is different from the human, as are the sites of epiphyseal/metaphyseal fusion in the immature individuals. Fragments identified as animal bone by the writer were removed to be sent to the specialist (Julie Bond). It is likely that odd fragments of long bone shaft were overlooked by the writer in cremations containing large quantities of animal bone.

It is not possible with cremated remains to refer every fragment to an individual bone. Much of the collection will be small fragments of long bone shaft or spongy bone, which cannot definitely be identified as being from a particular bone. The quantity of identifiable fragments in any particular cremation will depend to a large extent on the degree of fragmentation; it is obviously easier to identify larger fragments of bone than smaller ones. It will also depend on the area of the body; even as quite small fragments, areas of the skull are relatively easy to identify because of the unique appearance of the bones. Alternatively, considerable difficulty may be experienced with fragments of long bone. For example, the dorsal surface of the femur, with its strongly defined muscle attachments, is easy to identify; a small fragment of anterior shaft, however, may be confused with fragments of humerus. Similar confusion may arise between small fragments of radius, ulna and fibula shaft. In these areas of possible confusion, bone was left as 'unidentified', rather than risking the bone being placed in the wrong category.

The identifiable bone was divided into four categories: skull, axial (including innominates), upper limb and lower limb. Each fragment was identified and recorded within its category (anatomical terminology from Gray 1977 and McMinn and Hutchings 1985) with notes relating to fusion (where relevant), sexual dimorphism, pathology (morphological variations were included in this section though not actually pathological), colour, condition and the fusion of any grave-goods. These results are presented in total in Details of Cremation Identifications (archive).

The weight of identifiable bone was calculated as a percentage of the total weight (Table 7, microfiche). This figure will give the reader an impression both of how much information it was possible to extract and, by implication, the degree of fragmentation (see above).

The weight of each species of animal in a cremation is recorded in the 'Animal Bone' field in the details (archive). The total weight of animal bone in a cremation is presented at the end of the same field as a percentage of the total weight of cremated bone. By comparing the percentage of identified human bone against that of identified animal bone, an indication of how much of the cremation was composed of animal bone is given. It should be remembered, particularly in collections which contained large quantities of animal, that fragments of unidentified animal bone will probably have remained mixed in with the 'unidentified' (*i.e.* individual bone unspecified) human bone.

The quantity of bone within each of the four identified categories was weighed and is expressed as a percentage of the total weight of identified material (Table 7, microfiche). It should be possible to recognise any bias in the collection of certain areas of the body after cremation. It should be remembered, however, that the four categories would not be equally divided by weight if the entire skeletal remains were present. The total weight of a dry skeleton is about the same as the cremated skeleton. The percentages by weight of the four areas are as follows:

skull:18.2%
axial:20.6%
upper limb:23.1%
lower limb:38.1%.

III. Criteria for assessing number of individuals
(Figs 3–10)

Only the clear duplication of *several* bones should be used as an indication of the presence of more than one adult in a cremation. In cases of an immature individual deposited with an adult, the difference in the sizes of the bones and the stage of development should be immediately obvious, though duplication of bones should still be apparent in many cases. However, even in the event of immature bones occurring with those of an adult, care must be exercised to ensure that sufficient bone is present to illustrate a genuine *multiple cremation* and that the apparent duality is not a result of contamination, either from disturbance of the site, or re-use of a pyre site.

The great risk of contamination is a major reason for not using single duplications of bones as indicative of more than one individual in a cremation, coupled with the fact that a single bone, or even a couple of bones can hardly be classed as representative of an entire adult.

Apparent contradictions in sexually dimorphic traits of the skeleton are insufficient indicators of multiple cremations, where they are not supported by duplication of bones. As may be seen from present-day populations, it is quite possible to have gracile males or robust females, and within any group of skeletal material, cremated or not, there may be variation in the definition of sexual traits. To say, for instance, that robust long bones and some gracile skull features signify the presence of two individuals of different sex is far from being a safe practice.

Bones of different colours are also not an indication of multiple cremations. It is common for the bones within a single cremation to show variations in colour (see Chapter 5).

For these reasons, it is imperative that a specialist has access to the site records and drawings in order that the presence of intrusive bone, there as a result of contamination from disturbed neighbouring cremations, is not taken as an indication of genuine multiple burial.

At Spong Hill, only about 15% of the urns were totally undisturbed. A large number had suffered from plough

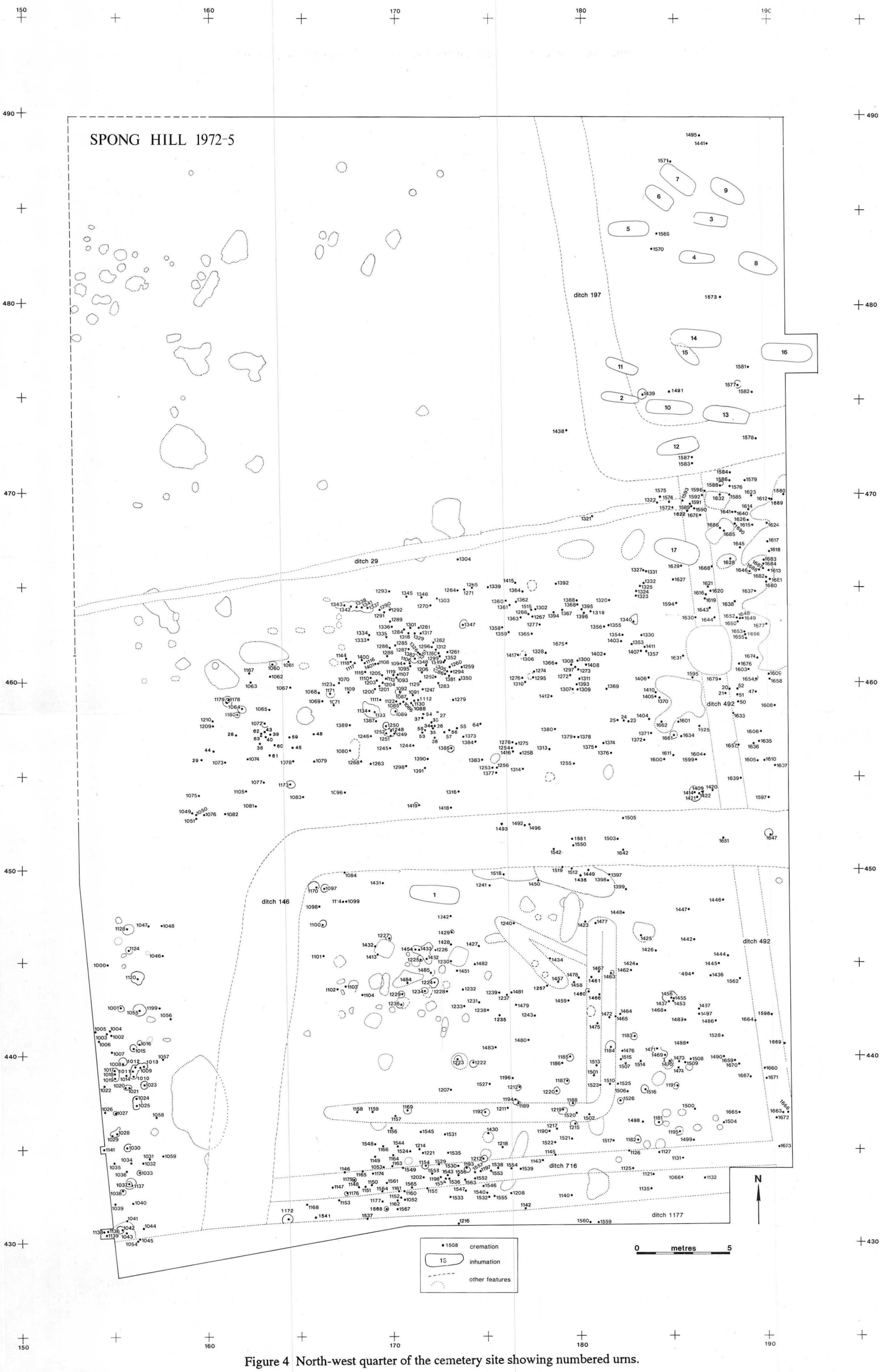


Figure 4 North-west quarter of the cemetery site showing numbered urns.

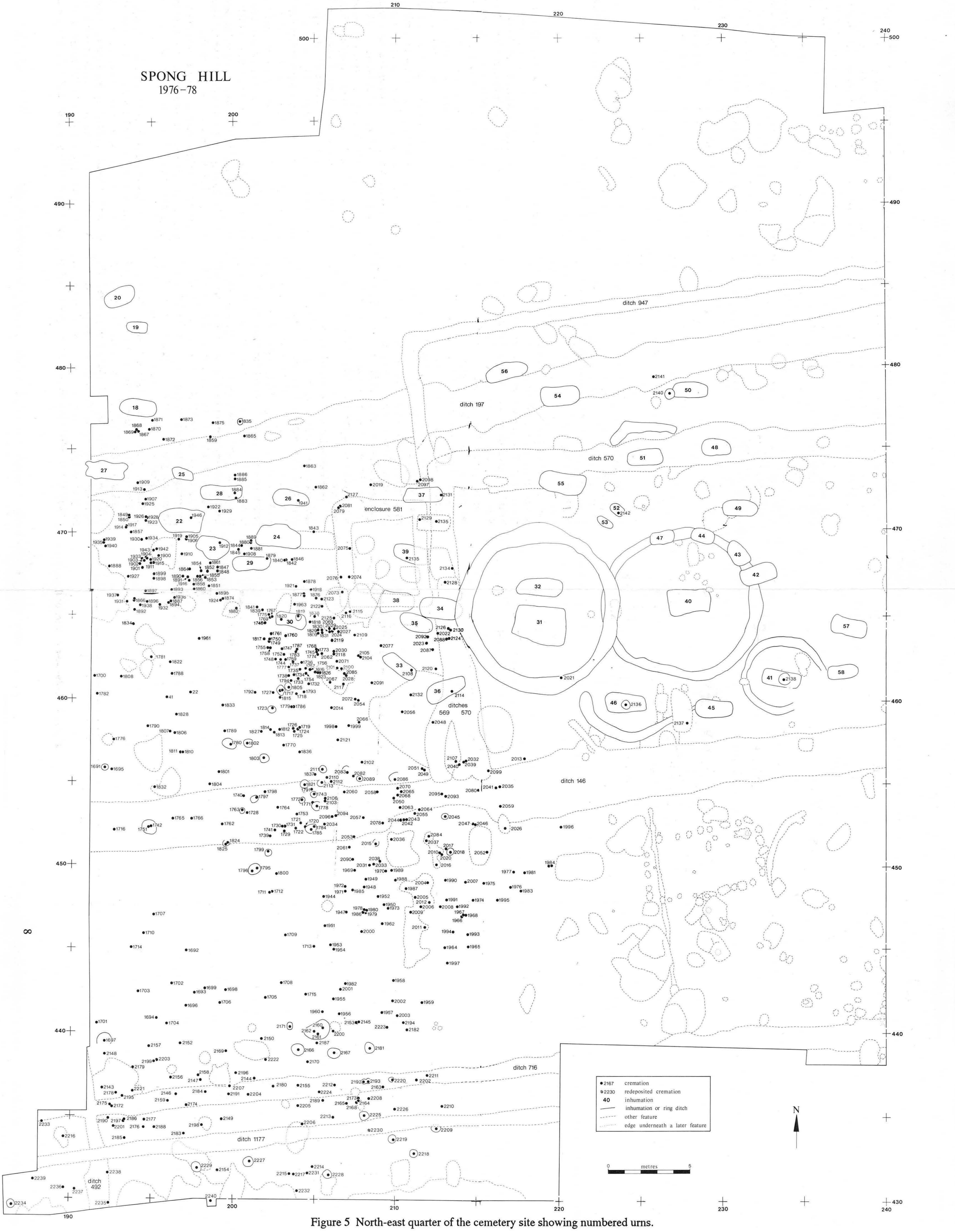


Figure 5 North-east quarter of the cemetery site showing numbered urns.

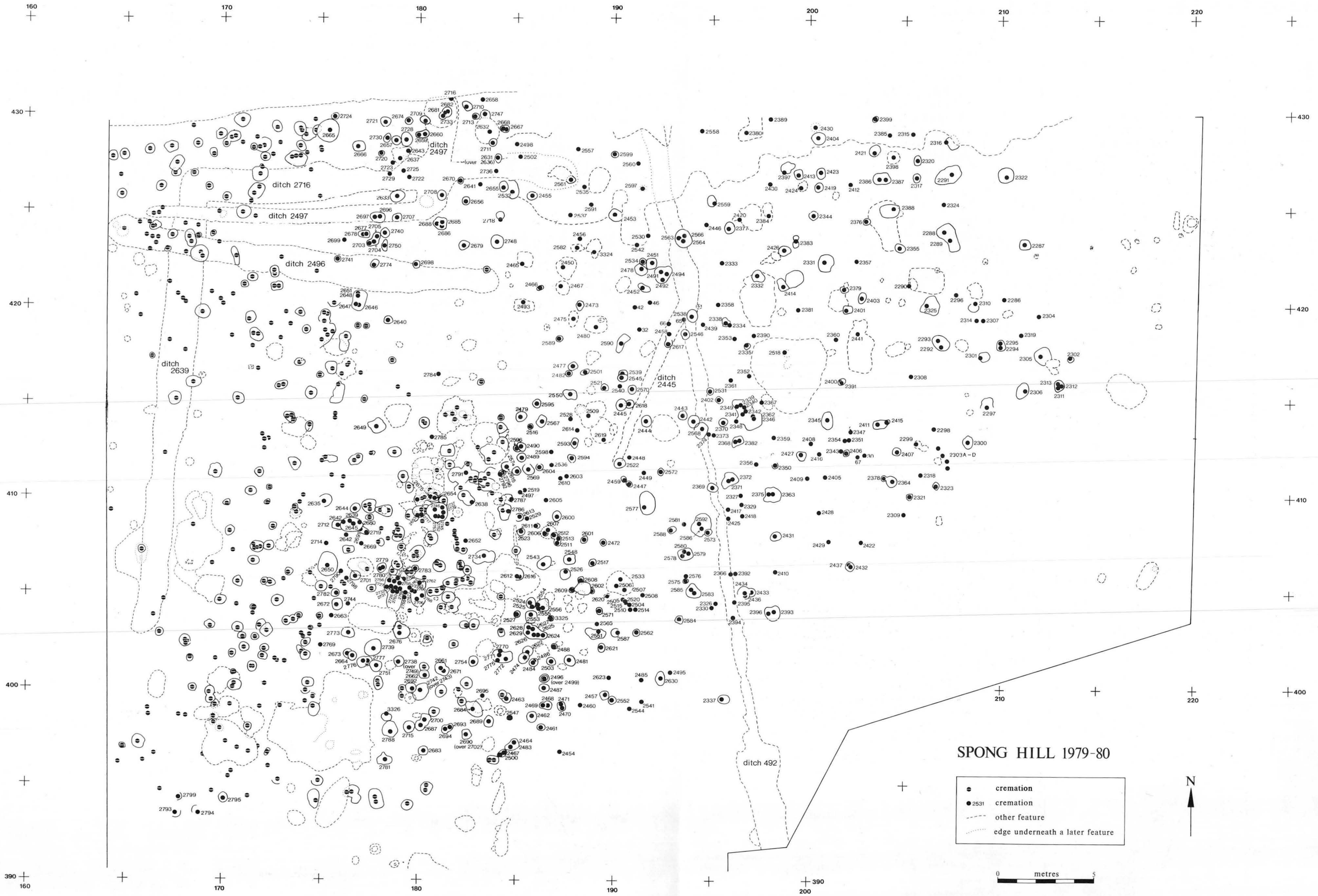


Figure 6 South-east quarter of the cemetery site showing numbered urns.

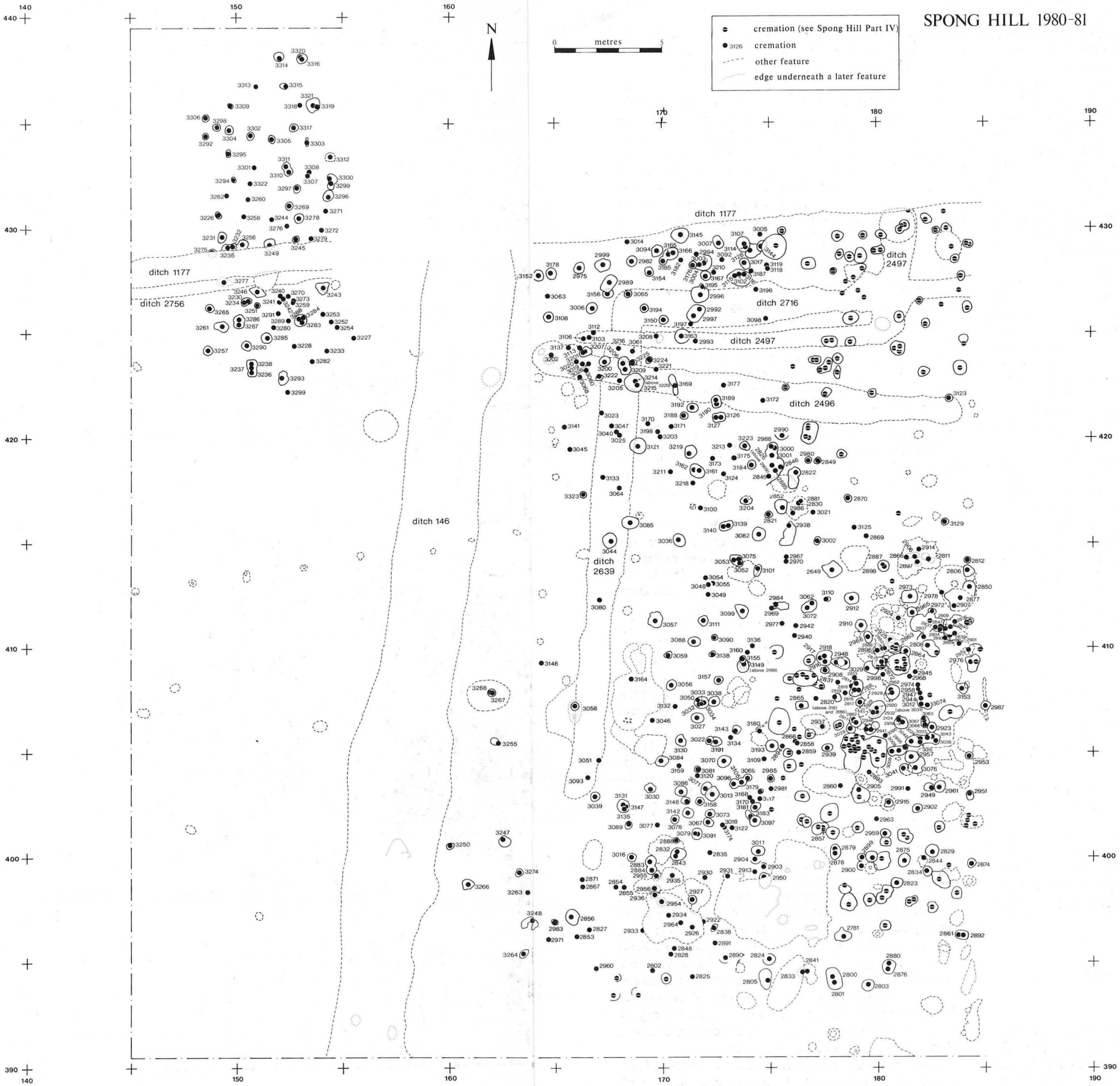


Figure 7 South-west quarter of the cemetery site showing numbered urns.

damage, resulting in crushing or smashing of the vessels. As may be seen from the site plans (Figs 3–7), many of the urns were placed close together, increasing the risk of contamination if disturbed. Contamination is apparent from the number of sherds recovered from disturbed collections which, during post-excavation, were found to belong to a neighbouring urn (Plan 233 in archive 'Showing movement of stamped sherds across the site'). In the same way, fragments of bone must have occasionally been transferred from one urn to another in areas of disturbance. The movement of bone may not have been as dramatic as that of the sherds. It was often apparent that not all of an urn had been filled with bone (Chapter 6). Hence if only the upper part of an urn were removed, the cremated bone itself may have been undisturbed.

The weight of bone in a cremation can rarely be taken as indicative of the number of individuals present, particularly where the collection contains animal bone as well as human. At Spong Hill, from the complete urns containing a single adult and no animal bone, the average weight of bone was 812.4g, with a range of weights between 117.2–3105.1g. The largest overall cremation from a complete urn was 3374.8g, but this urn also contained animal bone. The complete, multiple, adult cremations ranged between 1166.9–2008.1g. The average weight of undisturbed multiple cremations was higher than the average weight of undisturbed individual cremations. However, a larger number of single cremations than multiple ones, contained more than the average weight of bone from the multiple cremations. Add to this the variations in weight as a result of animal bone and/or disturbance, and the unreliability of using weights to identify multiple cremations becomes obvious.

Where apparently intrusive bones were noted at Spong Hill, it was usually possible, with the aid of the site records, to provenance the bone to a particular neighbouring urn. In a few cases, however, where urns were buried some way from any other urn, or with undisturbed urns, contamination could not have taken place due to disturbance. In these few instances it would seem that contamination had taken place before burial, perhaps through the re-use of a pyre site (see Chapter 6).

Only in instances where there are several clear duplications of individual bones, with little possibility of contamination, have multiple adult burials been identified. This occurrence is usually obvious; skull bones are frequently present, most of them are easy to identify even as small fragments, and they occur either singly or in pairs within the skeleton; for example, the external occipital protuberance, the mastoid processes or the malar processes (Figs 8 and 9). The atlas and the axis vertebrae (Fig.10) are also useful, being of distinctive appearance and occurring singly within the skeleton. Often, multiples of long bone articular surfaces are also represented in dual cremations.

IV. Criteria for estimation of age

(Table 1, Plates I–VI)

Estimation of the age of immature individuals is relatively easy. Beyond 25/30 yr (the approximate age of the last bone fusion within the skeleton and the eruption of all the permanent teeth) there are, as with inhumations, problems. With cremations these problems are compounded by the fragmentation of the bone and by the incomplete collection of the remains for burial.

The largest complete individual cremation from Spong Hill weighed 3105.1g, which is the weight one would expect from a fairly large adult. However, the average weight of material recovered from the undisturbed urns was only 812.4gm, *c.*27–40% (depending on the size/robusticity of the individual) by weight of the amount one would expect. Although a proportion of the bone would doubtless have been irretrievable dust (up to 30%, McKinley 1993 b) the larger part would have been collectable fragments (see Chapter 5). It would appear therefore that in the vast majority of cases complete collection of the remains after cremation did not occur, or, at least, that they were not deposited in the urn for burial. Certain parts of the skeleton are more useful than others for ageing and if those parts are not amongst the fragments collected, identification may be somewhat tentative (see Chapter 4).

The age of immature individuals was assessed from the stage of tooth development (Van Beek 1983) and bone fusion (Gray 1977; McMinn and Hutchings 1985), (Plates I–IV).

Unerupted tooth crowns often survive cremation, being protected from the full force of the heat by their position in the crown crypts of the maxilla or mandible. Erupted teeth tend only to be represented by the roots, the enamel having shattered as it expanded rapidly in the heat of the pyre.

Young adults, up to the age of 25/30 yr, may easily be identified, provided fragments of iliac crest in the innominate and/or medial clavicle had been collected. These are the last areas of epiphyseal fusion in the skeleton. However, there may be considerable difficulty in ageing adults over 25/30 yr (Plates V–VI).

The patterns of occlusal wear in teeth, devised by Brothwell (1972a) as a guide in ageing, cannot be used to help assess the age of cremated individuals. Shattered tooth enamel (see above) was rarely collected, and even if it were, it would be virtually impossible to interpret. However, there were occasions where excessive tooth wear has resulted in the total erosion of the crown, leaving only the roots and the polished occlusal surface in the cervical region. Further excessive wear may lead to the eventual loss of the tooth and resorption of the socket. The latter may be recognised in cremated bone and suggest the presence of an elderly individual. Care must be taken, however, to ensure that tooth loss was a result of excess wear and not of dental disease (see Chapter 7).

The degree of cranial suture fusion was formerly held to be a fairly reliable indicator of age. More recent work however, has called into question the use of the method (Brothwell 1972a, 38). There would seem to be a general trend towards increased fusion of the sutures over time, but it does not necessarily follow that lack of fusion indicates a younger individual. During a recent visit to a crematorium, the writer observed the cremated remains of a 97 year old individual, in which none of the cranial sutures had fused. However, with the overall paucity of evidence from which to assess age, the degree of suture fusion has been used as a general guide.

Most age identifications in adults are assessed from the various degenerative processes associated with ageing.

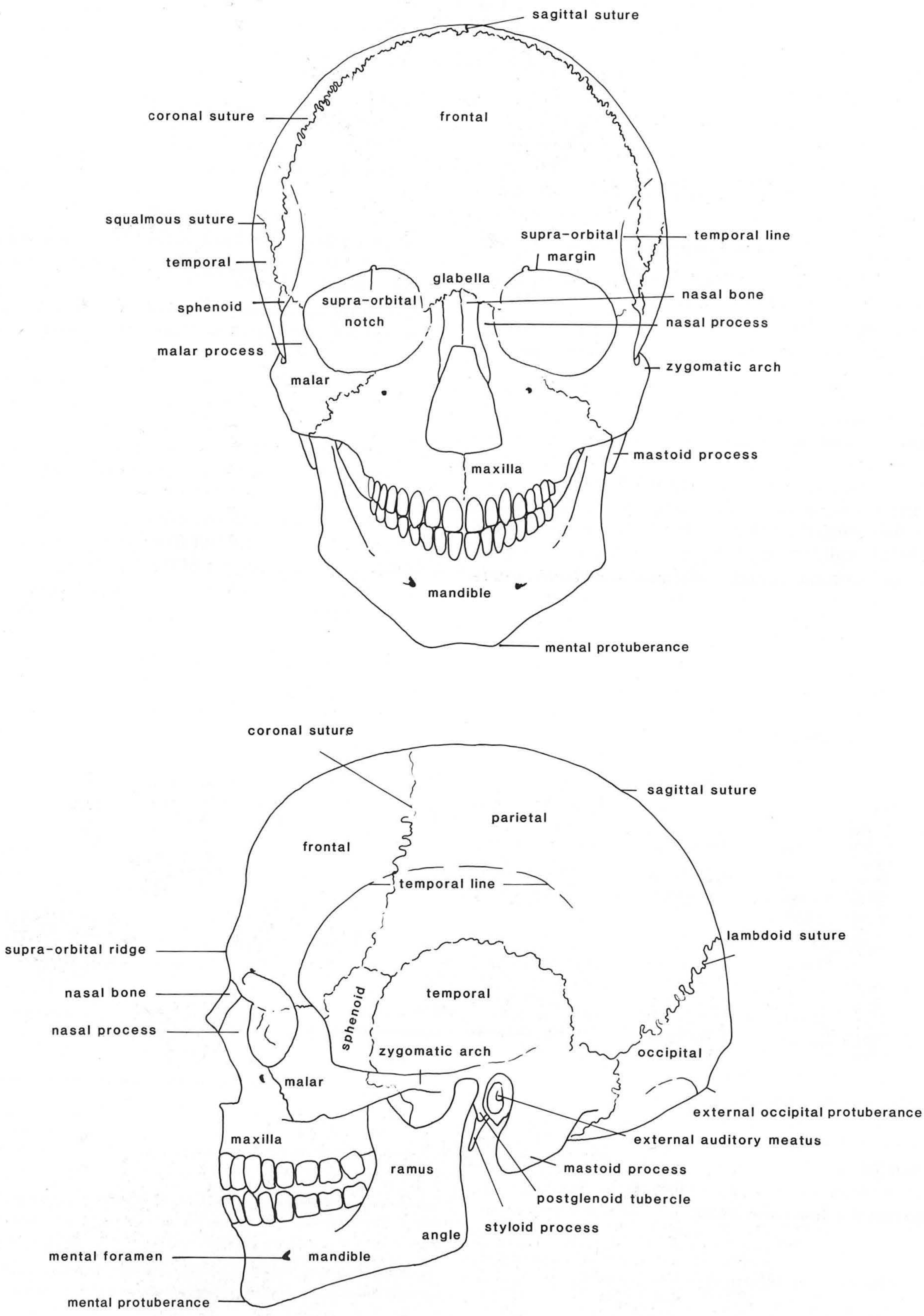


Figure 8 Elements and features of the skull; anterior and lateral views.

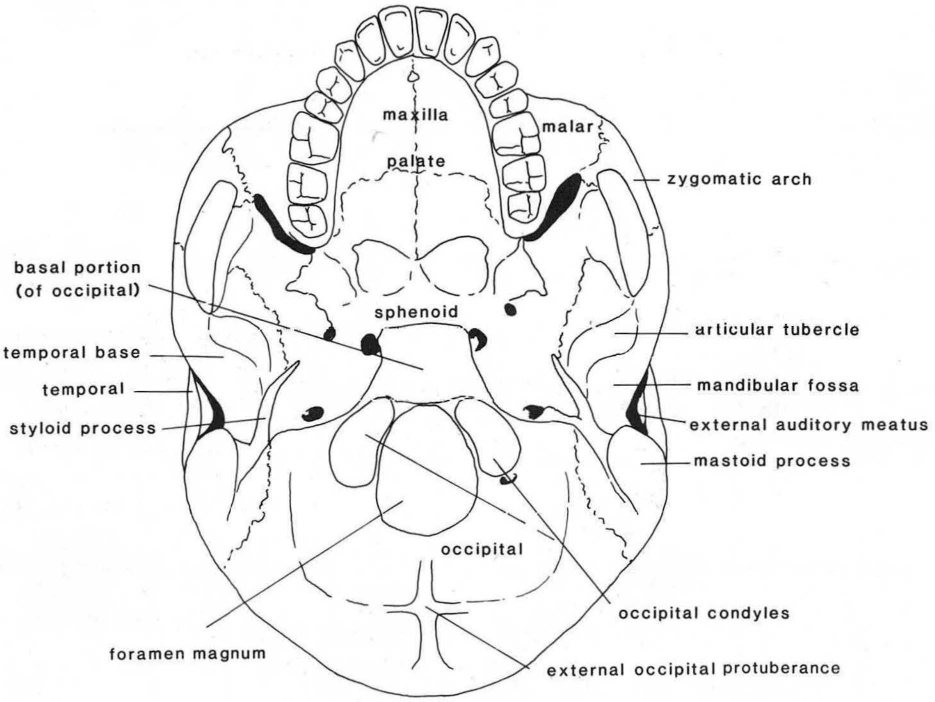


Figure 9 Elements and features of the skull; base view.

Plate I No.3134, young infant. Showing unerupted deciduous tooth crowns (top right), petrous temporals and vault (below), unfused epiphyses, metaphyses and diaphyses (right-left). Unidentified fragments at bottom.

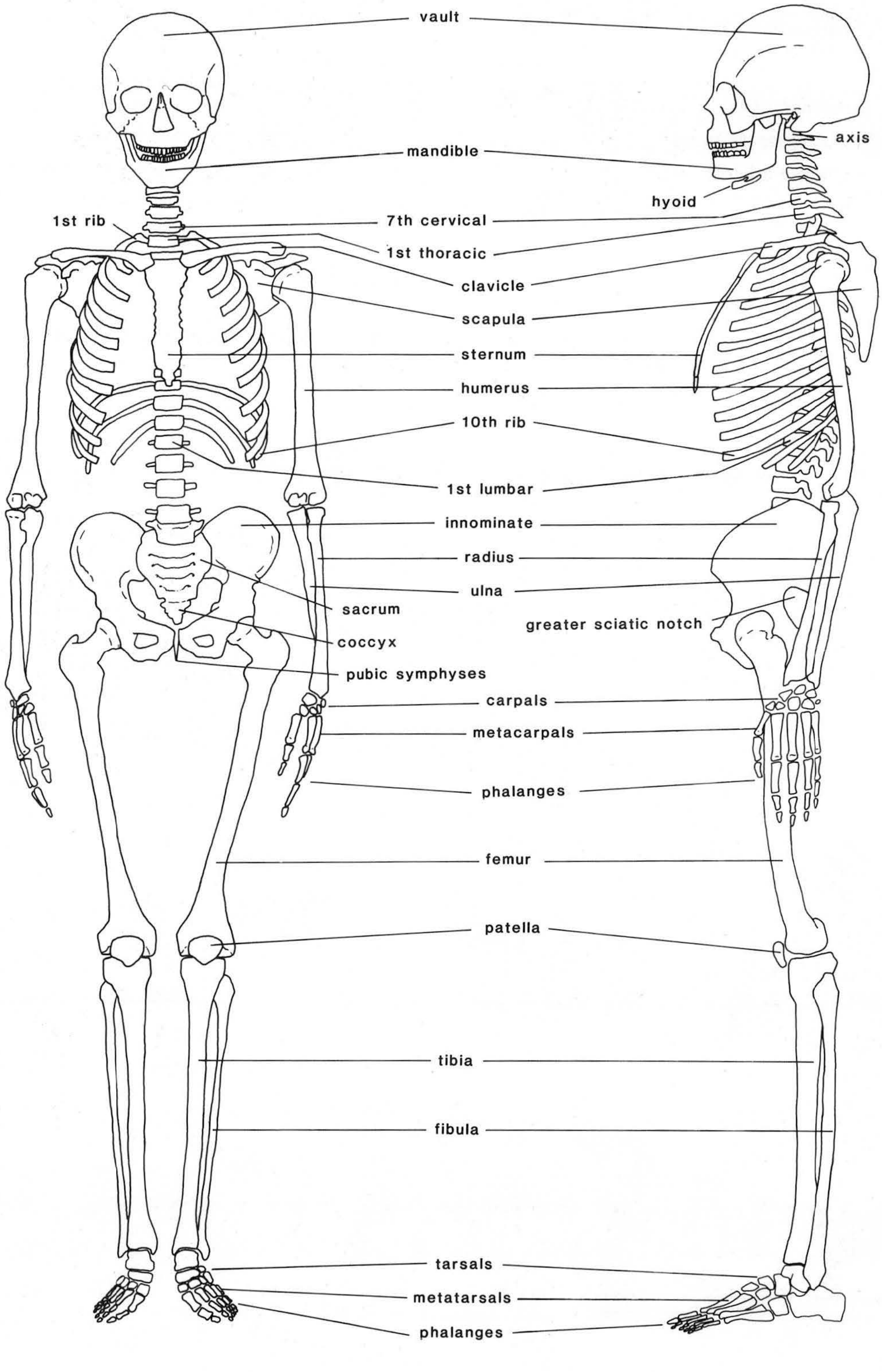


Figure 10 Elements and some features of the skeleton; anterior and lateral views.

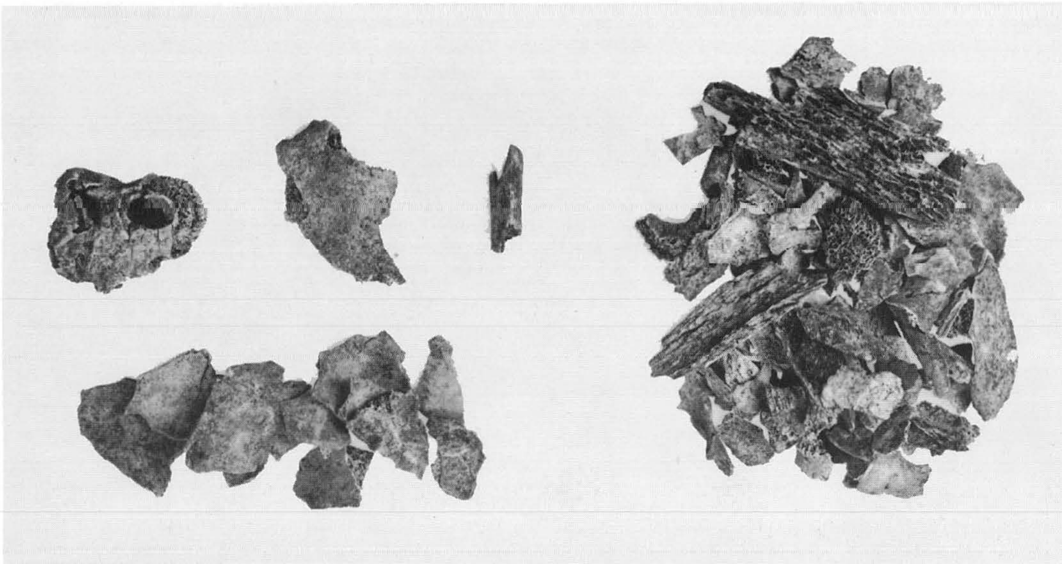


Plate II No.2946, infant. Showing left petrous temporal, frontal vault and long bone shaft (top left) and vault fragments (bottom left). Unidentified bone (right).

Plate III No.2775, older infant. Showing vault (centre left), unerupted tooth crowns and petrous temporal (centre), lower and upper limb (centre right), ribs (bottom left) and vertebrae (centre bottom). Unidentified bone at top. Reproduced at 90% actual size.

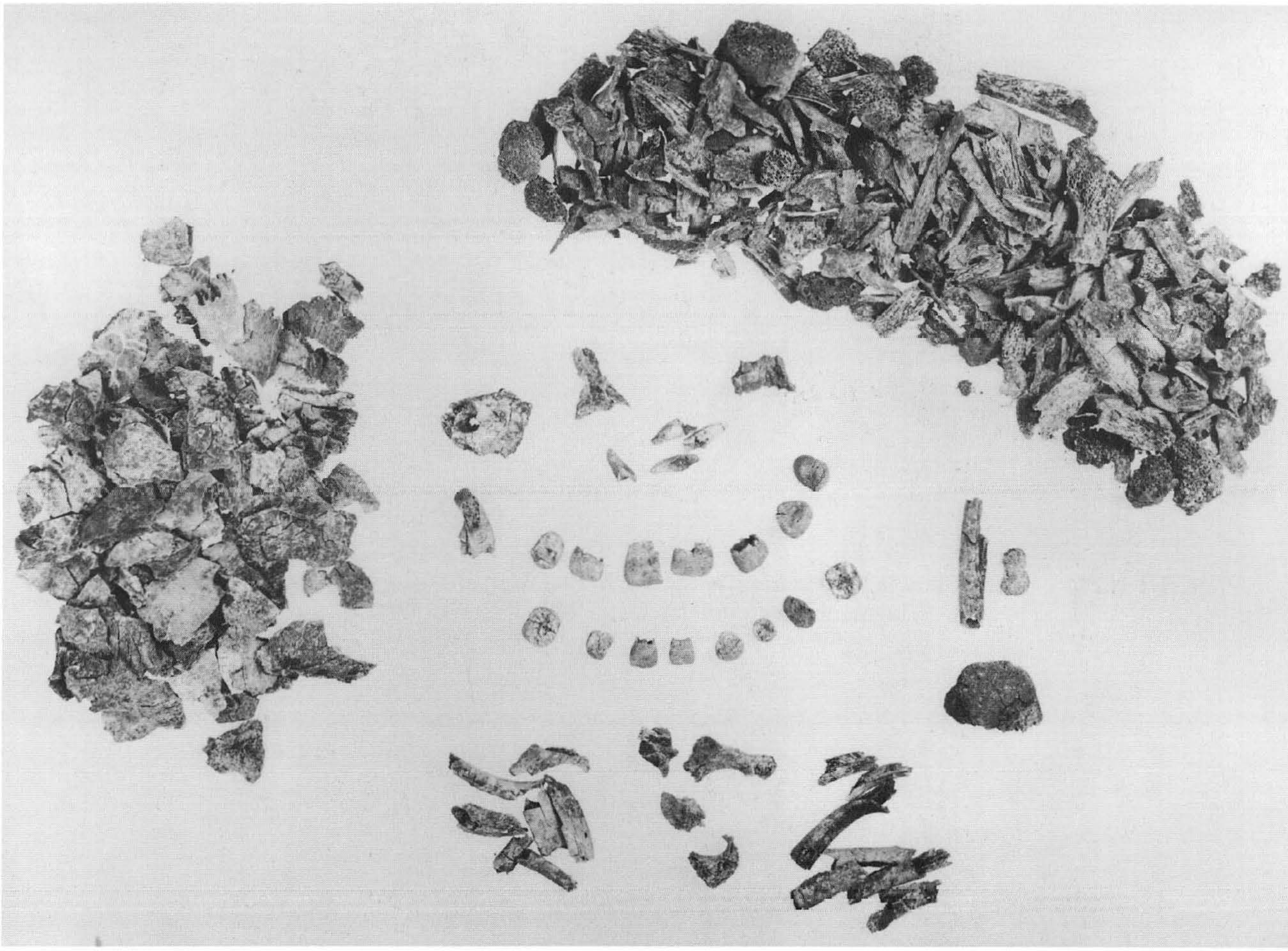


Plate IV No.2405, young juvenile. Showing unerupted tooth crowns (centre), ribs and vertebrae (below), vault (left) and limb bone (right). Unidentified bone (top right). Reproduced at 88% actual size.

The pubic symphysis of the innominate does not often survive in cremated material. Where it is present, the degenerative wear pattern on the symphyseal face has been used with broad age groups (Brookes 1955). This method is of greatest use for adults within the young and mature ranges, but only about 4% of the adults from Spong Hill presented this particular bone fragment. The auricular surface of the ilium has a considerably higher survival rate than the pubis, and age assessment may be conducted in a similar manner (Lovejoy *et al* 1985). The age categories with this method are more difficult to define, but it has proved useful as a general indicator.

The degree of degenerative changes in various parts of the skeleton provide a useful indication of the age of an individual. Spondylosis deformans in the vertebrae, osteophyte development on joint margins, and diseases such as degenerative disc disease and osteoarthritis, have been found to increase with age (Rogers *et al* 1987).

Wherever possible, a combination of the above methods has been used. The confidence of the assessment depends on the quality and quantity of information available. In some cases it was not possible to age with greater accuracy than 'adult', or 'subadult/adult', where it was obvious that an immature individual was not represented.

There are other, and to some extent more reliable, methods of ageing available, which it did not prove possible to use within the limits of this project. These methods require specialist equipment and are time-consuming and therefore expensive, especially when dealing with a site of the size of Spong Hill.

Singh and Gunberg (1970) have produced some interesting results in quantitative histology from osteon counts. Explained simply, bone is not a static material; from the time it has completed its development, it is constantly being resorbed and reformed. This process is carried out by cells which create small 'tunnels' or 'osteons' within the bone. The longer one lives, the more osteons will be present in a given area of bone. Although bone shrinks on cremation, the osteon structure remains intact (Herrmann 1977, Piontek 1976).

A preliminary investigation has been undertaken on a small sample of the Spong Hill cremations by Neil Garland, to assess the potential of osteon counting in ageing cremated bone. It has been possible to process and impregnate the bone with resin, but difficulty has been encountered in producing intact, handground sections. This is probably because the process of cremation has affected the natural porosity of the bone (by dehydration and shrinkage changing the crystal structure, see Chapter 5), thereby inhibiting the infiltration of the centre of the bone by the resin. Were it to prove possible to use this method with cremations it could be of great use, as it would cover those age groups most difficult to assess. An

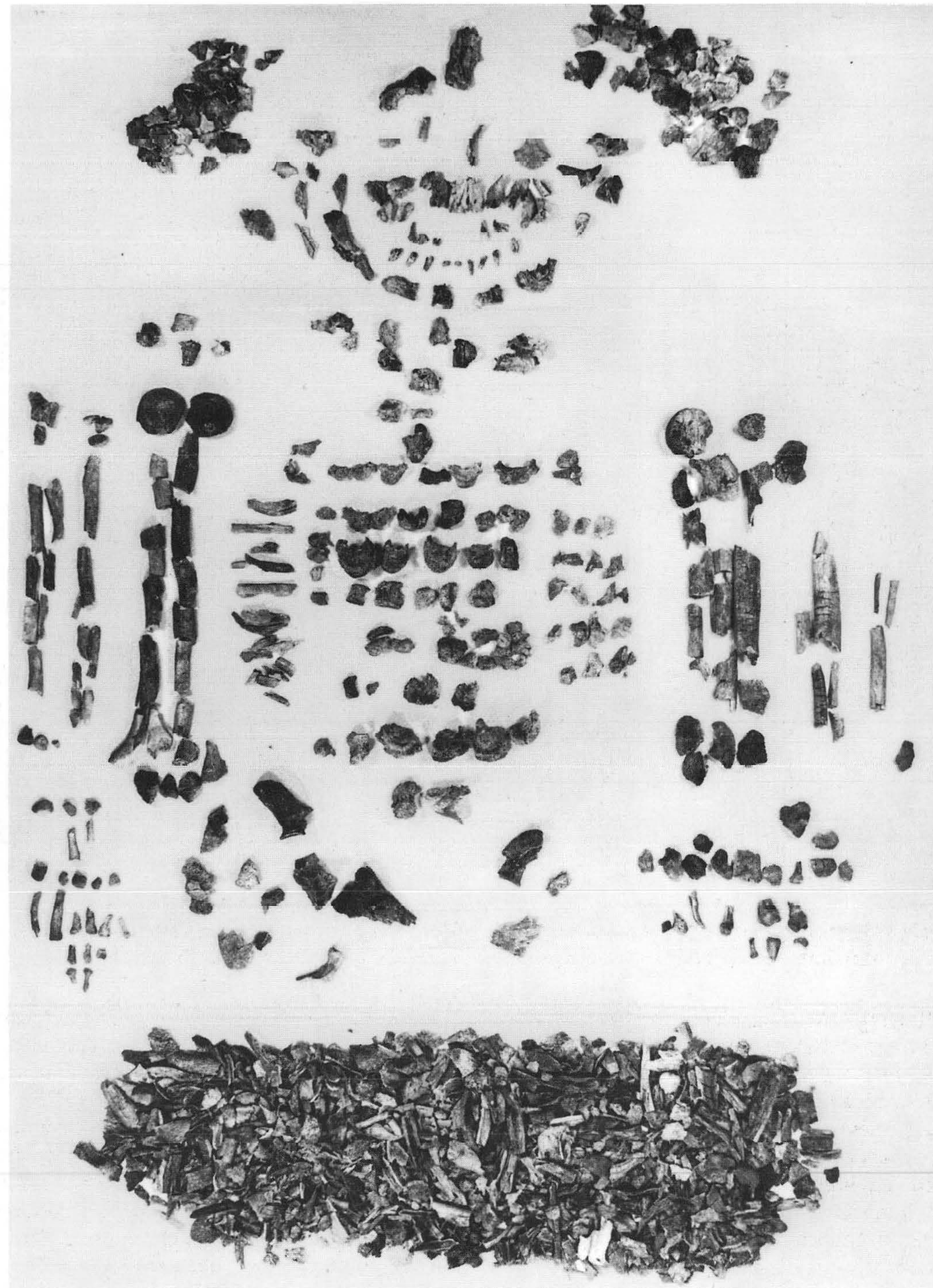


Plate V No.1665, younger mature female. Showing upper limb (centre left), skull (top), axial (centre) and lower limb (centre right). Unidentified bone at bottom.

additional problem, however, would be the need to know the sex of the individual to be aged, as there is sexual dimorphism present in the osteon development.

Methods used for ageing in forensic odontology (Gustafson 1947, Whittaker 1982), have met with success in archaeological material. Measurement of the developed degree of translucent dentine at the apex of the tooth roots has achieved an accuracy of ±7 years ageing in recent studies of the Spitalfields inhumations (Whittaker, pers. comm.). The method requires thin-sectioning of the material for microscopic analysis. As yet, attempts have not been made to age cremated bone using this method. Thin-sectioning should be possible, though the process may encounter problems similar to those found when sectioning for osteon counting.

Throughout the analysis, age categories rather than age in years have been used (Table 1).

Even with tooth development in infants and juveniles, the accuracy to which an age in years may be attributed decreases with age. At six months, one may give an accurate age to within two months. This increases by the age of two years to ±six months, at four years to ±nine

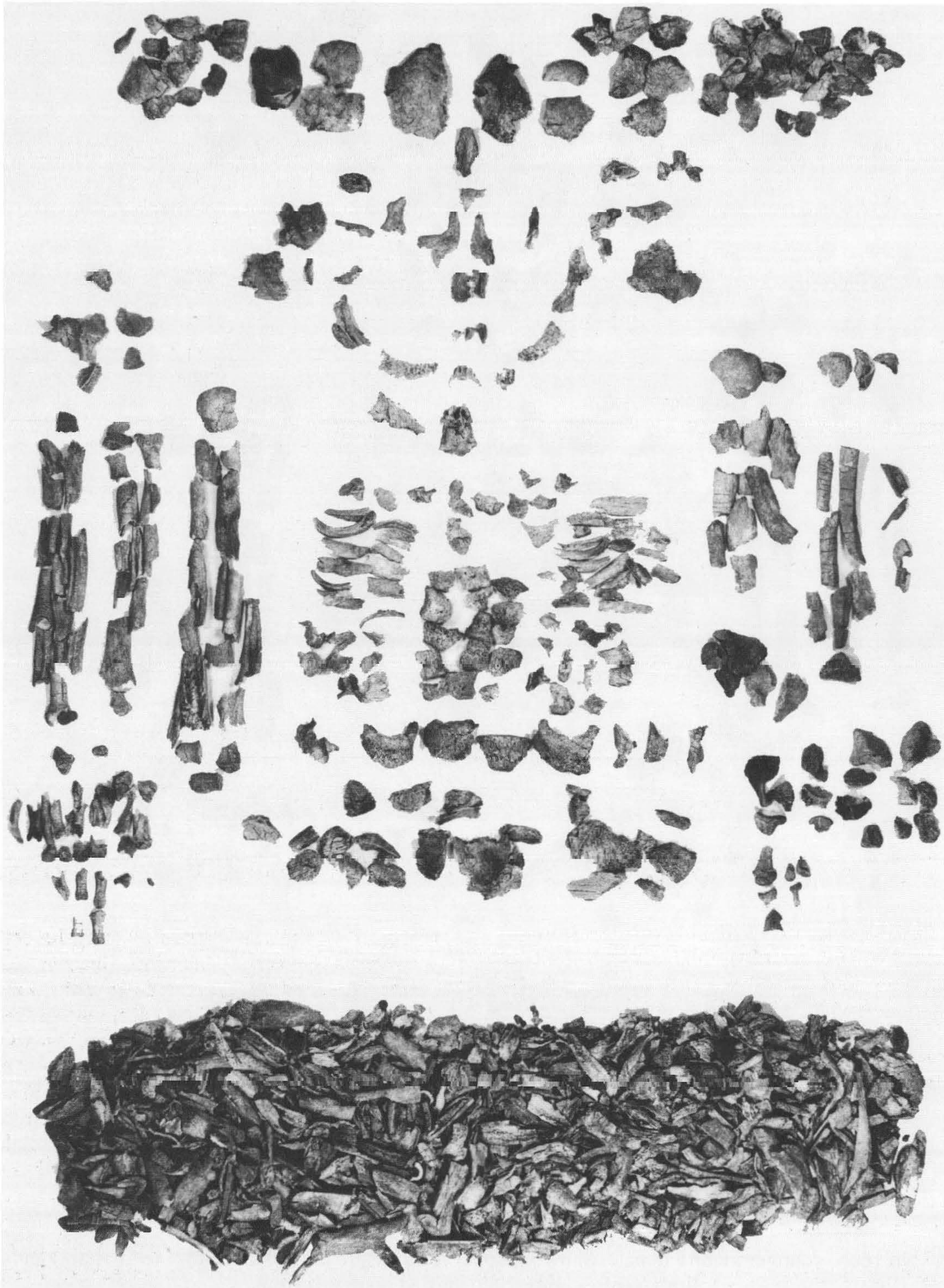


Plate VI No.1647, younger mature male. Showing upper limb (centre left), skull (top), axial (centre) and lower limb (centre right). Unidentified bone at bottom.

months and so on. The age at which epiphyseal fusion takes place varies similarly; in both cases, it is known that female development is in advance of male. Different reference books suggest slightly different ages of fusion for the various epiphyses, and there is bound to be a certain amount of variation between individuals anyway.

Once adulthood is attained, the accuracy to which age may be estimated diminishes even further. Individuals appear to age at different rates depending on a variety of genetic and environmental factors. Although it is generally held that degenerative processes increase with age in both frequency and severity, hard and fast rules and close age ranges cannot be adhered to with confidence. This argument has been reinforced by recent work on the Spitalfields crypt collection. The ages produced during examination of the skeletal material illustrated a tendency to over-age those individuals under 45 years and under-age those over 45 years. This analysis also illustrated the genetic links affecting the degenerative ageing processes, the members of one family were

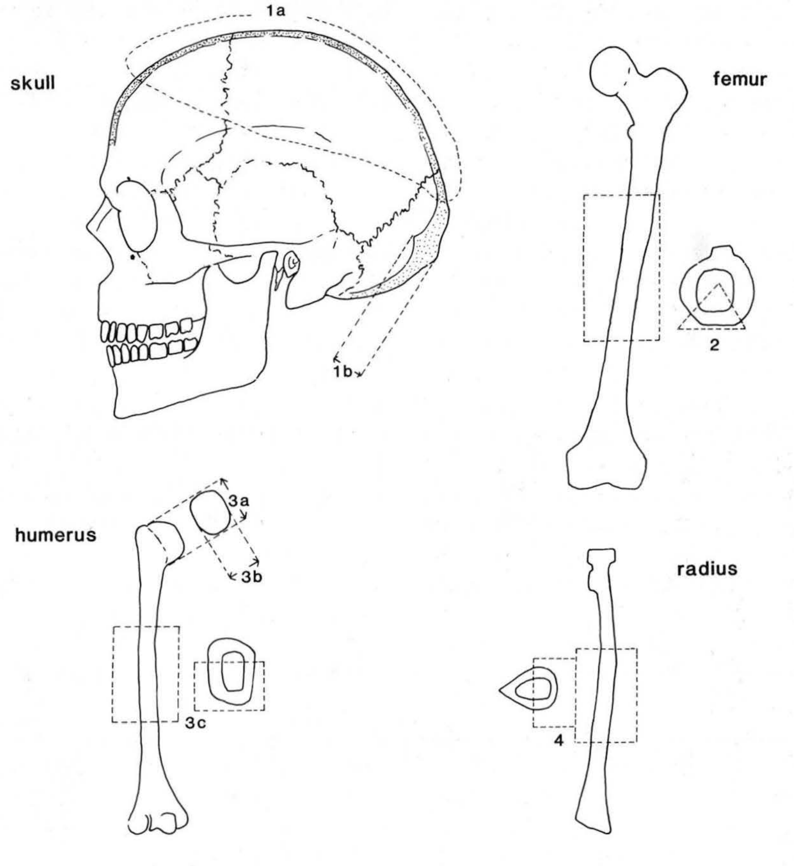


Figure 11 Areas of skeleton used for measurements to indicate sexual dimorphism. After Gejvall (1981).

infant	0–4 yr.	(young 0–2 yr.	older 3–4 yr.)
juvenile	5–12 yr.	(young 5–8 yr.	older 9–12 yr.)
subadult	13–18 yr.	(young 13–15 yr.	older 16–18 yr.)
adult: young	19–25 yr.		
adult: mature	26–40 yr.	(younger 26–30 yr.	older 31–40 yr.)
adult: older	40+yr.		

Table 1 Age categories.

consistently over-aged, whilst the members of another family were consistently under-aged (M. Cox, pers. comm. 1989).

It is for these reasons that age categories are used, both in this, and in other studies undertaken by the writer.

V. Criteria for ascertaining sex

(Fig. 11)

The ease of sexing, as with ageing, largely depends on the presence of certain bones within a cremation. As explained in section III above, there rarely seems to have been complete collection of the cremated remains, which leaves an incomplete record on which to base the assessment, and all the additional problems that entails.

Sexing of the Spong Hill material, as with most human skeletal remains, was restricted, with a couple of exceptions, to adults because the sexually dimorphic traits of the skeleton are usually insufficiently defined in immature individuals. The sex of the adults was assessed with varying levels of certainty, depending on the quantity and quality of information available. Assessment was based on the sexually dimorphic traits of the skeleton, as outlined by Brothwell (1972a) and Bass (1987).

The innominates provide the most secure evidence of the sex of an individual, being directly linked with childbirth. Fragments of innominate were frequently recovered from the Spong Hill material, particularly the area of the greater sciatic notch. Unfortunately, the fragments were not always sufficiently large enough to observe the angle and enable secure sexing. The skull was almost always well represented and this area of the skeleton is probably the second best to use for the determination of sex. The male skull is typically larger and more robust, with greater definition of features, such as the mastoid processes, supra-orbital ridges and the external occipital protuberance (Figs 8 and 9). The post-cranial skeleton may also provide information about sex. As with the cranial features, the female skeleton tends to be smaller and more gracile than the male. These features may be most evident in the relative sizes of articular heads and the robusticity of muscular tendon attachments.

However, caution must be applied. There are variations in the reliability of certain features between skeletal groups (*i.e.* groups from different periods or different places). Whereas some groups may display quite clear definition of a certain feature between the sexes, another may not. There is always a degree of overlap between the sexes within any one group. It is not acceptable, therefore, to sex a cremated individual on the strength of a single dimorphic feature. Several corresponding features are needed to provide a reliable assessment. Traits may contradict one another within a single cremation. In these cases, the individual is best left unsexed. A 'points' system, similar to that suggested by Acsadi and Nemeskéri (1970) may be used. At Spong Hill, a four-tier system of categorisation was used: unquestioned, probable (?), possible (??), and unsexed.

There has been a growing tendency in recent years to apply metrical criteria in the determination of sex within cremated material, to increase the objectivity of the methods described above (Gejvall 1981, Van Vark 1975, Wahl 1982). Holck (1986) has outlined some of the methods and various authors' objections to their use for the sexing of cremated bone. Particular reference is made to the limitations of measurements of vault thickness and cortical thickness of the long bones, where there may be considerable variation in thickness over the areas suggested for measurement.

Where practical within the Spong Hill material, measurements were made to provide additional evidence for sexing, but numerous problems with the applicability of the methods became apparent over time, showing their limited use for archaeological cremations.

Both Gejvall and Van Vark devised their methodologies with reference to modern cremated material, thus of known sex. This also means, however, as will be demonstrated in Chapter 5, that more or less the entire skeleton would have been present, and that the bone, particularly the articular heads of the long bones, would have been less fragmentary than is usual in archaeological cremations. A major problem in applying the methods to archaeological cremations is that many of the bones needed to take the measurements from, particularly the seventy-nine measurements suggested by Van Vark, are either not present at all or only as fragments of an unusable size. Of these seventy-nine measurements, the writer has estimated that only 7.6% may be taken frequently, 8.9% occasionally, and a further 10.1% rarely. The remaining 73.4% of measurements can be taken so rarely (once in 2,500 is hardly statistically viable), they are barely worth considering. Variations in the amount of shrinkage between and within cremations (see below) creates additional limits to the application of the methods.

With the Spong Hill bone, not all of the measurements that could have been made were recorded, though a subjective record of relative sizes was made. Measurements of the articular heads were taken where they survived entire. The most frequent survivor was the radial head, of which thirty-eight were measured, that is, only 2.6% of the adults identified. It will be apparent from this low percentage of survival that, even though relevant bones will survive in some cases, the same bones will not be recovered in every case. This makes meaningful statistical analysis of the collected data difficult. It is felt, however, that the recording of a selection of the more commonly occurring measurements suggested by Van Vark is a useful addition to the sexing criteria, especially when the results are used in conjunction with the other, non-metrical analyses.

As it is not possible to be sure that the required point of maximum vault thickness in Gejvall's stipulated '1a' area (Fig. 11) was amongst those fragments of vault collected for burial, there is likely to be a bias towards sexing an individual as female using this trait alone, see McKinley (forthcoming (c)) for further discussion. In an attempt to counteract the bias, measurements were only taken where at least six or more appropriate fragments of vault were available. The '1a' measure was taken in 272 of the cremations; the number of fragments, mean and standard deviation for each are presented with the Details of Cremation Identifications (archive). The results showed the method to be of limited reliability, with few of the readings falling into clear female or male groups. A major problem with taking the thickness of the long bone shafts as suggested by Gejvall (1981, and Fig. 11), was the identification of the exact fragment of bone needed. This difficulty was accentuated by small fragment size. As with the skull vault, there are local variations in thickness. It was not considered to be worth the extra time attempting to use maximum cortical long bone thickness. A general comment on size and robusticity of the long bones was made instead.

In 1982, Wahl published a new criterion for sexual diagnoses in cremated material, using the petrous temporal (ear region). His data base was constructed on a non-homogeneous group of 154 inhumed skeletons, the dates of which covered 1200 years. The sex of the individuals was assessed largely from the dimorphic traits of the skull and, in two-thirds of cases, the post-cranial indicators as well. A series of five variables was constructed, the measurement of some involving a rather complex process with lengths of cotton passed along some of the narrower canals of the bone. Using this technique, a variation between male and female was noted. However, the graphs suggest that there was a large overlap between the two groups for each variable.

Wahl had chosen the petrous temporal on which to work because this particular bone is frequently recovered in archaeological cremations. Applying this method to cremated material, the problem of shrinkage is highlighted. Wahl argues for a 8–10% shrinkage factor to be taken into consideration, even though earlier, in the same paper, he had pointed out that different workers had calculated between 12–25% shrinkage factors in cremated bone. Provided the measurements taken within each group of cremations were compared only with each other and not with inhumed material (which after all would not be necessary), it would be safer to make no adjustments for shrinkage at all. Shrinkage may vary considerably between and within cremations depending on a number of factors (see Chapter 5) and taking a single figure to cover all eventualities is pointless.

This method was not attempted in the identification of the Spong Hill cremations because the enormous expenditure in time it would take to make the measurements, balanced against the poor statistical reliability of the end product, would not have made it worthwhile. Future research may increase the viability of the method, particularly as the petrous temporal is so frequently recovered. However, it would be of interest to see the method developed on a more homogeneous group of individuals of known sex, on a similar basis to those devised by Van Vark, who used modern cremated material.

With respect to all the metrical analyses outlined above, the same point must be emphasised as with the non-metrical methods, that no single dimorphic trait should be used to assess the sex of an individual, whether cremated or not. There is too much variation within a group, and certainly between groups, to make this acceptable. A combination of metric and non-metric analysis provides the ideal base for assessment. Caution should be exercised when comparing the metrical results from two groups of skeletal material, where considerable variation may arise. There is a danger with metrical data that the information will be taken as an exact, universal measure, but each human skeleton is highly individual and does not always lend itself to such treatment.

At all times, the sex of the individual was assessed on the osteological evidence alone and not on the associated grave-goods: the writer did not become acquainted with these until after the osteological examination was completed.

VI. Stature estimation

Many European workers attempt to estimate the stature of cremated remains using the diameter measurements of humeral, radial and femoral heads (Malinowski 1969, Gralla 1964). Gralla uses the regression equation obtained by Müller, calculating the length of the radius from the diameter of the head and using one of the known methods (*which* known method is not stated, possibly Trotter and Gleser 1952, 1957), to estimate stature. The accuracy obtained is claimed to be ±7.5cm in skeletons of known sex, and ±10.0cm in those of undetermined sex. In her own study on 162 inhumations from a medieval cemetery, Gralla calculated a correlation coefficient between the radial head diameter and the length of the skeleton *in situ*. In this way, an estimate of body height with an accuracy of ±6.1cm for males and 5.5cm for females was obtained. The formula for stature estimation devised by Malinowski uses measurements of the humerus, radius and femur heads. The data base was constructed upon a skeletal group from the south of France.

Both these methods have been constructed using archaeological skeletal material. The 1952 analysis by Trotter and Gleser was carried out on 1200 military personnel from American World War II casualties, all males of known age and height. A further 825 individuals from the Terry Collection were also studied. In the 1957 studies, a further 5517 individuals from the Korean War casualties, all males of known age and height, were examined. The relationships of stature to length of long bones within the different ethnic groups represented was found to differ sufficiently to require different regression equations to be used. A variation in the estimated statures between the two studies was also noted. A reliability to within 1.47cm was found when the femur alone was used, as against 2.07cm when an average of several measurements was used. It was also found that a loss in stature occurs as an individual ages and a shrinkage in long bone length will take place as the bones dry out after death (Trotter and Gleser 1952).

There is a very great difference in the size and quality of the data on which the methods of Trotter and Gleser have been constructed, compared to those using the diameter of articular heads. Even with the excellent data base of Trotter and Gleser there are a number of variables which come into play and we still have only an estimate of known reliability. The writer has compared the two methods of stature estimation, using long bone measurements and the diameters of articular heads within the same skeleton. The results showed a 4–5cm difference (not including the minimum ±1.47cm reliability using Trotter and Gleser's methods).

Obviously, it is not possible to use Trotter and Gleser's long bone measurements to estimate the stature of cremated individuals. There are, however, numerous problems in attempting to estimate the height of cremated individuals using the measurements of the articular heads apart from the objections outlined above.

Firstly, the relevant bones have to be present in a complete state, to enable the primary measurement to be made. As illustrated above, this is a rare occurrence. The cremated bone from Spong Hill was not particularly fragmentary, and yet, from the almost 2300 individuals identified, there were only thirty-eight complete radial heads, two complete humeral heads and no complete femoral heads.

Secondly, the sex of the individual needs to be known in order to ascertain which of the two sets of equations to use with the Malinowski method, or to obtain better than ±10cm reliability with Müller. The confidence with which one may sex a cremated individual may be considerably reduced compared with the ease of sexing inhumed material (section V).

There is also the ever present problem of shrinkage during cremation, variations between 0–25% being recorded (Holck 1986). Using a universal shrinkage factor is hardly adequate since individuals cremate differently dependent on a number of variables, not all of which may be allowed for (Chapter 5).

The ethnic variations noted by Trotter and Gleser, necessitating the use of different regression equations for different groups, highlight the unreliability of transferring equations devised for use on one group to another, often distant in time and space. Using a small data base on which to calculate these equations will do nothing to alleviate the inherent problems.

All these points suggest that an estimate of stature, accurate to only ±5–10cm, and based upon estimates to begin with, is not only not worth the trouble but may also be misleading. The unreliability of the end product does not warrant the use of this method. Stature has not been estimated for the mere 2.8% of the adult population of Spong Hill for whom estimates may have been possible. The writer feels, with the methods currently available, it is more realistic to restrict comment to observations on the relative size and robusticity of the individual. The relevance of the latter point may be emphasised further considering that the height of an individual in itself is not static even in adulthood, height will decrease from a maximum with age and even diminishes during the course of a day due to fatigue.

Chapter 3. Results

A summary of the results, comprising the urn number, total weight of the cremation, the number of individuals, age and sex of the individual(s), pathology, animal species and grave-goods in each urn, are presented here in tabulated form (Table 2).

The full details for each cremation are in the Details of Cremation Identification (archive). They include:

a) Urn number, with * if complete urn, or urn number equal to/mixed with.

b) All identified bone in each category of skull, axial, upper limb and lower limb. Any measurements taken and description of pathological lesions/morphological variations.

c) Description of pathological lesions/morphological variations.

d) Type of pathology/lesions (including morphological variations) and bones affected.

e) Bone with description of colour if other than buff-white.

f) Species/species size of animal bone, weight of each species and percentage by weight of the cremation composed of animal bone. NB. 'sheep' = sheep/goat and includes 'sheep size', see Appendix V for breakdown.

g) Type of grave-good material if fused to specific bone.

h) Age and sex of each individual.

i) Number of individuals and number of urns.

j) Site co-ordinates.

It was originally intended that Julie Bond's animal bone report, on species, age, sex and elements identified, would be included in the Details of Cremation Identifications (archive). Unfortunately, the majority of the information was not received until late in the project, and lack of time necessitated a separate presentation of this information in Appendix V (microfiche).

All cremation weights, percentages and maximum fragment sizes are presented in Table 7 (microfiche).

Urn numbers were allocated as follows. Urns 3 and 14 were found in 1954. The cremations in both cases are incomplete (Chapter 1). Urns 20 to 67 were recovered during the 1968 trial excavations. Urns 1000 to 3326 were excavated between 1972 and 1981. Details of the urns, their condition, associations and grave-goods, may be found in the Spong Hill reports Parts I, II, IV and V, *Catalogue(s) of Cremations* (Hills 1977, Hills and Penn 1981, Hills *et al* 1987, and forthcoming). Numbers 3327 to 3334 were allocated by the writer during the osteological investigation. (see archive). The latter numbers were cremations extracted from grid-square/ context collections. One cremation, no. 3333, had originally been incorrectly recorded, and published, as a grave-good to inhumation 30 (Hills *et al* 1984).

There is a gap in the numerical sequence between numbers 2240 and 2283. These numbers were given to substantial parts of smashed urns found in an area of modern disturbance (see Fig. 3). Bone recovered from the area could not be attributed to any individual urn and was put with the grid square collections (see Chapter 4).

During the movement of the cremations, to Poland, Cambridge and eventually back to the Norfolk Archaeological Unit at Gressenhall, bone from fifty-eight of the cremations was lost (1.7% of those originally recovered). Considerable effort has been made to rediscover the missing bone in the various possible locations but although some was returned to Gressenhall from Cambridge, not all was found.

I. Bone from grid squares and contexts

Almost every collection from each of the 165 grid squares yielding bone contained cremated human bone, often with fragments of burnt animal bone. Some collections were very large; for example grid square 288 contained 1697.8g of bone, representing fragments of at least two adults. A large proportion of the bone must originate from the many disturbed urns on the site (see above). It was not possible, except in a few cases, to attribute any of this material to any one urn. Even a total weight of cremated bone would give no accurate idea of numbers represented, as so much bone must have been lost following ploughing and other agricultural activity. Also, as demonstrated in Chapter 2:III, the weights of cremations may vary considerably. A more realistic idea of minimum numbers in these areas of disturbance is gained from weight of pot sherds (see Chapter 4).

The collections from the 146 contexts containing cremated bone differed from those from the grid squares. There were none of the very large collections found in the grid squares and there is less burnt animal bone and small finds.

The information in both cases was of limited use. (Details in archive).

II. Guide to Table 2

Urn number

Every urn number allocated is represented, with the exceptions noted above.

Urn numbers marked with an asterisk (*), were the complete, undisturbed urns, those marked with a dollar sign ($) contain parts of more than one urn.

As outlined in Chapter 2, post-excavation analysis revealed that some separately numbered and fragmentary urns were identical. This has resulted in the double numbering of some cremations. In these cases, the *in situ* urn fragments have been taken as representing the cremation (x), whilst the joining urns (y) have been suffixed with an equals sign (=) followed by the number of the urn the sherds were found to have originated from *i.e.* y = x.

In the vast majority of cases, 'un-urned' cremations were not separate cremations at all. Most were shown to be either spills because of disturbance, deliberate deposits of urn contents by 19th-century grave-robbers seeking grave-goods, or deliberate deposits of part of a cremation in the pit around an urn rather than all the bone being placed inside. Again, an equals sign (=), has been suffixed to these numbers giving the urn of origin as above.

Where one urn number is shown as equal to another, the weight of bone is recorded, but further information may only be present under the number of the urn of origin. Details are still presented under each urn number in the archive.

There were a few cases where a collection of cremated bone was recovered which may have originated from one of two or more urns. In most instances it was possible to ascertain which was the more likely urn of origin, but in some the bone was mixed. In the latter, each possible associated number follows the equals sign *i.e.* y = x/x as above. Only the total weight is given with the number.

Total weight

The total weight of all bone in each cremation. Weights are in grams, to one decimal place.

Number of individuals

Where any uncertainty existed, either due to dubious multiples (see Chapter 2), or to very small, disturbed cremations *i.e.* less than 50–100g for an adult (which represents only *c.*5% of the cremated body weight), the number of individuals is question-marked *e.g.* '1/2?' or '?'. It was noted in Chapter 2:I that an urn number was occasionally allocated during excavation to what proved to be two or more vessels. No provision has been made in this table to indicate number of urns, but a dollar sign ($) after the urn number marks the presence of more than one urn. The number of vessels represented by any 'urn number' was recorded in the archive, and details may be found in Hills (1977), Hills and Penn (1981), Hills *et al* (1987, and forthcoming). It should not be assumed that every number showing the presence of more than one individual indicates a multiple cremation.

Age

Categories are shown in Table 1. The criteria by which the assessments were made in each cremation may be found in the archive.

Overlap between two categories is shown as, for example, 'subadult/adult'. Where more than one individual was recorded, the entries are numbered, these numbers will correspond to any recorded under 'sex'.

Sex

Categories are given in Chapter 2:V. The criteria by which the assessments were made may be found in the archive. Any numbering will correspond to that in the 'age' section.

Pathology

Morphological variations, although not pathological, have been included in this field. Type of pathology/morphological variation and the affected bone(s) are presented. Where possible, a diagnosis has been made. Where this has not been possible, a description of the lesion(s) has been given instead. Detailed descriptions of the lesions in each case are presented in the archive.

Animal bone

Where present, the species of animal or species size is noted. The majority of the bone recorded as horse/cattle size, is probably horse (Julie Bond, pers. comm.). For sake of simplicity, 'sheep' and 'sheep size' bone has been recorded as 'sheep'. 'Sheep size' may included sheep/pig/roe deer, but the majority is probably sheep (Julie Bond, pers. comm.) This should also be taken as 'sheep/goat', as the species are very difficult to distinguish. Animal accessory vessels are discussed in Chapter 6:II.

Grave-goods

Numbers, materials and basic types are presented. For further details see Hills (1977), Hills and Penn (1981), Hills *et al* (1987 and forthcoming).

Key to abbreviations used in Table 2

Pathology	
o.p.	osteophytes
o.arthritis	osteoarthritis
disc degen.	degenerative disc disease
T.B.	tuberculous
m. v.	morphological variation
Animal	
h/c	horse/cattle size
p/s	pig/sheep size
u/id	species unidentified
imm	immature
A.A.	animal accessory (one of a pair of urns which mostly contains the animal bone from a mutual cremation of human and animal).
u/b	unburnt
Grave-goods	
Ag	silver
Ae	bronze
Fe	iron
a/b	antler/bone
t.s.	toilet set: may include tweezers, razors, ear-scoops, shears, altogether or in a combination of at least two items. With or without ring.
s.w.	spindle whorl
p.p.	playing piece
obj	object
dec.	decorated

Table 2, Results of cremation identifications, follows.

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3	106.7	1	Adult: young	?			
14	29.7	1/?2	Adults	?		deer	
20	117.3	1	Subadult				
21	495.4	1	Adult: mature/older	Male	destructive lesion - finger phalanx: o.p. - finger phalanx: exostoses - finger phalanx	u/id	Fe tweezers
22	40.9	1	Adult	?			glass bead
23	1598.2	1	Adult: mature	?		pig: u/id	2 p.p.: bone bead: Ae: burnt pot
24	0.0		Missing				
25	920.1	1	Adult: younger mature	?Female			comb: ivory: 2 glass beads
26	1076.6	1	Adult: mature	?			crystal bead: burnt pot
27	107.9	1	Juvenile				glass
28	474.0	1	Adult: young/mature	?Female		pig	Ae brooch, sheet: antler ring: 14 glass beads: ivory: s.w.: burnt pot
29	607.1	1	Adult: young/mature	Female			3 glass beads
30	122.2	1	Adult	?			Ae sheet
31 =2411	25.3						
32	739.1	1	Adult: young/mature	Male	o.p. - metatarsal		Ae tweezers: comb
33	383.7	1	Adult: young/mature	?			comb: glass bead: burnt pot
34	53.4	1	Infant		cribra orbitalia		Ae brooch: 2 glass beads
35	11.1	1	Infant: young			sheep: u/id	comb
36	1151.5	1	Adult: younger mature	Male	m.v. - wormian: o.arthritis - axis		glass: Fe shears
37 =58	0.0						
38	48.8	1	Infant: young			p/s	Fe t.s.: glass bead: Ae sheet
39	1434.0	2	1) Juvenile: older/subadult: young 2) Adult: mature/older	2) Female	disc degen. - thoracic, lumbar: o.p. - thoracic	sheep - imm: u/id	glass: comb: s.w.: antler obj.
40	630.5	1	Adult: mature/older	??Male	disc degen. - cervical, sacral: ligament ossification - thoracic: o.p. - lumbar: exostoses - femur	pig - imm: dog: u/id	Ae t.s.: Fe blades
41	135.4	1	Adult	?			Ae strip: comb: ivory
42	618.7	1	Adult: young/mature	?			Ae buckle: Fe sheet: burnt pot
43	158.5		A.A. to 40	?		dog	
44 $	796.2	1	Adult: older mature	??Male		cattle: u/id	glass bead
45	99.1	1	Juvenile				
46	42.4	1	Adult: older	?	o.arthritis - cervical		
47	48.3	1	Juvenile: young			sheep	
48	57.2	1	Infant				Ae wire: Fe
49	0.0		Not an urn - pottery spread				
50	500.2	1	Adult: younger mature	Male	o.arthritis - atlas		
51 =50	199.2						Ae
52	829.3	1	Adult: mature	Female	o.arthritis - atlas, axis: disc degen. - thoracic/lumbar	cattle: u/id	3 Ae brooches: 20 glass beads: ivory
53	887.3	1	Adult: older mature/older	?Female	o.arthritis - atlas, axis: pitting - ischium	pig: u/id	glass bead
54	154.1	1	Adult: mature/older	?		u/id	comb
55	13.8	1	Infant: young			sheep: u/id	Fe shears
56	11.1	1	Infant			p/s	Fe shears
57	142.0	1	Infant: older			u/id	
58	427.7	1	Adult: older mature/older	?Female	disc degen.- cervical		Fe 2 brooch springs, ring: antler ring: 6 glass beads
59	327.1	1	Adult	?			
60	18.8	1	Immature			u/id	
61 $	804.7	1	Adult: mature	?Male	o.arthritis - atlas		
62	388.7	1	Adult: mature	?	disc degen. - thoracic: exostoses - finger phalanges		2 Ae brooches: 4 glass beads: ivory
63	265.1	1	Adult	?			2 glass beads: s.w.: ivory
64	0.0		No. not used				
65	1349.2	1	Adult: older mature/older	??Male	o.arthritis - atlas: o.p. - lumbar		Ae tweezers: Fe knife: glass
66	1118.1	1	Adult: older	Male	o.arthritis - cervical, thoracic, finger phalanx, knee: disc degen. - thoracic/lumbar: cyst - ulna, lunate		Fe obj.
67	5.0	1	Infant: young				
1000	2.3	1?	?	?			
1001	609.9	1	Adult: younger mature	?			comb
1002	642.3	1	Adult: mature	?Female	new bone - radius		10 glass beads
1003 *	165.8	1	Juvenile				
1004	333.4	1	Juvenile			u/id	Ae
1005	1.6	?					
1006	428.3	1	Older subadult/young adult	?Female			glass: Ae

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1007	386.1	1	Older subadult		m.v. - tooth crown	u/id	glass bead
1008	308.2	1	Adult: young	??Female			glass
1009	448.5	2	1) Adult: mature 2) Infant	?	periodontal disease	sheep-imm	10 glass beads
1010	243.1	1	Adult: young	??Female		sheep: u/id	
1011	1372.4	1	Subadult: older	??Male	periostitis - fibula, ?ulna	horse: h/c: u/id	Fe t.s.: ivory: 10 glass beads: antler s.w.: glass vessel
1012	930.3	1	Subadult: older			horse: u/id	3 glass beads
1013	131.0	1	Adult	?			Ae
1014	53.2	1	Adult	?	m.v. - wormian		s.w.: glass
1015	237.9	1	Subadult: young				14 p.p.
1016	0.0		Missing				
1017	820.8	1	Adult: young	??Female			glass beads
1018	37.3	1	Infant			h/c	
1019	588.4	1	Adult	??Male		horse: dog: u/id	Ae: 8 glass beads: ivory
1020*	42.9	1	Infant			sheep	
1021	419.2	1	Infant/juvenile				Fe t.s.
1022	175.2	1	Subadult			u/id	5 crystal and glass beads
1023	1759.1	1	Adult: younger mature	Male	destructive lesion - lumbar: disc degen. - lumbar: ligament ossification - lumbar: periostitis - tibia/?femur	sheep: h/c: u/id	comb: glass vessel
1024*	794.3	1	Adult: mature	?		horse: h/c: u/id	Ae tweezers
1025	2579.7	1	Subadult: older	?		horse: h/c: u/id	
1026	293.3	1	Adult: mature	??Female	o.arthritis - axis		Ae: 4 crystal and glass beads
1027*	0.0		Missing				Ae: ivory: glass
1028	890.1	1	Adult: younger mature	??Female		sheep: u/id	
1029	530.7	1	Adult: mature	?	disc degen. - cervical		
1030	1239.9	1	Adult: younger mature	??Male			
1031	238.5	1	Adult	?			
1032	466.9	1	Adult: young/younger mature?			u/id	glass vessel
1033	7.5	1	Infant/juvenile			u/id	glass
1034	510.3	1	Adult	?			2 Ae/Fe brooches: 20 glass beads
1035	371.7	1	Adult	?			Fe t.s.
1036	314.7	1	Adult	?			
1037	658.2	1	Adult: mature?		o.p. - finger phalanx		
1038	1631.2	1	Adult: young/younger mature	?	m.v. - tori		comb
1039	395.4	1	Adult	?			comb
1040	601.4	1	Adult: young/younger mature	?			3 p.p.: bead
1041	61.4	1	Adult	?			
1042	62.2	1	Adult	?	m.v. - tori: periodontal disease		10 glass beads
1043	157.5	1	Adult	?		pig: u/id	Ae: ivory: 2 glass beads
1044	17.5	1	Infant			sheep	Ae brooch
1045	1402.9	1	Subadult	??Male		horse: h/c: u/id	Ae: comb: glass
1046	1121.2	1	Adult: young/younger mature	?	o.p. - foot phalanx	horse: u/id	Ae: glass vessel: p.p.
1047	888.4	1	Adult: mature	?			36 p.p.
1048	6.5	1	Juvenile: older				glass
1049	2.2		Mostly missing				
1050	28.6	1	Adult	?			Ae: glass bead
1051	65.6	1	Infant: young			sheep	Fe arrow head
1052	175.5	1	Adult	?	o.p. - finger phalanx		comb: Fe t.s.: ivory
1053	960.4	1	Adult: young/younger mature	?			Ae tweezers
1054 =1090	391.0		All animal			horse: h/c: sheep: u/id	
1055*	1735.4	1	Adult: mature	?		horse: h/c: u/id	Ae: glass: ivory
1056*	1005.6	1	Adult: mature	?	o.p. - finger phalanx: destructive lesion - lumbar: disc degen. - lumbar		Fe
1057	0.0		Missing				Ae brooch: 3 p.p.
1058	283.1	1	Adult	?			glass vessel: ivory: s.w.
1059	758.7	1	Adult	?		horse: h/c: u/id	
1060	18.6	1	Infant: young				7 glass beads: Ae
1061	7.1	1	Infant: older	?			Ae brooch: 3 glass beads
1062	38.6	1	Infant/juvenile	?	m.v. - 3rd centre (metatarsal)		
1063	440.5	1	Adult	?			Fe tweezers
1064	904.2	1	Adult: young	??Female	periostitis - ulna	horse: h/c	Ae tweezers: Fe shears
1065	0.0		Missing				3 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1066	0.0		Missing				
1067	764.7	1	Adult: young	?	o.arthritis - cervical	u/id	Ae tweezers: glass
1068	75.0	1	Adult/subadult	?			3 glass beads
1069	0.0		Missing				
1070	16.7	2	1) Infant/juvenile: young 2) Adult	?		sheep - imm	glass: burnt sherds
1071	0.0		No bone				
1072	945.1	1	Adult: younger mature	?			Ae brooch: 40 glass beads
1073	14.2	1	Juvenile				
1074	3.8	1	Infant/young juvenile				
1075	840.2	1	Adult: young/mature	?		horse: h/c: u/id	
1076*	294.6	1	Adult: young	?		h/c: u/id	Ae: glass
1077	1377.0	2/?4	1+2) Adults: young + young/mature 3+4) ?Immature	1+2) ??Male ??Female	o.arthritis - axis: exostoses - femur		3 glass beads: antler ring u/id
1078	776.0	1	Adult: mature	??Male			
1079	42.7	1	Juvenile: young				comb
1080	148.3	1	Juvenile				Ae: glass bead
1081	709.1	1	Adult	?			Ae: bone bead
1082	0.0		Missing				
1083	35.5	1	Adult/older subadult	?			
1084*	5.4	1	Infant	?			
1085	1435.1	1	Adult: young/younger mature	?	m.v. - metopism	horse: h/c: u/id	Fe: glass
1086	0.0		Missing				glass
1087	6.1		Mostly missing				Ae: glass vessel
1088	1250.9	2	1) Adult: young/younger mature 2) ?juvenile	1)??Male			comb: antler bead
1089*	0.0		Missing				Fe knife
1090 =1054	133.9					horse: u/id	
1091	0.0		Missing				Ae: 4 glass beads
1092	1027.1	1	Adult: young/younger mature	??Female			bone bead
1093	826.5	1	Adult: mature	?Male	o.p. - thoracic		
1094*	505.6	1	Adult: young/younger mature	??Female			
1095	643.2	1	Adult: young	?		horse: u/id	glass vessel: Ae: bone bead
1096	704.1	1	Adult: young/younger mature	??Female	o.p. - mandible		glass bead
1097*	771.6	1	Adult: mature	?	dental abscess - mandible		12 glass beads: Ae brooch
1098	450.4	1	Adult: young	?			Ae: 8 glass beads
1099	629.5	1	Adult: young	??Female		horse: h/c: u/id	Fe: 3 glass beads: comb
1100	1095.0	1	Adult: young/mature	?Male			Fe t.s.: glass bead
1101	55.4	1	Adult	??Female			
1102	202.6	1	Adult	?			
1103	23.9	1	Juvenile: young	?			
1104	616.4	1	Adult: mature	??Female			10 glass beads: comb
1105	1118.1	1	Adult: mature	??Female	o.arthritis - axis: o.p. - finger phalanx	sheep - imm: u/id	Ae sword pommel: Fe tweezers: antler bead
1106	624.4	1	Adult: young	?		horse: h/c: u/id	
1107*	1438.1	1	Adult: mature	??Male	tooth loss: periodontal disease: Schmorl's node - thoracic: destructive lesion - thoracic	u/id	
1108*	63.5	2	1) Infant 2) Adult/subadult: older	?			2 glass beads
1109	1677.5	1	Adult: mature	Female	o.p. - foot phalanx		Ae t.s.: a/b bead
1110	548.4	1	Adult/subadult	?		horse: h/c: u/id	
1111	521.1	1	Adult: young/mature	?			
1112	240.5	1	Juvenile/young subadult	?			6 glass beads
1113	340.1	2	1) Infant 2) Adult: young/ older subadult	?		h/c: u/id	
1114	0.0		No bone				
1115 =1110	17.3						
1116	590.7	1	Adult: older mature	??Female	disc degen. - cervical: destructive lesions - distal ulna: o.arthritis - finger phalanx		
1117*	349.3	1	Adult	?			ivory: glass: comb
1118*	33.7	1	Infant: young			sheep - imm: u/id - imm	
1119	8.4	1	Infant				
1120*	976.5	1	Adult: young/mature	?		u/id	glass: counter: Fe
1121*	1471.9	1	Adult: mature	?			

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1122	0.0		Missing				glass bead
1123	138.1	1	Adult	??Female			
1124	13.5	1	Infant			sheep	2 glass beads
1125	192.4	1	Adult: young/younger mature	?		sheep	Ae: Fe
1126	35.8	1	Adult/subadult	?			
1127*	370.0	1	Adult	??Male			
1128*	419.3	1	Subadult: older/Adult : young	??Female		sheep: h/c: u/id	Ae tweezers: Fe: hone
1129	690.0	1	Adult: young/mature	?			Ae brooch
1130	114.2	1	?Immature				
1131	91.2	1	Adult/subadult	?			Fe tweezers
1132	148.9	1	Adult/subadult	?			a/b bead
1133	2159.5	1	Adult: young	?	periostitis - fibula	horse: h/c: u/id	glass vessel: 3 p.p.: worked bone needle
1134	1147.9	1	Adult	?		horse: h/c: u/id	p.p.
1135	3.0	1	Infant				
1136	911.1	1	Adult: younger mature	??Female			ivory: comb: Ae: glass
1137	653.5	1	Adult: young/younger mature	?			
1138	368.2	2	Adult: mature	?	o.p. - cervical/thoracic		Ae brooch: 8 glass beads: ivory
1139	276.2	1	Adult	?			Ae tweezers: glass
1140	172.4	1	Adult	?			Ae: Fe: 12 glass beads
1141	0.0		Missing				
1142*	684.2	1	Adult: young	?			Fe: 12 glass beads: Ae: comb: ivory
1143	720.9	1	Adult: young/mature	?		sheep	
1144	737.8	1	Adult: older mature/older	?	o.p. - lumbar: destructive lesions - lumbar	h/c - imm: u/id	
1145	145.0	1	Adult/subadult	?			Ae: glass
1146	119.5	1	Older infant/young juvenile	?		u/id	Fe: 3 glass beads: Ae
1147	571.6	1	Adult: mature	?	o.p. - finger phalanx		
1148	404.7	1	Adult	?		u/id	glass
1149	1060.9	1	Adult: older	??Male	o.arthritis - atlas, axis		Fe t.s.: dec. antler
1150	63.1	1	Older infant/young juvenile				
1151	800.2	1	Adult: young	?			Fe t.s.: 9 p.p.: comb
1152*	766.3	1	Adult: younger mature	Female			Ae: glass
1153	136.8	1	Infant/juvenile				
1154*	671.2	1	Adult: mature	?			Fe
1155*	49.8	1	Infant			sheep	ccmb
1156	507.5	1	Adult: young/younger mature	Female			glass vessel: comb
1157	119.1	1	Subadult/adult	?			
1158$	889.7	1	Subadult: older	?			Fe: glass bead: a/b bead: comb
1159	0.0		Missing				glass
1160	515.2	1	Adult: younger mature	?			Ae brooch
1161	99.5	1	Infant				Fe: antler s.w.
1162	143.2	1	Juvenile: young				2 glass beads
1163	562.0	1	Adult: young/younger mature	?			Ae brooch: glass
1164	95.0	1	Infant				
1165	30.8	1	Infant				Fe
1166	647.8	1	Adult: young/younger mature	?			
1167	628.6	1	Adult	?			Fe t.s.
1168	415.3	1	Adult	?		sheep/goat horn	Ae brooches: Fe: glass bead: bone bead
1169	136.4	2	1) Infant 2) Subadult/adult	?			2/3 glass beads
1170*	28.2	1	Adult: young/younger mature	?Female	periostitis - metacarpal	u/id	Fe t.s.: comb + case
1171	130.3	1	Subadult/adult				glass bead
1172	269.8	1	Adult: young/younger mature	?			
1173	139.4	1	Juvenile: young			sheep - imm: u/id - imm	
1174$=`170	517.9		No bone: wrongly numbered ?			Fe	
1175	25.9	1	Infant				
1176	46.5	1	Infant				Ae brooch: Fe blade: Ae
1177	112.3	1	Adult	??Male			
1178*	746.0	1	Adult: older mature/older	??Male	o.arthritis - atlas: o.p. - thoracic, finger phalanx	u/id	Ae: 6 glass beads: ivory
1179	32.1	1	Subadult/adult	?		sheep	Fe
1180	11.8	1	Infant				

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1181	31.9	1	Infant				
1182	807.9	1	Adult: younger mature	?			pot s.w.: 3/5 glass beads: Ae: Fe
1183	969.2	1	Subadult			sheep - imm: u/id - imm	Fe t.s.: comb + case: 2 a/b beads
1184	1140.2	1	Adult: young/younger mature	??Male			Fe t.s.: comb
1185	283.3	1	Adult	?			
1186	0.0		Missing				
1187	462.1	1	Adult: mature/older	?	tooth loss	h/c	Ae: glass bead: antler ring: Fe: burnt pot
1188	717.7	1	Adult: mature	?			Ae: chalk s.w.: 9 glass beads: comb: Fe
1189$	67.0	2	1) Infant 2) Adult: mature	2)??Male			comb
1190	821.8	1	Adult: young/mature	?			
1191	22.8	1	Infant				
1192	82.0	1	Adult	?		sheep	6 glass beads: comb
1193	1145.7	1	Adult: older mature	??Male	o.p. - thoracic, lumbar: Schmorl's node - thoracic: ligament ossification - thoracic hypercementosis	u/id	comb
1194	171.5	1	Subadult/adult	?			
1195	562.7	1	Adult: younger mature	?		u/id	ivory
1196	9.9	1	Subadult/adult	?			
1197	37.2	1	Subadult/adult	?			
1198$	186.1	1	Adult: mature	?			Fe
1199*	2874.6	1	Adult: young/younger mature	?		horse: h/c: sheep: u/id	glass vessel: p.p.
1200	1156.7	1	Adult: young	?		horse: h/c: u/id	glass bead: burnt pot
1201*	1135.3	1	Subadult: older/adult: young	?		horse: sheep: h/c: u/id	Ae tweezers: glass
1202	0.0		Missing				
1203 =1113	25.3					u/id	
1204 =1113	18.4					u/id	
1205 =1113	23.9					u/id	
1206	1279.9	1	Adult: mature	Female	o.p. - cervical, thoracic: disc degen. - cervical	sheep: u/id	burnt pot
1207	793.7	1	Adult: mature	??Male	o.p. - cervical: disc degen. - cervical	p/s: u/id	Ae: ivory
1208	222.7	1	Adult: young/younger mature	?			glass
1209	180.5	1	Adult: younger mature	?	o.arthritis - atlas: disc degen. - cervical		Ae: glass bead: comb
1210	453.9	1	Adult: older mature	??Female	o.p. - cervical, thoracic: disc degen. - cervical, thoracic: o.arthritis - axis, costo-vertebral		
1211	218.6	1	Subadult/adult	?			2 Ae brooches: Fe: glass bead: Ae + Ag obj.
1212	52.6	1	Infant			u/id	Fe t.s.
1213	721.3	1	Adult: young/younger mature	?		dog: u/id	20 glass beads: antler s.w.: ivory
1214	335.3	1	Adult: younger mature	?	o.p. - sacral		Ae tweezers: Fe tweezers: Fe objs.: 2 glass beads: Ae obj.
1215	1550.8	1	Adult: younger mature	?	o.arthritis - atlas		
1216	839.0	1	Adult: young/mature	?		sheep: u/id	Ae brooch: 7 glass beads: 3 Fe brooch pins: comb: Fe obj.
1217	55.7	1	Infant: young			u/id	Fe - buckle, 2 arrowheads, blade
1218	149.7	1	Older juvenile/young subadult				
1219	854.5	1	Adult: younger mature	?			Fe tweezers
1220	451.0	1	Adult: mature	?	o.arthritis - atlas		Ae tweezers
1221	332.0	1	Adult	?		pig: u/id	Fe tweezers
1222	482.7	1	Adult	?		u/id	Fe
1223	662.6	1	Adult: mature	?	o.p. - lumbar	u/id	Fe
1224	1209.8	1	Adult: young/younger mature	??Female		horse: h/c: u/id	Fe tweezers: glass: 4 p.p.
1225	46.0	1	Adult: mature	?	o.p. - patella		glass
1226	0.0		No bone				
1227	41.4	1	Infant: young				Fe arrowhead, blade: comb
1228	579.7	1	Adult: mature	??Male	tooth loss: disc degen. - cervical		Ae tweezers: burnt pot
1229	10.7	1	Infant: young			u/b sheep	
1230	138.6	1	Adult: young/mature	?			comb: glass
1231	2.5	?	?	?		dog	
1232	4.9	?	Adult/subadult	?			
1233	0.0		Missing				
1234	164.7	1	Adult	??Female			glass bead
1235	13.0	?	Adult	?			
1236	143.1	1	Subadult/adult	?		h/c: u/id	roman coin: glass
1237	138.9	1	Juvenile/subadult				
1238	83.2	1	Adult	?			Fe blade
1239	0.0		No bone				

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1240	26.5	1	Juvenile: young		m.v. - tooth crown		comb
1241	129.0	1	Subadult/adult	?			
1242	0.7	?	?				
1243	0.0		Missing				
1244	557.0	1	Adult: young/younger mature	?		sheep: p/s: h/c: u/id	Ae brooch, key, bar: Fe tools: 12 glass beads: ivory: a/b bead
1245	1118.4	1	Adult: young/younger mature	??Female		ps: h/c: sheep: u/id	Ae: Fe blade: glass bead
1246*	931.3	1	Adult: young	??Female		sheep: u/id	Ae brooch: 10 glass beads: crystal bead: s.w.
1247*	887.7	1	Adult: younger mature	??Female	o.p. - cervical		8 glass beads
1248*	836.0	1	Adult: older mature	??Female	destructive lesion - pubic symphysis	u/id	
1249	144.1	1	Juvenile: older		m.v. - metopism, 3rd centres (metacarpals)		antler ring: a/b obj.: glass bead
1250	752.8	1	Adult: younger mature	??Female			7 glass beads
1251*	3.3	1	Infant: young/neonate				3 glass beads
1252	583.0	1	Adult: older mature/older	?	tooth loss: periodontal disease	u/id	Ae brooch: 12 glass beads
1253	159.3	2	1) Infant: older/juvenile: younger	?			
			2) Adult				
1254*	1588.7	1	Adult: younger mature	?	o.p. - rib		
1255	383.0	1	Adult	?		pig: u/id	Fe blade
1256*	1721.9	1	Adult: older mature/older	Male	o.p. - cervical, lumbar: Schmorl's node - thoracic: disc degen. - thoracic: cyst - metacarpal		Ae: Fe t.s.: comb: a/b objs.: crystal
1257	256.7	1	Subadult/adult	?			antler
1258	217.6	1	Adult	?			
1259	250.1	1	Adult: older mature/older	?	o.arthritis - lumbar: gall stone	p/s	ivory
1260	1392.9	1	Adult: mature	??Male			
1261	497.8	1	Adult: older mature/older	?	o.arthritis - cervical	sheep	comb: burnt pot
1262*	1148.6	1	Adult: mature	?	o.p. - cervical: disc degen. - thoracic	sheep: u/id	
1263	37.1	1	Older juvenile/young subadult	?			Fe brooch spring
1264	2362.6	1	Adult: young	?		horse: h/c: u/id	Ae obj.: glass vessel: shale: Fe blade
1265	158.4	1	Juvenile: young		dental hypoplasia: m.v. - 3rd centre (metatarsal)		Ae tweezers: Fe shears
1266	508.3	1	Adult: young/mature	??Female			Ae ring
1267	554.8	1	Adult: mature	?	o.arthritis - axis	lamb/dog: u/id	Ae + glass: crystal bead
1268	982.4	1	Adult: young/younger mature	Male			
1269 =1255	3.7						
1270	0.0		Missing				Ae tweezers: Fe shears
1271	1165.0	1	Adult: mature	?Male		horse: h/c: u/id	Ae tweezers: Fe t.s.: glass bead
1272	1317.3	1	Adult: younger mature	?		u/id	Ae
1273	128.0	1	Subadult/adult	?		h/c: u/id	
1274	546.2	1	Adult: mature	?			
1275	1036.7	1	Adult: mature	?Female	o.arthritis - axis		comb
1276	0.0		No bone				
1277*	140.7	1	Infant			h/c	
1278	73.0	1	Adult	?			glass
1279	146.9	1	Adult	?	disc degen. - thoracic/lumbar		Ae: Fe: glass bead
1280$	571.6	1	Subadult/adult	?		horse: p/s: h/c: u/id	
1281	1734.7	1	Adult	?		horse: sheep: dog/fox:	Ae bell
						bird: h/c: u/id	
1282	0.7	?	?	?			
1283	21.1	1	Infant: young				
1284*	1166.9	2	Adults: mature + younger mature	Male + Female	o.arthritis - atlas: o.p. - thoracic/lumbar	u/id	
1285*	1006.4	1	Subadult: young			horse: pig - imm:	Fe shears: comb
						h/c: u/id	
1286	1589.2	1	Older subadult/young adult	?		horse: sheep: h/c: u/id	
1287	379.2	1	Infant: older			sheep: dog: u/id	glass vessel: comb
1288 A	82.7	1	Older subadult/adult	?		u/id	
1288 B	119.1	1	Older subadult/adult	?	o arthritis - axis, thoracic		Ae brooch: glass bead
1288 C	821.2	1	Adult: mature	?			
1288 D	142.9	1	Adult: mature	??Female			
1289	398.5	1	Adult: older mature/older	?	o.arthritis - thoracic: tooth loss - trauma?	u/id	glass bead: ivory
1290	602.8	1	Adult	?		horse: h/c: u/id	
1291	645.1	1	Older subadult	?		pig - imm: h/c: u/id	glass bead
1292	820.0	1	Adult: younger mature	?		u/id	Fe belt fitting: 4 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1293	908.2	1	Adult: younger mature	?		h/c: u/id	6 glass beads
1294	54.7	1	Adult: young/mature	?			
1295*	1243.3	1	Adult: mature	??Female			Ae
1296*	797.9	1	Adult: younger mature	??Female	o.arthritis - axis:	u/id	
1297	80.2	1	Adult	?			
1298	206.7	1	Adult	?			glass bead
1299	411.5		A.A. to 1280A			h/c: u/id	Ae
1300	152.5	2	1) Older subadult/adult 2) Infant	?		h/c	
1301	403.1	1	Older subadult-mature adult	?Female		sheep	Ae: 3 glass beads: ivory
1302	1738.4	2	1) Adult: younger mature 2) Adult	??Female		horse: pig - imm: goose: h/c: u/id	
1303*	855.6	1	Adult: younger mature	Female	destructive lesion - lumbar: o.p. - rib	sheep	comb
1304	503.8	1	Adult: young	?			
1305	130.6	1	Adult: older mature/older	?	o.arthritis - tempero-mandibular: disc degen. - thoracic/lumbar		
1306	288.7	1	Adult : mature/older	??Female	o.arthritis - cervical, scapula		
1307	770.7	1	Adult: younger mature	?			Ae
1308*	1175.4	1	Adult: mature	?		horse: h/c: u/id	3 glass beads
1309*	326.4	1	Adult	?			2 glass beads: Ae wrist clasp
1310	0.0		No bone				
1311	553.5	1	Adult: older mature/older	?	o.arthritis - bi-lateral tempero-mandibular, axis: o.p. - sacral		3 glass beads: Ae: ivory
1312	669.5	1	Adult: mature	Female	disc degen. - cervical:		comb: 9 glass beads: antler s.w.: ivory: burnt pot
1313	185.5	1	Adult	?	?	sheep - imm	
1314	17.3	1	Infant				
1315 =1302	803.2					horse: sheep: h/c: u/id	Fe + Ae
1316	267.8	1	Adult	?			Fe blade
1317	124.8		A.A. to 1281			dog: h/c: u/id	
1318	1185.6	1	Adult: young/younger mature	?		horse: dog: h/c: u/id	Ae: 5 glass beads
1319	144.2	1	Juvenile: older				
1320*	1261.0	1/?2	Adults: younger mature	?Male + ??Female	ligament ossification - thoracic	p/s: h/c: u/id	ivory: 16 glass beads
1321	506.9	1	Adult: mature	?	disc degen. - cervical		
1322	1197.9	1	Adult: mature	?	o.arthritis - axis: cyst - lunate		3 glass beads
1323	454.9	1	Adult: mature	?		u/id	Ae wrist clasp: Fe: ivory
1324$	599.1	2	1) Adult: mature 2) Infant	?		h/c: u/id	ivory
1325	455.7	1	Adult	?		u/id	
1326	9.2	1	Infant				
1327	196.6	1	Adult: mature/older	?	o.arthritis - lumbar: o.p. - thoracic		Ae: comb
1328	427.4	1	Adult: mature	?	o.arthritis - clavicle		
1329	703.5	1	Adult: young/younger mature	?			Ae obj.: Fe shears: comb: a/b obj.
1330	0.0		Missing				
1331	82.5	1	Adult	?			Ae: Fe: comb: antler ring: ivory
1332	1069.8	1	Adult: younger mature	?	m.v. - tooth crown	horse: sheep: h/c: u/id	
1333	808.9	1	Adult: young/younger mature	?		horse: sheep: h/c: u/id	
1334	1359.9	2	1) Adult: younger mature 2) Older infant/young juvenile	1) Female		horse: pig: h/c: u/id	Fe tweezers: glass: burnt pot: worked antler tine
1335	751.6	1	Adult: older	?Male	disc degen. - cervical, thoracic/lumbar		
1336	729.1	1	Adult: older mature	?	o.arthritis - axis, finger phalanges	sheep: u/id	Ae tweezers: Fe shears: Fe obj.
1337	947.4	1	Adult	?		horse: pig: h/c: u/id	Fe tweezers: glass: comb: s.w.
1338	1409.0	1	Older subadult/young adult	?		horse: h/c: u/id	
1339	330.7	1	Adult : young	?			
1340	80.8	1	Juvenile				Ae: 4 glass beads
1341	906.8	1/?2	1) Adult: mature 2) ?Subadult	??Male	o.arthritis - atlas: o.p. - lumbar	horse: pig - imm: h/c: u/id	Fe t.s.: 18 p.p.
1342	1238.1	2	Adults: older mature/older	??Male + ?	peridontal disease: o.p. - thoracic/lumbar: disc degen. - cervical	horse: sheep: h/c: deer: u/id	
1343	354.1	1	Adult	?		horse: h/c: u/id	
1344 =1338	1140.9					horse: cattle: sheep: h/c: u/id	
1345	0.0		No bone				Ae wire
1346*	1699.7	1	Adult: mature	??Male	dental abscess - maxilla: o.p. - cervical, thoracic/lumbar	pig: u/id	Fe spike: antler disc
1347*	115.4	1	Young juvenile				glass bead: comb
1348	3.2	1	Infant			u/id	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1349	721.9	2	1) Adult: young 2) Older juvenile/young subadult	?		horse: pig - imm: h/c: u/id	Ae sheet: 8 glass beads: comb: s.w.
1350*	725.2	1	Adult: younger mature	?Male			
1351	537.3	1	Adult: mature	Female		p/s: u/id	dec. bone: dec. antler: glass bead
1352 =1349	33.4					u/id	glass
1353	141.6	1	Adult	?			3 glass beads
1354*	542.5	1	Adult: older mature/older	?	disc degen. - thoracic/lumbar	cattle: u/id	Ae
1355	317.6	1	Adult: older	??Female	disc degen. - cervical: o.arthritis - cervical, finger phalanx: o.p. - scaphoid: m.v. - non-fusion (scapula)		comb
1356	267.1	1	Adult: young/younger mature	?			4 glass beads
1357	372.8	1	Adult: mature	?			Fe pin
1358*	765.4	1	Adult: older	?	o.p. - thoracic/lumbar: Schmorl's node - thoracic/lumbar: disc degen. - thoracic/lumbar, sacral: o.arthritis - axis	u/id	Ae sheet: Fe tweezers
1359	69.9	1	Juvenile				glass bead
1360	836.6	1	Adult: older	??Male	m.v. - teeth: disc degen. - cervical, thoracic: o.arthritis - cervical, thoracic, humerus/femur/tibia: o.p. - finger phalanges		
1361	1126.3	1	Adult: older mature	??Male	periodontal disease: m.v. - metopism: disc degen. - thoracic: cysts - scaphoid		
1362*	856.4	1	Adult: mature	Female	m.v. - wormian: o.arthritis - clavicle: o.p. - ulna: cyst - scaphoid		Ae: glass bead: antler ring
1363	540.5	1	Adult: older mature/older	??Female	tooth loss: dental abscess - maxilla		5 glass beads: s.w.: ivory: Ae
1364	839.3	1	Adult: young/younger mature	??Male		h/c: u/id	Fe tweezers
1365*	184.8	1	Juvenile: young				glass bead
1366*	1489.4	2	1) Adult: mature 2) Juvenile/young subadult	1) ??Male	o.p. - finger phalanx, cervical, thoracic: exostoses - tibia	sheep: h/c: u/id	antler disc
1367*	653.0	2	1) Older infant/young juvenile 2) Adult: older mature/older	?	disc degen. - cervical, thoracic, lumbar, sacral: o.arthritis - sacro-iliac, thoracic: o.p. - finger phalanges, metatarsal: tooth loss	u/id	6 glass beads
1368	1520.8	2	Adults: older + young/mature	??Female + ?		sheep: u/id	
1369*	758.3	1	Adult: mature	??Male			Ae: ivory
1370$	33.7	1	Older subadult/adult	?			
1371	181.5	1	Adult: mature	?		bird/small mammal	glass
1372	603.1	1	Adult: mature	?			
1373	522.5	1	Adult: mature	??Female	disc degen. - thoracic/lumbar		hone
1374	579.0	1	Adult: mature	??Male	disc degen. - cervical	pig: u/id	Fe rivet
1375	287.4	1	Adult	?			Ae ring
1376	623.3	1	Adult: young	??Female		sheep: u/id	glass vessel: ivory: s.w.
1377	66.3	1	Adult	?			
1378	28.6	1	Infant				comb
1379	152.0	1	Juvenile				
1380	771.9	1	Adult: older mature/older	??Female	tooth loss: dental abscess: periodontal disease: disc degen.- cervical, thoracic, lumbar: o.arthritis - cervical, costo-vertebral		Fe t.s.
1381*	1600.9	1	Subadult: older	?		horse: sheep: h/c: u/id	
1382	719.4	1	Adult: older mature	?	tooth loss: o.p. - thoracic/lumbar: disc degen. - sacral		
1383	791.9	1	Adult: mature	?			Ae
1384	581.2	1	Adult: mature	??Female			Fe t.s.: Ae ring
1385*	19.4	1	Infant				
1386 =1381	608.6					horse: sheep: h/c: u/id	glass vessel: comb
1387*	1038.1	1	Adult: mature	?	o.p. - lumbar, rib: cyst - clavicle	u/id	a/b obj.
1388	699.7	1	Adult: younger mature	Male		dog	
1389	1249.0	2	1) Adult: younger mature 2) Juvenile: young	?	o.arthritis - atlas	sheep: u/id	Ae brooch: 9 glass beads: comb: ivory
1390	455.1	1	Adult	??Female		sheep - imm	Fe tools: glass: Fe
1391	579.5	1	Adult: mature/older	?			2 glass beads: s.w.
1392	304.5	1	Adult: mature/older	?		u/id	
1393	1155.6	1	Adult: young	?	destructive lesion - lumbar	sheep: u/id	Ae
1394	5.9	1	Infant: neonate				
1395*	1151.8	1	Adult: young	?	Schmorl's nodes - thoracic	horse: h/c: p/s: u/id	comb
1396 =1395	181.0					horse: h/c: u/id	
1397	611.8	1	Adult: mature	?			3 glass beads: comb: ivory
1398	729.7	1	Adult: young/mature	?			glass vessel: comb: ivory
1399	591.3	1	Adult: mature	?	destructive lesion - thoracic/lumbar: disc degen. - thoracic/lumbar	sheep: u/id	
1400$	92.5	1/?2	1) Juvenile/subadult 2) Older subadult/adult	?			
1401	0.0		Missing				
1402	565.8	1	Adult: mature	?	disc degen. - thoracic/lumbar: o.arthritis - elbow		glass

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1403*	4.3	1	Infant: young				
1404	0.0		No bone				
1405	11.8	?	Subadult/adult	?			
1406	374.0	1	Adult: older	?	tooth loss: disc degen. - cervical, thoracic, lumbar: o.arthritis - cervical, thoracic: o.p. - finger phalanx		comb: glass
1407	425.7	1	Adult	?			4 glass beads: comb
1408	79.9	1	Subadult/adult	?			
1409*	598.3	1/?2	1) Older juvenile 2) Infant/young juvenile	?	m.v. - 3rd centre (metatarsals, metacarpals, finger phalanges), tooth crown: calculus: periostitis - ulna	sheep: pig - imm: u/id	Fe blade
1410	0.4	?	?	?		u/b - contamination	
1411 =1407	5.0						
1412	773.6	1	Adult: younger mature	Female		pig: u/id	burnt pot
1413	484.4	1	Adult: young/younger mature	?			comb: ivory
1414	1764.5	1	Adult: young	Male	m.v. - metopism	horse: sheep: p/s: cattle: h/c: u/id	Ae sheet: Fe blade
1415	378.5	1	Adult: younger mature	?			
1416=?1275/ 1254	99.4		Adult	?			
1417	7.0	1	Infant: young				comb
1418	11.2	1?	Subadult older/adult	?		bear	
1419	503.4	1	Adult: older	Male	o.p. - thoracic, radius, finger phalanges: disc degen. - thoracic: o.arthritis - thoracic: calcined mass - lymph node? (T.B.?)		6 glass beads
1420	954.3	1	Adult: older	??Male	disc degen. - thoracic/lumbar: calcined mass -lymph node? (T.B.?): o.p. - ulna, finger phalanges		
1421	2130.3	1	?A.A. to 1414	?		horse: cattle: h/c: u/id	p.p.
1422	9.1	1	Adult: mature	?Female			
1423	54.6	1	Infant: older			u/id	
1424	7.5	1?	Subadult/adult	?			
1425	72.1	1?	Subadult/adult	?			glass vessel
1426	54.5	1?	Subadult/adult	?			
1427	4.3	1	Infant				
1428	8.2	1	Adult	?			
1429	304.3	1	Subadult: young				Fe t.s.: comb
1430	70.1	1	Infant				
1431	1226.8	1	Adult: younger mature	Female		sheep: u/id	25 glass beads
1432	157.4	1	Adult: young/mature	?			
1433	192.9	1	Infant: older				Fe t.s.: comb
1434	0.0		No bone				
1435	26.9	1	Adult	?			
1436	31.8	1	Adult	?			
1437	260.0	1	Adult	?			Ae tweezers, strip: Fe
1438	445.2	1	Adult: young/mature	??Female			Ae: ivory
1439	667.1	1	Adult: younger mature	??Female	o.p. - finger phalanx	u/id	glass vessel
1440 =1571	0.0						
1441	669.0	1	Adult: young/mature	?			
1442	140.0	1	Older juvenile/young subadult				
1443	4.4	1?	Subadult/adult	?			
1444	50.9	1?	Adult	?			crystal
1445	7.4	1?					
1446	20.2	1?	Older subadult/adult	?		u/id	glass
1447	110.0	1	Adult	?			Fe blades: comb
1448	69.6	1	Adult: mature/older	?	o.p. - finger phalanx		
1449*	452.7	1	Subadult: young			u/id	comb: 3 glass beads
1450*	132.8	1	Juvenile: young				12 glass beads: s.w: comb
1451	693.3	1	Adult: young/mature	?			glass vessel
1452=1225?	128.5	1	Adult: older mature/older	??Male			Ae: 4 glass beads
1453	204.1	1	Adult	?			antler obj.
1454	13.6	1	Infant: young				Fe t.s.: comb
1455	39.2	?	Adult: older mature/older	?	disc degen. - cervical		
1456	11.6	1	Infant: young				Fe: 3 glass beads
1457	144.8	1	Adult: mature	?			
1458	31.7	1	Juvenile: older/subadult				

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1459	513.4	1	Adult: young/mature	?			comb
1460	11.3	1	Infant				Ae tweezers
1461	241.1	1	Adult: mature/older	??Male			
1462	17.9	1	Subadult/adult				
1463	131.1	1	Infant			sheep	
1464	257.2	1	Adult	?			
1465	714.7	1/?2	1) Adult: mature 2) ?Adult	1) ??Female	o.arthritis - costo-vertebral	pig: u/id	Fe t.s.: comb: bone bead
1466	0.0		No bone				Ae
1467	403.3	2	1) Juvenile 2) Infant		m.v. - 3rd centres (metacarpal, metatarsal)	u/id	comb
1468	379.2	1	Adult: mature	?	o.arthritis - atlas, lumbar		2 Ae brooches: glass
1469	202.2	1	Adult: mature/older	?	o.arthritis - shoulder		Ae brooch: Ae needle: Fe brooch: Fe blade, strip, ring, pin
1470	876.8	1/?2	1) Adult: older mature/older 2) Subadult	1) Male	tooth loss: disc degen. - cervical, thoracic		Fe ring: comb
1471	1067.3	1	Adult: older mature/older	?	o.arthritis - axis: o.p. - cervical		
1472	34.9	1	Older subadult/adult	?			
1473	358.4	1	Subadult : young		m.v. - 3rd centre (metacarpal, finger phalanx)	u/id	Ae tweezers: Fe t.s.: comb
1474	188.6	1	Adult: young/mature	?			Ae brooch: Fe t.s.: s.w.: 3 glass beads: comb
1475*	580.9	1	Subadult: older			fox: h/c: u/id	Ae brooch: comb: glass
1476	180.1	1	Adult	?		u/id	
1477	20.7	1?	Subadult: older/adult	?			
1478	593.6	1	Adult: mature	?			Fe blade
1479	18.7	1/?2	1) Infant 2) ?Subadult				a/b bead
1480	22.3	1	Adult				6 glass beads
1481 =1237	4.2						
1482	167.2	1	Older juvenile/subadult				comb
1483	320.4	1	Adult	?Male			Ae: 2 glass beads
1484	8.3	1	Infant/young juvenile				
1485	654.5	1	Adult: younger mature	?Female		h/c: u/id	Fe nail: 6 glass beads: comb: burnt pot
1486	268.6	1	Adult: older mature/older	?	tooth loss: o.p. - finger phalanx		comb
1487	81.5	1	Adult: young/mature	?			
1488*	779.7	1	Adult: mature	??Female	o.arthritis - atlas	sheep: u/id	Ae: Fe: 2 glass beads: comb: ivory
1489	719.0	1	Adult: young/younger mature	Female			3 glass beads: Ae
1490*	728.9	1	Adult: young	?Female		sheep: u/id	Ae brooch: Roman coin: glass bead: worked bone
1491	8.4	1?	Subadult/adult				
1492*	1061.3	1	Subadult: older	?Male	m.v. - tooth root		Ae: 10 glass beads: s.w.
1493	0.1	?					
1494	0.0		No bone				
1495	299.7	1	Adult	??Male		u/id-imm	
1496*	675.1	1	Adult: mature	Female	cyst - finger phalanx: o.p. - finger phalanx: exostoses - metatarsal	sheep: pig: deer: u/id	Ae brooch: Fe bars: comb
1497 =1487	116.8						
1498	54.1	1	Infant				Fe t.s.
1499$	48.8	1	Adult	?			glass bead
1500*	169.8	1	Juvenile: young		hypoplasia		Ae: comb
1501*	1490.7	1	Adult: young/younger mature	?		u/id	
1502	50.9	1	Infant: young			pig: u/id	Ae tweezers: Fe t.s.
1503	39.4	1	Subadult/adult	?		h/c-u/b	
1504*	1061.7	1	Adult: mature	??Female	o.arthritis - axis: o.p - lumbar, finger phalanx: disc degen. - lumbar	p/s: u/id	Ae
1505	720.2	1	Adult: young/younger mature	Female		sheep: h/c	Ae
1506=1525?	35.5		Adult	?			
1507	6.7	1	Infant: young				
1508	7.4	1	Infant: young				Ae brooch, ring: glass
1509	0.0		Missing				
1510	46.1	1	Adult				
1511	10.0		?	?			
1512*	1215.9	2	Adults: younger mature + mature	Male + ?	o.arthritis - axis: Schmorl's node - lumbar		glass
1513	505.7	1	Adult: young/younger mature	?Female		u/id	Ae: glass: ivory: comb
1514	116.4	1	Infant/juvenile: young				Fe tweezers: comb
1515	76.7	1	Infant				4 glass beads: comb
1516	815.9	1	Adult: younger mature	Female			4 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1517	86.0	1	Adult: older mature	?	disc degen. - thoracic/lumbar		Fe tweezers
1518*	55.5	1	Infant: older			u/id	comb
1519*	420.8	1	Adult: younger mature	?Male			burnt pot
1520	323.2	1	Adult: mature	?Male			
1521	16.8	1	Subadult/adult	?			
1522	15.7	1	Subadult/adult	?			
1523	832.7	1	Adult: young/younger mature	?		sheep	bone disc: a/b disc: Fe: burnt pot
1524*	244.0	1	Juvenile: young				
1525	322.5	1	Adult: young	?			Fe knife: antler ring: burnt pot
1526	183.7	1	Adult: older mature/older	?	disc degen. - cervical/thoracic		Ae: glass: s.w.
1527	8.9	1	Subadult/adult	?			
1528	25.5	1	Adult: young/mature	?			
1529	343.0	1	Adult: younger mature	?			Fe t.s.
1530	291.5	1	Adult	?		pig	
1531	111.0	1	Adult: younger mature	?			ivory: lead
1532 =1555	0.0						
1533	31.3	1	Subadult/adult	?			Ae: Fe loop
1534	646.5	1	Subadult				Ae buckle: 2 glass beads: comb: bone handle
1535	458.8	2	Adults: young/mature	??Male + ?? Female			Fe
1536	407.4	1	Adult: younger mature	??Male			
1537	1307.0	1	Adult: older mature	?	o.p. - cervical, thoracic, lumbar: o.arthritis - axis, cervical: disc degen. - thoracic, lumbar: pitting -os pubis	sheep: h/c	Fe t.s.
1538	494.6	1	Adult: mature	?		h/c: u/id	comb
1539	38.3	1	Adult	?			
1540	20.7	1	Subadult/adult	?			
1541	66.8	1	Adult	?		sheep	
1542	729.4	1	Adult: older mature/older	?	o.arthritis - right elbow, axis, cervical: m.v. - tori: disc degen. - thoracic/lumbar		bone bead
1543	9.4	1	Juvenile				
1544	897.1	1	Adult: mature	?	o.p. - finger phalanx: o.arthritis - axis		Fe t.s.
1545*	1358.1	1	Adult: younger mature	Female			Ae tweezers: Fe shears
1546	295.0	1	Adult: mature	??Female			Fe tweezers: comb
1547*	943.5	1	Adult: older mature	?Male	o.p. - thoracic: o.arthritis - clavicle, femur		Fe t.s.
1548	12.4	1	Infant/juvenile				
1549	6.3	1	Adult	?			
1550*	708.0	1	Adult: older mature/older	??Female	o.p. - finger phalanx: disc degen. - thoracic/lumbar: cyst - humerus		15 glass beads: bone bead
1551	2.4	1	Infant/juvenile				
1552	0.0		Missing				
1553	31.6	1	Adult	?			
1554	36.9	1	Adult	??Male			
1555	192.2	1	Subadult: young				glass
1556*	207.1	1	Juvenile: young		m.v. - tooth crown: destructive lesion - tooth crown		comb
1557*	599.4	1	Adult: older mature	?	o.p. - cervical: o.arthritis - thoracic		
1558	599.1	1	Adult: older mature/older	?	o.arthritis - shoulder: hypercementosis		15 glass beads
1559	437.6	1	Adult	?		horse: h/c: u/id	s.w.
1560	175.0	1	Adult: mature	?	o.p. - finger phalanges	u/id	dec. antler peg
1561	843.7	1	Adult: older mature	Female	o.arthritis - tempero-mandibular, costo-vertebral	u/id	glass: Ae
1562	589.1	1	Adult: older mature/older	?Female	o.arthritis - axis		Ae t.s.: 2 glass beads
1563	769.2	1	Adult: older mature	?Male	tooth loss - ?trauma: o.p. - thoracic		Fe
1564	1196.3	1	Adult: older mature	?Male	o.p. - thoracic/lumbar	u/id	Ae sheet: Fe: 6 glass beads: ivory
1565	304.0	1	Subadult: young	??Male			
1566	704.3	1	Adult: mature	?			worked antler
1567	85.1	1	Infant				3 glass beads
1568*	14.9	1	Infant: young				
1569	9.4	1	Subadult/adult	?			
1570	298.6	1	Adult: young/mature	?Female			
1571	101.2	1	Juvenile: young		m.v. - 3rd centre (metatarsal)	bird	Ae brooch
1572	507.8	1	Adult: older mature	?			
1573	93.3	1	Adult	?			
1574	664.0	1	Adult: mature	?		sheep: h/c: u/id	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1575	4.8	1	Infant				
1576	234.7	1	Subadult: young			u/id	
1577*	145.0	1	Adult	?			
1578*	364.8	1	Adult: older mature/older	??Female	o.arthritis - atlas: disc degen. - thoracic/lumbar		s.w.
1579	677.4	1	Adult: mature	??Female			comb
1580	3.2	1	Immature				
1581	50.6	1	Juvenile: young				
1582	428.6	1	Adult: mature	?			
1583	560.7	1	Adult: younger mature	Female			ivory
1584	0.4	?	?				
1585	15.8	1?	Subadult/adult	?			
1586	1.3	1	Infant				
1587	49.7	1	Subadult/adult	?			
1588	183.4	1	Juvenile: young		m.v. - 3rd centre (metatarsal)		Fe
1589	209.6	2	1) Older infant/young juvenile 2) Adult		m.v. - 3rd centre (metatarsal), tooth crown		antler bead
1590*	12.1	1	Infant: young				
1591	555.8	1	Subadult: older	??Female		sheep: u/id	
1592	691.0	1	Adult: young/mature	??Female		horse: u/id	glass bead
1593	261.0	1	Adult: mature	??Male		u/id	
1594	951.6	1	Adult: mature	?Female	o.arthritis - atlas		5 glass beads: Ae: comb
1595	227.7	1	Adult	?			crystal
1596$	3188.9	2	Adults: 1) older 2) young/mature	1) Male 2) ??Female	tooth loss - excess wear	horse: sheep: h/c: u/id	
1597	85.4	1	Infant				
1598	53.3	2	1) Adult 2) Infant	?			Ae brooch
1599$	137.7	1	Adult	?			glass
1600	750.6	1	Adult: young/younger mature	??Female			Fe: 5 glass beads: ivory
1601	831.4	1	Adult: mature	Female		dog	Fe tweezers, wire
1602	679.3	1	Adult: mature	?	o.p. - cervical	u/id	glass vessel
1603	148.7	1	Infant: older				comb
1604	119.8	1	Infant: older		cribra orbitalia	p/s	10 glass beads
1605	64.6	1	Subadult: older	?	m.v. - tooth crown	sheep: u/id	Ae t.s.: Fe shears: antler bar: ivory
1606	346.2	2	1) Subadult: older/adult 2) Juvenile	?	2) m.v - 3rd centre (metacarpal)		
1607	717.3	1	Adult: young/mature	?			comb: burnt pot
1608	829.4	1	Adult: younger mature	?Male	o.p. - cervical		Ae: comb
1609	8.3	1	Subadult/adult	?		u/id	
1610	511.7	1	Subadult: young		m.v. - 3rd centre (metacarpal)	u/id	Ae: Fe knife: comb
1611	11.8	1	Infant: older/juvenile				
1612	79.6	1	Subadult: older	?			
1613	28.7	1	Adult	?		u/id	
1614	1404.2	1	Adult: young/younger mature	?		horse: sheep: h/c: u/id	Ae: comb
1615	11.8	1	Subadult/adult	?			
1616	1236.7	1	Adult: young/mature	?		horse: h/c: u/id	
1617	0.0		No bone				
1618	4.3	1	Subadult/adult	?			
1619	269.4	1	Juvenile		m.v. - 3rd centre (metacarpal)	pig - imm: u/id	
1620	102.3	1	Older juvenile/young subadult		m.v. - 3rd centre (metatarsal)		
1621$	1028.8	1	Adult	?		horse: h/c: u/id	
1622*	974.9	1	Adult: younger mature	?Female	o.p. - lumbar: o.arthritis - costo-vertebral		Ae: 2 glass beads: ivory
1623	361.5	1	Adult: older mature/older	Male	o.p. - thoracic/lumbar, finger phalanges: o.arthritis - thoracic	sheep	5 glass beads
1624$	42.6	1	Adult: young/mature	?			
1625	19.6	2?	1) Adult 2) Juvenile/subadult	?			
1626$	418.2	1	Adult: older mature	?Female	hyperostosis - thoracic/lumbar	sheep	
1627	926.5	1	Subadult: older	??Male	cyst - metacarpal	u/id	worked antler
1628	103.2	1	Adult: young/younger mature	?			
1629*	895.6	2	1) Subadult: older 2) Young infant	?	m.v. - tooth crown	sheep: u/id	20 glass beads: comb: ivory
1630$	5.1	?	?	?		cattle	
1631	177.6	1	Adult: mature	??Female		sheep	Ae: 2 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1632	9.4	?	Adult	?			
1633	103.5	1	Infant: older			sheep: u/id	2 glass beads
1634*	55.0	1	Infant: older		m.v. - tooth crown		comb
1635*	8.3	1	Infant: young			sheep/dog	
1636	805.5	1	Adult: older mature/older	??Female	o.p. - thoracic/lumbar	sheep	
1637	8.8	1	Infant/juvenile				
1638*	138.3	1	Juvenile: young			u/id	comb
1639	168.9	1	Adult	?			comb
1640	728.1	1	Subadult: older	?		u/id	Ae: ivory: glass
1641	464.5	1	Adult: younger mature	?	m.v. - tooth root	u/id	Ae: glass vessel: 20 glass beads
1642	0.0		Missing				
1643	623.7	1	Subadult: older	?		u/id	
1644	1482.4	1	Adult: mature	?		h/c: u/id	Fe obj.
1645	695.2	1	Adult: older mature	?Female	periodontal disease	sheep: h/c: u/id	dec. antler: comb: s.w.: crystal: ivory: glass bead
1646	532.0	1	Adult: younger mature	?			
1647*	1616.8	1	Adult: younger mature	??Male			Ae tweezers: Fe blade: 9 sheep astragali p.p.: burnt sherds
1648	11.3	1	Infant: young				glass
1649	417.5	1	Adult: older mature	?		p/s/dog	
1650	916.1	1	Adult: older	?Male	o.p. - cervical, lumbar: o.arthritis - atlas, cervical: disc degen - thoracic: exostoses - innominate		comb: antler obj.
1651*	1390.5	1	Adult: older mature	?	o.p. - lumbar: cyst-calcaneum	u/id	Ae stains
1652	115.5	1	Adult: young/mature	?Male			
1653*	48.8	1	Older infant/young juvenile			u/id-imm	glass bead
1654	1872.4	1	Adult: younger mature	?		u/id	Fe tweezers: comb: antler disc
1655*	702.9	1	Adult: older	Female	tooth loss: o.p. - thoracic		Ae brooch: Ae bowl staple: 20 glass beads: Fe loop
1656*	588.2	1	Juvenile: older		m.v. - 3rd centre (metacarpals, metatarsal, finger phalanges)	sheep: pig - imm: u/id	Fe t.s.: Ae sheet
1657	56.9	1	Infant			u/id	
1658	197.5	1	Juvenile			p/s	Fe t.s.
1659	838.6	1	Adult: younger mature	Male			Fe nails
1660	156.6	1	Adult: older mature/older	??Female			Ae: comb
1661	222.5	1	Juvenile		m.v. - 3rd centre (metacarpal, metatarsal)	sheep: deer: u/id	Fe shears
1662	165.3	1	Adult	?			Ae brooch
1663	790.6	1	Adult: mature/older	??Female	tooth loss		2 glass beads: comb
1664	324.4	1	Adult: mature	??Female	cyst - talus	u/id	Ae brooch: Fe needle: bone needle case: comb: ivory
1665	1213.4	1	Adult: younger mature	?Female	o.p. - thoracic		Ae brooch: Fe t.s.: 20 glass beads: Ae
1666	877.1	1	Adult: younger mature	?			a/b disc: burnt pot
1667*	1035.7	1	Adult: mature	Female	cyst - humerus		comb
1668	8.6	1	Infant				
1669	96.8	1	Subadult/adult	?			
1670	0.0		No bone				
1671	16.3	1	Adult	?			
1672$	1098.2	2	Adults: mature	?Male + ?	o.arthritis - axis: o.p. - thoracic		Ae + Fe razor in leather case: Ae tweezers: hone:
							5 glass beads: comb: bone bead
1673*	1035.2	1	Adult: younger mature	?Female		u/id-u/b	Fe nail: 10 glass beads: worked bone
1674	782.7	1	Adult: mature	?		sheep: pig-imm: u/id	comb: ivory
1675	218.0	1	Juvenile: older			sheep: u/id	
1676*	209.1	1	Juvenile			sheep	10 glass beads
1677	662.3	1	Adult: mature	?		u/id	Fe knife: comb: ivory: lead
1678	153.0	1	Adult: young/mature	?		u/id	
1679	1575.4	1	Adult: mature	??Female	periodontal disease: disc degen. - thoracic		comb
1680 =1682	0.0						
1681	4.3	1?	Subadult/adult	?			
1682	496.7	1	Juvenile		m.v. - 3rd centre (metatarsal)	h/c: u/id	Ae tweezers: Fe shears: comb: glass
1683	1525.6		Probably A.A. to 1684			horse: sheep: h/c: u/id	4 p.p.
1684*	1555.4	1	Subadult	??Male		horse: sheep: h/c: u/id	5 p.p.: bone obj.
1685	2073.7		Possible A.A. to 1686	?		horse: sheep: h/c: u/id	antler ring: glass
1686	1749.5	1	Adult: younger mature	??Male	o.p. - lumbar	sheep: h/c: u/id	comb: glass vessel
1687	536.4	1	Adult: mature/older	?		sheep: h/c: u/id	
1688	1357.7	1	Adult: mature	?		u/id	Fe t.s.: comb
1689	305.5	2	1) Adult: mature 2) Infant: older	?	o.p. - finger phalanx	h/c	Ae brooch: ivory

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1690	1551.4	1	Adult: mature/older	?		horse: h/c: u/id	burnt pot
1691	47.1	1	Adult: older	?	o.p. - cervical, finger phalanges, ulna: o.arthritis - costo-vertebral, hip: disc degen. - thoracic	u/id	
1692	372.3	1	Older subadult/adult	?Female			Ag wire: glass: comb
1693	125.0	1	Adult	?			
1694	64.4	1	Infant				Ae brooch
1695	395.0	1	Infant/juvenile: young				
1696	50.5	1	Infant		m.v. - 3rd centre (metatarsal)		Fe t.s.
1697*	1022.5	1	Adult: older mature/older	??Male	o.arthritis - costo-vertebral	u/id	Ae brooch: 4 glass beads: comb
1698	0.0		No bone				
1699	3.6	?	?	?			
1700	234.3	1	Adult: young/mature	?			
1701	56.8	1	Adult	?			
1702	16.3	1	Adult	?			
1703	4.7	1	Infant				glass
1704	3.8	1	Adult	?			
1705	257.9	1	Juvenile: older/subadult: young				Fe t.s.
1706	674.0	1	Adult: older mature	?Male	o.arthritis - cervical		Fe
1707	14.7	1	Subadult/adult	?			Ae bowl: antler ring
1708	982.6	1	Adult: older mature	?Male	o.p. - cervical	sheep - imm: u/id	
1709	591.0	1	Adult: young/younger mature	??Female		sheep: u/id	Ae: crystal bead: Fe
1710	632.8	1	Adult: mature	?			Ae tweezers: Fe bar
1711/1712	963.9	1	Adult: mature	?	o.p. - finger phalanx	pig: h/c: u/id	
1713	854.9	1	Adult: young/mature	?		h/c: u/id	Ae brooch, tweezers: Fe bar: comb
1714	35.5	1	Juvenile				
1715	172.8	1	Adult	?		sheep	
1716*	127.8	1	Juvenile: young				glass bead
1717$	691.0	1	Older subadult/young adult	?		u/id	glass bead
1718	654.9	1	Adult: younger mature	??Female		pig: u/id	ivory: glass
1719	262.4	1	Adult: older	?Male			Ae brooch: comb: antler ring: ivory
1720	75.8	1	Adult	?			
1721*	17.6	1	Infant/juvenile			cattle: u/id	
1722*	75.0	1	Infant			p/s: u/id	
1723	906.9	1	Adult: mature	?	o.arthritis - atlas, costo-vertebral		Fe bar: burnt pot
1724	1608.6	1	Adult: mature	??Female	o.arthritis - atlas	horse: p/s: h/c: u/id	Fe shears: Ae tweezers: p.p.: burnt pot: worked bone
1725	605.8		A.A. to 1726	?		horse: sheep: dogs (2): h/c: u/id	
1726	1669.3	1	Adult	?		horse: sheep: dog: h/c: u/id	bone
1727	8.9	1	Subadult/adult	?			Fe bar
1728*	53.3	1	Infant			pig - imm: u/id	
1729*	1124.7	1	Adult: older	??Male	o.arthritis - axis: destructive lesion - lumbar/sacral: disc degen. - lumbar/sacral		ivory: burnt pot
1730*	138.0	1	Juvenile: young				Ae brooch, bar
1731	559.2	1	Adult: young/mature	?		sheep	ivory
1732*	997.5	1	Adult: mature	Male	destructive lesion - lumbar	u/id	Ae tweezers: Fe: ivory
1733	1509.6	1	Adult: young/younger mature	??Female			
1734	324.5	1	Adult: older	?Female	o.arthritis - atlas, cervical: disc degen. - cervical: o.p. - finger phalanges		
1735	474.4	1	Adult: younger mature	?Female		sheep	
1736	798.4	1	Adult: mature	?			glass bead
1737	167.3	1	Older infant/young juvenile			h/c: u/id	
1738	69.1	1	Adult	?			
1739B=1739	42.6						
1739*	999.2	1	Adult: older mature/older	??Female	tooth loss - ?trauma: o.p. - lumbar	small mammal	Ae brooch: 15 glass beads: ivory: Ae: burnt pot
1740	880.6	1	Adult: mature	?Female			a/b bead
1741*	108.6	1	Infant: older			u/id	glass bead
1742	2316.7		Possible A.A. to 1751	?		horse: h/c: u/id	
1743	931.5	1	Adult: older mature	??Male	o.arthritis - atlas	sheep	Ag - 2/3 rings, pendant: Ae 2 brooches: Fe brooch: 6 glass beads: comb
1744	881.2	1	Adult: mature	?		pig: u/id	comb
1745	0.0		Missing				glass vessel
1746	96.9	1	Juvenile				
1747	133.0	1	Juvenile: young				
1748	265.1	1	Adult	?			

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1749	599.8	2	1) Adult: mature 2) Infant	?	2) m.v. - tooth crowns	u/id	Ae
1750$	135.9	1	Juvenile				
1751*	1535.9	1	Adult: young/mature	?Female		horse: h/c: u/id	Ae sheet: Fe t.s.: glass: comb: 2 p.p.
1752*	362.3	2	1) Adult: older 2) Juvenile: young	1) Female	o.p. - metatarsals: disc degen. - cervical, lumbar	sheep - imm.	glass
1753$	770.6	1	Adult	?		cattle - u/b	burnt pot
1754	1286.1		Possible A.A. to 1757	?		horse: cattle: sheep: h/c: u/id	
1755*	664.8	1	Adult: younger mature	?Female		dog	glass vessel, bead: antler ring: ivory
1756	641.0	1	Adult: mature	?		sheep: h/c: u/id	p.p.
1757	700.6	1	Adult: young/mature	?		horse: h/c: u/id	10 p.p.: antler obj.
1758*	45.6	1	Infant: young			u/id	
1759	175.3	1	Adult: older mature/older	?	o.p. - thoracic/lumbar		Fe shears: hone
1760	51.4	1	Infant/juvenile				
1761*	480.4	1	Adult: mature	?	disc degen. - lumbar		burnt pot
1762*	468.9	1	Adult: older mature	??Female	disc degen. - cervical: o.p. - ulna, femur	pig	6 glass beads: ivory: burnt pot
1763*	100.2	1	Infant/young juvenile			sheep	Roman coin: Ae bracelet
1764*	1005.7	1	Adult: older mature/older	??Male	calculus: o.p. - cervical, finger phalanges, lumbar: o.arthritis - cervical, costo-vertebral		comb
1765	36.1	1	Infant				comb + case
1766*	1687.0	1	Adult: mature	Male	o.p. - thoracic, finger phalanx: Schmorl's nodes - thoracic, lumbar	cattle-u/b: sheep: pig: u/id	Ae brooch: Fe t.s.: glass: 3 p.p.
1767*	437.6	1	Adult: younger mature	??Female			ivory
1768	127.0	1	Adult/subadult	?		horse: u/id	
1769 =1775	148.4		Adult	?			Ae brooch: 15 glass beads: antler ring
1770	587.9	1	Older subadult	?		pig: dog: h/c: u/id	12 glass beads
1771	460.4	1	Adult: younger mature	??Female			Ae: comb
1772	739.7	1	Adult: mature	Female	o.arthritis - atlas: Schmorl's node - sacral		ivory: glass
1773	338.2	1	Juvenile				Ae tweezers: Fe t.s.: 2 glass beads: bone bead
1774$	0.0		No bone				
1775	0.0		Missing				
1776	623.8	1	Adult: mature	?	o.p. - cervical	horse: sheep: u/id	
1777$	2226.8	2	1) Young juvenile 2) Adult: young/mature	2) ?Male		horse: cattle: sheep: h/c: u/id	Fe blade: glass
1778A=1778	1558.5		A.A. to 1778			horse: cattle: sheep: h/c: u/id	
1778*	887.1	1	Older juvenile		m.v. - 3rd centre (metacarpal, metatarsal)	horse: h/c: u/id	Fe t.s.: glass bead: comb
1779	911.1	1	Adult: mature	??Male		sheep: u/id	bone
1780*	1174.7	1	Adult: younger mature	?	o.arthritis - atlas		Ae
1781	322.1	1	Adult: mature	??Female	disc degen. - cervical		Ae: ivory
1782	178.2	1	Adult	?			Ae: 4 glass beads: ivory: burnt pot
1783$	496.4	1	Adult	?		horse: sheep: h/c: u/id	Ae fitting, tweezers: 10 glass beads
1784	1730.7	1	Adult: young	Male	o.arthritis - atlas	horse: sheep: h/c: u/id	glass beads: comb
1785	1710.8		Possible A.A. to 1784	?		horse: cattle: sheep: h/c: u/id	Ae: glass
1786$	1014.1	1	Adult: young	?		u/id	Fe t.s.: bone
1787	331.6	1	Young subadult				Fe tweezers: 20 glass beads: a/b bead: Fe pin
1788	244.5	1	Adult: mature	?Female			glass vessel
1789	265.3	1	Adult: mature/older	?	disc degen. - thoracic		
1790	0.0		Missing				3 glass beads
1791*	43.3	1	Older infant				antler obj.
1792*	127.8	1	Juvenile		m.v. - 3rd centre (metatarsal)		2 glass beads
1793*	525.3	1	Adult: mature	?	o.p. - ulna		bone cylinder
1794*	214.6	1	Adult: older	?Female	tooth loss		glass bead
1795*	1294.4		Possible A.A. to 1796	?		horse: sheep: h/c: u/id	
1796	490.7	2	1) Juvenile 2) Subadult/adult	?		horse: sheep: h/c: u/id	Fe t.s.: comb
1797	668.2	1	Subadult: young			u/id	comb
1798	19.2	1	Infant/juvenile				glass
1799	249.5	1	Young juvenile		m.v. - 3rd centre (metatarsals)		Ae needle: 5 glass beads
1800	21.1	1	Subadult/adult	??Female			glass vessel: ivory
1801*	1114.7	1	Adult: mature	?Female	cyst - lunate: disc degen. - thoracic	sheep: u/id	Ae: 5 glass beads: ivory: s.w.: burnt pot
1802*	1281.1	1	Adult: older mature	??Female	o.p. - humerus, femur: disc degen. - thoracic: o.arthritis - atlas, thoracic		Fe t.s.: comb
1803	1632.2	1	Adult: older mature/older	Male	disc degen. - cervical, thoracic: cyst - clavicle	sheep: u/id	Ae bucket rim, obj.: Fe t.s.: comb: 10 sheep astragali
1804*	822.3	1	Adult: older mature/older	Female	m.v. - teeth: ligament trauma/m.v. - axis: o.arthritis - costo-vertebral, thoracic, clavicle: o.p. - finger phalanges		Ae: glass bead
1805*	998.3	1	Adult: older	?Male	tooth loss: o.arthritis - cervical, clavicle: o.p. - thoracic: infective lesion? - humerus		comb

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1806	198.0	1	Juvenile			deer: u/id	Ae t.s.: comb: antler obj.
1807	950.1	1	Adult: mature/older	Female		h/c: u/id	
1808	239.8	1	Older juvenile			sheep	Fe t.s.
1809$	850.7	1	Adult: mature	?		horse: h/c: u/id	glass vessel
1810	23.2	1	Older infant/young juvenile				Ae tweezers: Fe t.s.: ivory
1811	810.8	1	Adult: mature/older	?	o.p. - cervical, lumbar: hyperostosis - lumbar: destructive lesion - lumbar	bird	Ae bowl rim: glass vessel: 17 p.p.
1812*	652.3	1	Adult: older	?	hypercementosis: periodontal disease	h/c: u/id	
1813	260.7	2	1) Infant 2) Adult: older mature/older	?	disc degen. - cervical: o.p. - finger phalanx		
1814*	847.5	1	Adult: older mature	Female	o.arthritis - atlas		Ae sheet: Fe t.s.
1815	663.1	1	Adult: mature	??Male	tooth impaction		glass bead
1816*	4.9	1	Infant	?		h/c	
1817*	604.3	1	Adult: mature	Female	o.p. - foot phalanx	sheep: u/id	Fe t.s.
1818	1482.6		Possible A.A. to 1838	?		horse: cattle: sheep: h/c: bird: u/id	glass
1819*	132.5	1	Older juvenile				
1820*	195.0	1	Adult: older mature/older	?Female	o.p. - thoracic/lumbar: o.arthritis - atlas		2 glass beads
1821*	256.7	1	Older juvenile		m.v. - 3rd centre (metatarsal)	pig - imm.	Ae sheet: antler obj.
1822	149.5	1	Adult: mature	?		u/id	glass vessel: p.p.
1823*	877.4	1	Adult: older mature/older	?	o.arthritis - tempero-mandibular: periodontal disease: o.p. - cervical, thoracic: cyst - axis		Ae brooch: 2 glass beads: crystal bead
1824	81.3	1	Juvenile: young			u/id	Fe t.s.: antler obj.
1825*	1268.1	1	Adult: older mature	Male	o.p. - thoracic/lumbar, sacral, finger phalanx:? lytic T.B. lesion - sacral	cattle: sheep: u/id	Fe bar, nail
1826	1753.1	1	Adult: older mature/older	Female	o.arthritis - atlas, cervical: disc degen. - cervical, thoracic, sacral: excstoses - patella	horse: cattle: h/c: bird: u/id	
1827	618.8	1	Subadult				
1828	595.3	1	Adult: younger mature	??Female		u/id	glass bead + Ae obj: ivory
1829	7.6	1	Infant: young			sheep - imm.	
1830	700.6	1	Adult: older mature/older	??Male	Schmorl's node - sacral: o.arthritis - clavicle: cyst - humerus	sheep - imm.	
1831	246.6	1	Subadult			sheep: u/id	
1832	1215.4	1	Adult: mature	Male	cyst - finger phalanx	sheep: u/id	Fe t.s.: comb
1833	242.8	1	Adult: older mature/older	?	disc degen. - cervical/thoracic		
1834	1175.3	1	Adult: younger mature	Male			comb
1835	977.1	1	Adult	?		horse: h/c: s/p: u/id	Ae: comb
1836	104.6	1	Adult: mature/older	?	o.p. - thoracic/lumbar	sheep	
1837$	54.2	1	Infant				
1838*	1217.3	1	Adult: young/younger mature	??Female		horse: cattle: sheep: h/c u/id	Ae sheet
1839$	128.5	2	1) Adult 2) Juvenile/subadult	?		u/id	a/b obj.
1840	91.3	1	Juvenile: young		m.v. - 3rd centre (metatarsal)		
1841$	303.1	1	Adult	?			
1842*	35.4	2	1) Infant 2) Adult	?			
1843	172.1	1	Adult	?Male			
1844	940.2	1	Adult	?		horse: h/c u/id	comb
1845	581.2	1	Adult: older	?	o.p. - finger phalanx: tooth loss: o.arthritis - costo-vertebral: disc degen. - cervical	sheep: u/id	glass
1846	2238.5	1	Adult: older mature/older	Female	tooth loss: o.p. - cervical: destructive lesion - cervical: Schmorl's node - thoracic/lumbar	h/c: u/id	Ae obj.: glass vessel
1847	285.2	1	Adult: mature	?			2 glass beads: comb
1848	547.3	1	Adult	?	cyst - metatarsal	u/id	
1849	37.1	1	Infant				
1850*	413.3	1	Adult: older	?Female	o.arthritis - atlas, axis, hips: disc degen. - cervical thoracic: o.p. - thoracic/lumbar: pitting - innominate		
1851$	98.5	1	Adult	?		horse: u/id	
1852	590.6	1	Adult: mature	Male	o.p. - cervical	sheep: u/id	Ae sheet
1853	675.9	1	Adult: mature	?	o.arthritis - tempero-mandibular		
1854	1086.2	2	1) Older infant/young juvenile 2) Adult: younger mature	 ?	2) disc degen. - lumbar	u/id	Ae tag: 8 glass beads: crystal bead: s.w.: antler ring
1855	10.7	1	Subadult/adult	?			2 glass beads
1856	243.1	1	Subadult: young		m.v. - wormian, 3rd centre (metatarsal)		
1857$	342.0	2	1) Infant 2) Adult	?			
1858	663.0	1	Adult: mature/older	?	disc degen. - cervical		2 glass beads
1859	1648.5	1	Adult	??Female		horse: sheep: h/c: u/id	Ae tweezers, sheet
1860	265.8	2	1) Infant 2) Adult: mature/older	?	2) o.p. - thoracic/lumbar		
1861	410.0	1	Adult: mature/older	?			
1862	451.4	1	Adult	?		u/id	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1863	1.0	1	Young infant/neonate				
1864	78.5	1	Subadult/adult	?			
1865	29.3	1	Infant			u/id	
1866$	498.1	1	Adult: mature	?	o.p. - cervical	u/id	
1867	467.0	1	Adult: mature	??Female		sheep-imm: u/id	
1868	477.3	1	Adult: older mature/older	?	o.arthritis - atlas		
1869	180.9	1	Subadult: young			sheep	ivory
1870	112.9	1	Adult	?		u/id	
1871	0.0		Missing				Ae bowl rim: glass
1872	968.1	1	Adult: mature	?	o.p. - ulna	h/c: u/id	
1873	24.1	1	Infant			h/c: u/id	
1874	136.6	2	Juvenile			horse: cattle: h/c: u/id	
1875	268.5	1	Adult: mature/older	?	o.p. - finger phalanx	horse: pig: h/c: u/id	6 glass beads: crystal
1876	299.2	1	Adult: mature/older	?			
1877$	2556.6	2	Adult: 1) older 2) mature/older	Male + ??Female	cyst - atlas: disc degen. - cervical: o.p. - thoracic/lumbar: Schmorl's node - lumbar: o.arthritis - costo-vertebral, clavicle, ulna	? missing	
1878*	909.4	1	Adult: mature/older	Male	o.arthritis - axis: disc degen. - axis, lumbar, sacral: destructive lesion - lumbar	u/id	Ae sheet: antler ring: ivory
1879	450.5	1	Adult: mature	?	o.p. - thoracic/lumbar		glass bead: worked antler
1880	672.9	1	Adult: mature	Female	o.arthritis - clavicle		Ae brooch: ivory
1881*	0.0		No bone				
1882$	89.6	1	Juvenile				
1883	390.4	1	Older subadult	?		u/id	comb
1884*	75.1	1	Young juvenile		m.v. - 3rd centre (metatarsal)		Ae brooch
1885	138.4	1	Older juvenile				
1886	834.4	1	Adult: older mature	Female	tooth loss: o.arthritis - atlas: o.p. - sacral	u/id	crystal/glass
1887	86.6	1	Older juvenile/young subadult		m.v. - 3rd centre (metatarsal)		
1888	14.4	1	Adult	?			Ae
1889	317.0	1	Adult: mature/older	?	periodontal disease	u/id	
1890	503.3	1	Adult: mature/older	Male		u/id	glass vessel
1891	355.4		A.A. to 1890			missing	glass vessel
1892$	568.2	1	Older subadult	??Male		horse: sheep: dog: h/c: u/id	Ae sheet: Fe t.s.
1893	208.8	1	Subadult: young				
1894	370.8	1	Adult: mature/older	?	disc degen. - thoracic/lumbar	u/id	glass vessel: amber bead
1895	81.2	1	Adult	?	dsetructive lesions - finger phalanx		bone peg: glass
1896	259.1	1	Adult: older	?	tooth loss: dental abscess: o.arthritis - axis, shoulder: disc degen. - cervical: exostoses - patella		glass
1897	217.0	1	Adult: mature	??Female	o.p. - scapula		
1898	341.8	1	Adult: mature/older	??Male		u/id	
1899	127.7	1	Adult	?		u/id	
1900	68.5	1	Older infant				
1901	539.6	1	Adult: mature/older	??Female	disc degen. - thoracic/lumbar		Ae brooch: 2 glass beads
1902	86.5	1	Subadult				
1903	12.3	1	Infant: young				
1904$	393.3	2	Adults: mature/older	?	o.p. - thoracic/lumbar, finger phalanx: o.arthritis - costo-vertebral	sheep	Ae sheet
1905	384.4	1	Adult: young/younger mature	?			
1906*	639.2	1	Adult: mature	?Female	o.arthritis - axis: Schmorl's node - cervical: disc degen. - cervical		
1907	214.0	1	Adult	?		u/id	
1908	453.2	1	Adult: young	Male	destructive lesion - thoracic/lumbar		
1909	449.6		All animal			horse: pig: h/c: u/id	
1910	657.0	1	Adult: young	??Female	Schmorl's nodes - lumbar	sheep: u/id	glass vessel: ivory
1911*	3187.2		A.A. to 1915			horse: sheep: pig - imm: h/c: u/id	Ae: glass vessel: hone: 22 p.p.: a/b handle
1912	596.8	1	Adult: mature/older	?Female	o.arthritis - axis: Schmorl's nodes - thoracic		comb: Ae: ivory
1912A=1912	44.8						
1913	357.4	1	Adult: mature	?			
1914	91.7	1	Juvenile: young				Ae strip: glass
1915*	1789.1	1	Adult: mature	??Female		horse: pig - imm: h/c: u/id	glass vessel: comb: a/b handle: p.p.: antler tine stamp
1916	186.8	1	Adult	?			
1917	636.5	1	Subadult: older	?		sheep: h/c: u/id	Fe t.s.: a/b bead
1918*	109.1	1	Juvenile: young				

Urn No.		Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1919		483.0	1	Adult: mature/older	?	o.arthritis - atlas		Ae sheet, brooch: 2 glass beads: s.w.
1920*		17.2	1	Juvenile: young				
1921*		781.8	1	Adult: mature	Female	tooth loss	pig: h/c: u/id	Ae wrist clasp: s.w.: glass
1922		569.1	1	Adult: mature	Female		pig: u/id	Fe: antler ring: ivory
1923		0.0		A.A. to 1926A				
1924		2428.9	1	Adult: young/mature	Female		horse: cattle h/c: u/id	
1925		223.6	1	Adult	?	cyst - ulna		glass bead
1926$	A+B	1103.9	1	Adult: mature	?	disc degen. - thoracic/lumbar	cattle - neonate: sheep: u/id	
1927$		447.7	1	Adult: mature/older	?	o.arthritis - axis: exostoses - patella	horse: cattle: h/c: u/id	
1928		414.9	1	Adult: mature	?	exostoses - patella	sheep	
1929*		677.9	1	Adult: young	?	m.v. - tooth root	sheep: u/id	Ae sheet: ivory
1930		1622.0	1	Adult: older mature/older	Male	dental abscess: o.p. - cervical, thoracic/lumbar: disc degen. - cervical, thoracic/lumbar: destructive lesion - cervical, thoracic/lumbar: o.arthritis. - hip: periodontal disease		Fe t.s.: comb
1931$		119.8	2	1) Adult 2) Juvenile: young	?	m.v. - 3rd centre (metatarsal)	u/id	bone bead: glass
1932		1664.4	1	Adult: mature	Female			Fe t.s.: comb
1933$		2894.0	2	Adults: mature	Male + ??Female	o.p. - cervical, metatarsal: o.arthritis - atlas		comb
1934		324.6	1	Adult: older mature/older	?	o.p. - thoracic		
1935		1131.0	1/?2	1) Adult: younger mature 2) ??Adult	??Female		sheep	Fe brooch spring: glass bead: a/b obj.: ivory: comb
1936		627.9	1	Adult: mature	Female		u/id	bone obj.
1937$		532.3	1	Adult: mature	?		h/c: u/id	
1938$		129.2	1	Juvenile: young			u/id	
1939*		920.1	1	Adult: young/mature	Male		cattle: sheep: h/c: u/id	Ae stud: Fe strip
1940		0.0		Missing				Fe nail
1941		402.0	1	Adult: mature	?		sheep: u/id	ivory
1942		269.3	1	Adult	?		horse: h/c u/id	
1943*		820.4	1	Adult: young/younger mature	?Female			Ae
1944		33.9	1	Older subadult/adult	?			
1945		0.0		Accessory vessel to inh.23				
1946*		448.5	1	Adult: older mature/older	?Female	o.arthritis - atlas: o.p. - thoracic		
1947		756.6	1	Adult: mature/older	Male	o.p. - finger phalanx	h/c: u/id	
1948		465.8	1	Adult: mature	??Female			glass bead: ivory
1949		1225.6	1	Adult: young	Male		h/c: u/id	
1950		772.6	1	Adult: older mature/older	?	o.p. - cervical	sheep: h/c: u/id	Fe t.s.: burnt pot
1951		148.4	1	Adult	?			2 glass beads: Ae
1952		373.8	1	Adult	?		sheep: u/id	Ae ears: 2 glass beads
1953		818.1	1	Adult: older mature/older	?	o.p. - thoracic/lumbar	h/c: u/id	Fe tweezers: burnt pot
1954		689.8	1	Adult: mature/older	?		sheep: u/id	antler disc
1955		673.0	1	Adult	Male			a/b bead
1956		135.6	1	Juvenile				Ae brooch: 4 glass beads
1957*		1089.3	1	Adult: mature	Female	o.p. - cervical, finger phalanx		2 glass beads: comb
1958		659.5	1	Adult: young/younger mature	?	m.v. - wormian	u/id	Ae: Fe tweezers
1959		16.7	1	Infant				
1960		819.2	1	Adult: older	??Male	o.arthritis - cervical: o.p. - finger phalanges, thoracic/lumbar: disc degen. - sacral: exostoses - ulna	u/id	
1961		2651.8	1/?2	1)Adult: younger mature 2) Adult	?		horse: sheep: h/c: u/id	Ae tweezers: Fe shears: 12 p.p.: comb
1962		625.4	1	Adult: young/mature	Female			Ae: 12 glass beads
1963		1553.6	1	Adult: young/younger mature	?		horse: cattle: sheep: h/c: u/id	
1964		1062.0	2	Adults: older mature/older	Male +?	o.p. - thoracic/lumbar: destructive lesion - cervical: disc degen. - cervical: o.arthritis - axis, patella		4 glass beads
1965		213.6	1	Older subadult/young adult	?			
1966		865.8	1	Adult: younger mature	?		u/id	Ae sheet: Fe rings
1967		1780.7	1	Adult: mature	?		horse: p/s: h/c: u/id	Ae sheet, brooch: comb
1968	=1967	542.6					horse: h/c: u/id	
1969		335.0	1	Adult: older mature/older	?	disc degen. - thoracic/lumbar	dog: h/c: u/id	Fe t.s.: comb
1970		433.7	1	Adult: older mature/older	??Male	periodontal disease: disc degen. - lumbar: o.p. - scaphoid	u/id	
1971		64.1	1	Juvenile: young			sheep	
1972		50.1		All animal. A.A. to 1971?			pig: u/id	Fe t.s.
1973*		474.1	1	Juvenile		m.v. - wormian, 3rd centre (finger phalanx)	sheep - imm: u/id	Fe t.s.: comb: hone
1974		540.7	1	Adult: older	??Female	tooth loss: o.arthritis - tempero-mandibular		s.w.
1975		884.3	1	Adult: older	?	benign tumour - temporal: disc degen. - thoracic/lumbar: o.arthritis - costo-vertebral: o.p. - finger phalanges		Fe obj.: bone bead

Urn No.		Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
1976		691.2	1	Adult: mature	Female	hypercementosis: o.p. - finger phalanges		Ae brooch: 5 glass beads: bone needle case: ivory: bone objs.: Ae obj.
1977		441.2	1	Adult	?		dog/lamb	glass: burnt pot
1978*		805.7	1	Subadult: older	Female			
1979		2045.0	1	Adult: young/younger mature	??Female		horse: sheep: h/c: u/id	Ae: Fe t.s.: comb: worked antler tine
1980*		3374.8		Possible A.A. to 1979			horse: sheep: h/c: u/id	Ae: glass vessel: burnt pot
1981		280.0	1	Adult: mature	?	destructive lesion - 1st metatarsal: exostoses - 1st metatarsal		Ae sheet
1982		121.1	1	Juvenile				4 glass beads: s.w.: Ae
1983		1219.5	1	Adult: mature	?Male		u/id	Ae tweezers
1984	A	1091.6	1	Adult: mature	??Female	tooth loss: dental abscess: o.arthritis - atlas, clavicle	horse: h/c: u/id	Fe tweezers: 2 glass beads: 2 p.p.: burnt pot
1984	B	1222.9	1	A.A. to 1984A			cattle: sheep: h/c: u/id	
1985*		916.6	1	Adult: mature	?	o.p. - ulna	deer	Ae tweezers: Fe buckle, shears
1986		408.6	1	Adult: mature/older	?	o.p. - ulna, finger phalanges: o.arthritis - cervical	u/id-u/b	Fe t.s.
1987*		816.9	1	Adult: mature	??Female			comb: 4 glass beads
1988		0.6	1	Infant				
1989		19.6	1	Infant				Fe t.s.
1990*		190.9	1	Adult: older mature/older	Male		u/id-missing?	glass beads
1991		485.6	1	Subadult: young			u/id	2 crystal beads
1992		20.5	1	Infant: young				Fe knife
1993		4.5	1	Infant/juvenile				
1994		259.0	1	Adult: mature	??Female			crystal
1995		721.6	1	Adult: older mature	??Male		h/c	Fe buckle: burnt pot
1996		62.9		All Animal			u/id	
1997		115.3	1?	?Subadult			sheep	Fe obj.
1998		753.0	1	Adult: mature/older	?	o.arthritis - atlas		
1999*		0.0		Missing				
2000		15.2	1	Adult	?			
2001		509.6	1	Adult: older	?	tooth loss: o.p. - finger phalanges: o.arthritis - axis		
2002*		436.6	1	Subadult			sheep	Ae: 11 glass beads
2003		679.9	1	Adult	?		horse: h/c: u/id	Ae
2004		264.6	1	Adult	??Male		sheep: u/id	
2005		91.2	1	Adult	?			glass bead: ivory
2006		46.9	1	Older subadult/adult	?			comb
2007		250.1	2	1) Adult: younger mature 2) Young infant/neonate	?		pig	Ae wrist clasp: glass vessel: ivory
2008		4.2	1	Infant: older			bird	
2009		1144.2	2	1) Adult: mature 2) Foetus/neonate	1) ?Female	1) tooth loss: Schmorl's nodes - thoracic, lumbar: o.p. - lumbar	h/c: u/id	7 glass beads: comb + case
2010		1103.7	1	Adult: young/mature	??Male		horse: sheep: h/c: u/id	
2011		421.7	1	Subadult: older	?	m.v. - wormian		comb
2012		10.3	1	Infant: young				Fe shears: comb
2013		0.0		Missing				Fe tool
2014		326.8	2	1) Adult: young 2) Juvenile	?			5 glass beads
2015		1192.2	1	Adult: younger mature	Female			2 glass beads
2016		572.2	1	Adult: older mature/older	?	o.arthritis - atlas, cervical: cyst - ulna		burnt pot
2017*		317.0	1	Juvenile: young				glass bead: comb + case: ivory: burnt pot
2018		252.1	1	Juvenile: young		periostitis - femur, fibula (contamination)		Fe t.s.: glass bead, vessel: p.p.
2019*		312.5	1	Adult: older mature/older	?Female	disc degen. - lumbar		3 glass beads
2020	=2010	531.1		Adult			horse: sheep: h/c: u/id	
2021*		20.5	1	Older infant/young juvenile				
2022*		0.0		Missing				
2023		71.4	1	Juvenile			horse	
2024		19.4	1	Infant: older			u/id	
2025		177.9	1	Adult: older	?	disc degen. - cervical: o.arthritis - thoracic		Ae bucket rim: comb
2026*		1010.1	1	Adult: younger mature	?			
2027		1743.9	1	Adult: mature	Female	Schmorl's node - thoracic: destructive lesion - thoracic	u/id	comb
2028$		733.0	1	Adult: mature/older	?	o.p. - lumbar	bird	
2029$		214.8	1	Adult: mature	??Female	o.p. - finger phalanx		Ae: glass: 2 s.w.: ivory
2030		157.5	1	Subadult: young				
2031		338.9	2	Adults: older + ?	??Female + ?	o.arthritis - atlas, axis, cervical: disc degen. - cervical, thoracic/lumbar		glass bead: comb: Ae: burnt Roman pot
2032??		73.6		Adult	?		cattle-u/b	Ae tweezers

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2033	0.0		Missing				
2034*	948.8	1	Juvenile: older			h/c: u/id	2 Ae brooches: bone bead: glass
2035	905.8	1	Adult: mature/older	?		horse: h/c: u/id	Fe t.s.
2036*	0.0		Missing				Fe t.s.
2037*	703.4	1	Adult: older mature	??Female			burnt pot
2038	1348.3	1	Adult: older mature/older	??Female	o.arthritis - atlas	horse: sheep: h/c: u/id	7 glass beads: crystal bead: s.w.: ivory
2039*	1286.3	1	Adult: older mature/older	?Male	o.arthritis - atlas, axis: disc degen. - lumbar: exostoses - patella		
2040*	0.0		Missing				glass vessel
2041	1376.8		?A.A. to 2035	?		horse: sheep: h/c: deer: u/id	burnt pot
2042	855.5	1	Adult: mature	?Female	o.arthritis - atlas	u/id	Ae obj.: Fe obj.: 15 glass beads: crystal: ivory: burnt pot
2043*	1489.9	1	Adult: younger mature	?		horse: h/c: u/id	Fe t.s.
2044	1219.4		Probable A.A. to 2043	?		horse: h/c: u/id	Ae
2045*	820.7	1	Adult: older	?	o.arthritis - axis: disc degen. - thoracic/lumbar: cyst -lunate	horse: u/id	comb. burnt pot
2046	491.7	1	Adult: mature	?Female		p/s	Ae: 10 glass beads: s.w.: ivory
2047	778.6	2	Adults: mature/older	?Female + ?	o.arthritis - costo-vertebral	sheep: u/id	Ae: Fe: 15 glass beads: ivory
2048	317.2	1	Adult: mature/older	??Male			
2049	182.0	1	Young subadult				
2050*	1090.6	1	Adult: older mature/older	Male	m.v. - wormian: o.arthritis - atlas: o.p. - lumbar		Fe t.s.: comb
2051	148.3	1	Adult	?			glass
2052	374.9	1	Adult: mature	?Female	disc degen. - cervical: o.arthritis - cervical		
2053	139.4	1	Infant: older			sheep: u/id	
2054	719.4	1	Adult: older	?Female	tooth loss: disc degen. - cervical: o.p. - lunate, foot phalanx: exostoses - innominate, femur	u/id	
2055	1009.6	1	Adult: mature	Male	tooth loss	u/id	
2056	244.7	1	Adult: older	?Female	periodontal disease: tooth loss		Fe t.s.
2057*	0.0		Missing				Ae brooch: Ae: ivory
2058	785.9	1	Adult: mature	??Female	o.arthritis - axis	cattle-u/b	♀ p.p.
2059	336.2	1	Adult: older mature/older	??Female	disc degen. - cervical, sacral: o.arthritis - clavicle		glass beads
2060*	1772.9	2	1) Adult: mature 2) Adult: older	Male + ??Female	m.v. - absent 3rd molar: tooth loss - ?trauma: o.p. - thoracic, lumbar, finger phalanges: o.arthritis - costo-vertebral: cyst - innominate, clavicle	sheep: u/id	Ae sheet: glass vessel
2061*	497.0	1	Adult: older	?	disc degen. - cervical, thoracic, lumbar		Fe t.s.
2062 =1774	933.2		All Animal			horse: h/c: u/id	
2063*	42.6	1	Infant				Ae brooch: comb
2064*	0.0		Missing				6 glass beads: comb: ivory
2065	612.3	1	Adult: young	?		h/c: u/id	glass
2066	45.5	1	Adult		o.arthritis - costo-vertebral		
2067*	793.7	1	Adult: young/mature	?Female		sheep - imm: u/id	glass vessel: 3 glass beads: jet bead: ivory
2068	976.1	1	Adult: mature	?Male	o.arthritis - atlas		Ae tweezers: Fe t.s.: antler obj.
2069	57.0	1	Infant			sheep	
2070*	1063.0		A.A. to 2065			horse: h/c: u/id	glass vessel
2071*	6.4	1	Infant				
2072*	1017.7	1	Adult: younger mature	?		sheep: u/id	
2073	291.3	1	Older juvenile/young subadult			h/c	
2074	32.5	1	Subadult/adult	?			
2075$	306.1	1	Adult: older mature/older	?	o.arthritis - knee		3 glass beads: Ae
2076	508.4	1	Adult: mature	?		u/id - imm.	Ae wrist clasp: 2 glass beads
2077	1076.3	1	Adult: mature	?	tooth loss: m.v. - absent 3rd molar	cattle: sheep: pig: bird: u/id	Ae
2078	853.8	1	Adult	?			Fe t.s.
2079	483.3	1	Adult: younger mature	?Female			2 glass beads
2080*	241.4	1	Juvenile: older		m.v. - 3rd centre (metacarpal, metatarsal)		8 glass beads
2081	18.5	1	Infant: older			bird	
2082	0.0		No bone				
2083*	549.9	1	Subadult: young		m.v. - 3rd centre (metacarpal, metatarsal)		glass beads
2084	122.0	2	1) Adult 2) Infant: young/neonate	?		sheep	Ae sheet: ivory
2085	520.0	1	Adult: mature	??Female			
2086*	1414.3	1	Adult: older mature	Female	periodontal disease	h/c: u/id	Ae
2087	393.7	1	Adult: mature	?	o.arthritis - atlas		Ae brooch
2088	1023.1	1	Adult: young	Male		horse: p/s: h/c: u/id	Ae sheet
2089	358.3	1	Adult: mature/older	?			
2090	46.6	1	Infant: young			sheep	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2091*	842.7	1	Older juvenile/young subadult				ivory: glass
2092	842.7	1	Adult: mature	??Male		sheep: u/id	Ae: comb
2093	814.0	1	Adult: older	??Female	disc degen. - cervical: o.p. - thoracic/lumbar: o.arthritis - costo-vertebral		Ae brooch: 4 glass beads: comb
2094*	0.0		Missing				Ae sheet: comb
2095	0.0		Missing				
2096	0.0		Missing				
2097	835.0	1	Adult: older	?	periodontal disease: disc degen. - cervical, lumbar		
2098	64.0	1	Juvenile		m.v. - 3rd centre (metacarpal)	cattle	
2099	940.2	1	Adult: mature/older	??Male	o.arthritis - atlas: o.p. - lumbar	horse: h/c: u/id	Ae band: Fe t.s.
2100*	195.2	1	Adult: mature/older	??Female	o.arthritis - cervical		Ae brooch: 5 glass beads: antler pegs
2101	2645.8	1	Adult: older mature	?Male	periodontal disease	horse: h/c: u/id	
2102*	0.1	?	?Missing				
2103 =2106	1885.6		A.A. in pit of 2106			horse: cattle-u/b: sheep: h/c: u/id	
2104	8.6	1	Juvenile/subadult			p/s	
2105*	21.4	1	Infant: older			sheep	
2106	2184.0	1	Adult: mature	?Female	o.arthritis - tempero-mandibular	horse: h/c: u/id	11 glass beads: s.w.: ivory
2107*	297.8	1	Adult: older mature/older	??Female	disc degen. - cervical: o.arthritis - cervical: exostoses - tibia		2 glass beads: comb: antler peg
2108	290.0	1	Adult	Female			antler obj.
2109$	954.1	2	1) Adult: older mature/older 2) Adult	?	o.arthritis - atlas	sheep: u/id	glass
2110	119.2	1	Juvenile: young			u/id	Ae tweezers: Fe t.s.
2111*	848.1	1	Subadult: older	??Female	m.v. - wormian: o.arthritis - atlas		10 glass beads: comb: Ae
2112	975.9	1	Adult: mature	Female	m.v. - metopism: cribra orbitalia	sheep: pig - imm	
2113*	3105.1	1	Adult	?Male	o.arthritis - atlas		
2114	589.5	1	Adult: older mature/older	?	o.arthritis - cervical, thoracic: disc degen. - thoracic/lumbar: exostoses - metatarsal		
2115	149.2	1	Adult				
2116	670.2	1	Adult: mature/older	?			crystal bead: comb
2117*	87.2	1	Infant: older			p/s	Ae brooch
2118*	853.7	1	Adult	??Female	o.arthritis - atlas	sheep: u/id	5 glass beads: ivory
2119	804.6	1	Adult	Male		p/s: h/c: u/id	Fe t.s.: antler bead
2120$	932.9	1	Adult: mature	?	m.v. - wormian: exostoses - humerus		Ae glass
2121	669.9	1	Subadult: older	??Female		bird: u/id	Ae: 4 glass beads
2122	96.6	1	Adult	?Male			
2123 A	64.9	2	1) Adult 2) Infant: young	?			glass bead
2123* B	66.1	1	Infant				
2124*	397.1	1	Adult	??Female		u/id	
2125	282.4	1	Adult	?		pig: u/id	
2126 =2130	55.1		Adult	?	o.arthritis - fibula		
2127	641.1	1	Adult: mature	?			
2128	224.2	1	Adult	?			glass bead
2129	34.3	1	Juvenile				
2130	5635.1	4	Adults: min. 2 younger mature + 1 mature/older	Male + ?Male + ?	periodontal disease: o.arthritis - atlas, axis: o.p. - thoracic: disc degen. - cervical	cattle: u/id	
2131	87.3	1	Infant: older		m.v. - 3rd centre (metatarsal)	u/id	
2132	280.7	1	Adult: older mature/older	??Female		pig - imm: u/id	Ae: Fe brooch spring: 24 glass beads: ivory
2133	24.8	1	Subadult/adult	?			
2134	86.5	1	Juvenile				
2135*	244.1	1	Juvenile			u/id	Ae: glass
2136	182.6	2	1) Adult 2) Infant/juvenile	?			Fe ring
2137	2.6	?	Subadult/adult				Fe loop
2138	449.9	2	1) Neonate/young infant 2) Adult: younger mature	2)? Female		u/id	Ae: bone obj.
2139*	0.0		Missing				
2140*	117.2	1	Adult: older mature/older	?	disc degen. - cervical		comb
2141	362.2	1	Adult: mature	?	o.arthritis - atlas	u/id	
2142	6.1	?	?	?			
2143	1183.6	1	Adult: younger mature	??Female	o.arthritis - atlas	p/s	Ae 2 brooches, buckle, ring: Fe strip: 30 glass beads: 2 antler pendants: antler ring
2144*	142.5	1	Juvenile: young				2 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2145	687.7	1	Adult: mature	?	o.p. - thoracic: destructive lesion - lumbar	cattle: u/ic	
2146	460.0	1	Adult	?		p/s - neonate: u/id - imm.	Ae: 7 glass beads: crystal: worked bone
2147	10.3	1	Subadult/adult	?			
2148	581.7	1	Adult : older mature/older	?Female	o.arthritis - atlas		13 glass beads: ivory
2149	32.4	?	?	?			
2150	537.0	1	Adult	Male	o.arthritis - atlas	h/c: u/id	Fe shears
2151	0.0		No. not used				
2152	36.5	?	Adult	?			
2153	2.0	?	?	?			
2154	1420.2	1	Adult: older	Male	tooth loss: periodontal disease: o.arthritis - axis, cervical, thoracic: disc degen. - thoracic, lumbar: destructive lesion - lumbar	h/c	comb
2155	0.0		No bone				
2156	0.1	1	Infant				
2157	43.3	1	Infant :older			? missing	9 glass beads
2158	1.5	?	Subadult/adult	?			
2159	38.0	1	Subadult/adult	?			glass bead
2160	826.5	1	Adult: mature	??Female		u/id	comb + case
2161	1343.6	1	Adult: mature	??Male		u/id	Fe t.s.: glass: comb
2162	434.2	1	Adult	?Female			Ae objs.: glass beads
2163	4.0	?	Subadult/adult	?			
2164*	1827.2	1	Adult: mature	?	o.p. - lumbar	u/id - imm.	Ae obj.: comb
2165	1.6	1	Infant/juvenile				glass
2166	1123.0	1	Adult: older mature/older	?	o.p. - cervical	u/id	
2167	292.1	1	Subadult			sheep	Fe t.s.
2168	442.9	1	Adult: older	??Female		u/id	1[illegible] glass beads: ivory
2169	495.1	1	Adult: mature/older	?			Fe t.s.: glass
2170	65.6	1	Older subadult/adult	?			
2171	313.5	1	Adult	??Female			Ae tweezers: Fe ring
2172 =2175	86.6						glass
2173	0.0		No bone				
2174	15.7	?	Subadult/adult	?			
2175*	296.6	2	1) Adult 2) Juvenile				
2176*	647.8	1	Adult: mature/older	?Male	periodontal disease: periostitis - humerus, tibia, fibula		Fe point
2177	426.8	1	Subadult: older	??Female	m.v. - wormian	u/id	Ae clasp: Fe brooch spring: 4+ glass beads
2178*	37.5	1	Infant: young			sheep-imm: u/id	
2179	59.6	1	Adult	?			Ae obj.: glass vessel: comb
2180	451.1	1	Adult: mature/older	?	o.p. - cervical		Fe t.s.
2181	69.5	1	Infant/juvenile			horse	4 glass beads
2182	534.3	1	Adult	?		sheep: u/id	comb
2183*	905.6	1	Adult: older mature/older	?	dental abscess: disc degen. - cervical: o.p. - finger phalanges		Fe t.s.: comb + case: burnt pot
2184	446.3	1	Adult: mature/older	??Female			Ae bar: Fe ring: glass
2185	554.6	2	1) Juvenile 2) Adult: mature/older	?		horse: h/c: u/id	Ae brooch: 5 glass beads: comb
2186	202.4	1	Older juvenile/young subadult		m.v. - metopism, 3rd centre (metatarsal)		10 glass beads: ivory
2187	40.1	1	Older infant/young juvenile				
2188*	780.4	1	Adult: older mature/older	?? Female	o.arthritis - axis: o.p. - thoracic/lumbar		Ae: 13 glass beads: antler ring
2189	49.1	1	Subadult/adult	?		pig - imm	glass beads
2190	393.5	1	Adult: older	?	o.arthritis - finger phalanx: o.p. - finger phalanges		Fe t.s.: glass vessel
2191	89.8	1	Adult	?			
2192*	488.8	1	Adult: older	Female	o.arthritis - cervical, thoracic	h/c	comb
2193*	469.1	1	Adult: older	?	tooth loss: o.arthritis - atlas, cervical, thoracic: disc degen. - cervical		
2194	98.3	1	Adult			h/c: u/id	
2195	284.7	2	1) Juvenile: young 2) Adult	?		horse: h/c: u/id	2 Ae brooches: s.w.: comb
2196	655.4	1	Adult: older mature/older	?	m.v. - metopism: o.p. - finger phalanx, metatarsal		
2197	416.2	1	Adult	??Female		sheep	Ae brooch: glass bead: comb
2198	13.6	?	Adult/subadult	?			
2199	513.0	1	Adult: mature/older	??Female	o.arthritis - thoracic	u/id	Fe t.s.: glass
2200	375.2	1	Adult: younger mature	??Female			
2201	692.0	1	Adult: mature	??Male	m.v. - wormian	sheep: u/id	Ae brooch: Fe ring, pin: 10 glass beads
2202	226.3	1	Subadult/adult	?			

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2203	169.0	1	Adult	??Male	periostitis - tibia	u/id	burnt pot
2204	6.0	?	Subadult/adult	?		h/c	
2205	24.9	1	Adult	?			
2206*	400.8	1	Adult: mature	?			Ae buckle
2207	286.5	1	Adult: mature	?	tooth loss: dental abscess		2 glass beads
2208	57.7	1	Subadult/adult	?			Ae brooch
2209	1122.9	1	Adult: mature	??Female		sheep: u/id	Ae: 2 glass beads
2210	1.2	1	?	?			
2211	1778.7	2	1) Adult: mature 2) Young/younger mature	??Female ?Male +	o.p. - foot phlanax: destructive lesions - thoracic	u/id	Ae t.s.: Fe t.s.: s.w.: 2 combs: antler bead
2212	101.3	1	Adult: young/younger mature	?			Ae sheet
2213	988.1	1	Adult: younger mature	?	m.v. - tooth root	u/id	glass bead: ivory
2214	876.6	1	Adult: mature	Female	o.p. - finger phalanx		Ae: ivory
2215	1191.3	1	Adult: young/mature	?		sheep: u/id	Ae ring, tweezers: Fe knife, obj.: burnt pot
2216	332.6	1	Adult: mature	?	o.arthritis - axis		
2217	663.6	1	Adult: older	?	tooth loss: dental abscess: periodontal disease: o.arthritis - atlas, cervical, thoracic	sheep-imm: pig-imm: u/id	Ae brooch: 2 glass beads: bone bead: ivory
2218*	2008.1	2	Adults: mature	1) ?Male 2) ?Female	hypercementosis: m.v. - tori, periodontal disease: o.p. - finger phalanx	horse: sheep: u/id	Fe knife, tweezers: 13 p.p.: antler pegs
2219*	1007.6	1	Adult: older	?Female	tooth loss: disc degen. - cervical, thoracic, lumbar: o.p. - cervical, finger phalanges, metatarsal: Schmorl's node-lumbar	h/c-u/b: u/id	Ae: 7 glass beads
2220	624.4	1	Adult: young	?		sheep: u/id	Ae sheet: glass bead: ivory: s.w.
2221*	149.2	1	Older juvenile/young subadult	?			glass bead
2222	370.0	1	Adult: young	??Female			Ae
2223	79.7	1	Adult	?			Fe t.s.
2224*	657.4	1	Adult: older	?	o.arthritis - axis, thoracic: o.p. - thoracic	u/id	burnt pot
2225 =2230	195.8					horse: h/c: u/id	
2226	48.8	1	Subadult/adult	?			
2227	692.4	1	Adult: older	?	dental abscess: tooth loss: o.arthritis - axis: disc degen. - cervical, thoracic, lumbar: destructive lesion - cervical	sheep - imm: h/c: u/id	comb: 3 glass beads: burnt pot
2228*	147.7	1	Adult	?			
2229	508.1	1	Adult: older/older mature	?Male	o.arthritis - thoracic: o.p. - thoracic, finger phalanx		Fe t.s.: hone
2230	206.7	1	Adult: older/mature	?	o.arthritis - cervical		antler
2231*	664.2	1	Adult	?		u/id	ivory
2232*	36.8	1	Infant				
2233	223.2	1	Juvenile: older/subadult: young		m.v. - tooth crown	sheep: h/c	Ae t.s.: Fe razor
2234*	568.6	1	Adult: mature	Male		sheep - imm: u/id	Fe t.s.
2235*	684.2	1	Adult: young	Female			glass bead: s.w.: comb: ivory: Ae
2236	473.6	1	Adult: older/older mature	?	o.p. - finger phalanges: o.arthritis - atlas, cervical, thoracic: disc degen. - thoracic/lumbar	sheep	Ae: Fe: 12 glass beads: burnt pot
2237*	9.9	1	Infant: young			sheep	3 glass beads
2238	43.2	1	Subadult/adult	?			
2239	51.2	1	Adult	?			
2240*	858.5	1	Adult: young/mature	?	m.v. - tori		Ae t.s.: glass vessel
2256=1927	0.0						
2272=1937B	0.0						
2273=1937A+B	0.0						
2283	78.0	1	Adult: younger mature	?		u/id	
2284	13.9	1	Infant: young				
2285	51.2	1	Adult	?		u/id	
2286	16.2	?	Subadult/adult	?			
2287	93.6	1	Adult	?			Ae
2288	41.6	?	Subadult/adult	?			
2289	46.4	1	Adult	?			
2290	13.0	1	Infant				
2291	754.3	1	Adult: mature	?	disc degen. - thoracic		Fe hammer head
2292	13.3	?	Subadult/adult	?			
2293	401.2	1	Subadult/adult	?		u/id	glass: burnt pot
2294	493.0	1	Adult: young/mature	?		sheep - imm: u/id	
2295	48.2	1	Infant			sheep	antler ring
2296	193.5	1	Subadult/adult	?			Ae sheet
2297	330.0	1	Adult	?			ivory

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2298	42.4	1	Adult: older mature/older	?	disc degen. - thoracic/lumbar		antler disc
2299$	520.3	1?	Adult: young/mature	?		u/id	Fe t.s., die: 2 glass beads: ivory
2300	540.4	1	Adult: mature	?Female		sheep	Ae: 8 glass beads
2301	1118.9	1	Adult: younger mature	?			Fe staple, point: antler handle: glass
2302	282.2	1	Older juvenile/young subadult		m.v. - 3rd centre (metacarpal)		
2303$	1489.5	1	Adult: mature	??Male		horse: h/c: u/id	p.p
2304	9.2	?	?	?			
2305	105.6	1	Subadult/adult	?			
2306	451.9	1	Adult: young/mature	?			glass bead
2307	205.8	1	Subadult/adult	??Male			
2308	166.3	1	Adult: mature/older	?			Fe brooch pin: Ae brooch
2309	520.6	1	Adult: young/mature	?			5 glass beads: Ae
2310	153.4	1	Adult: young/mature	?		sheep - imm: u/id	
2311	388.2	1	Adult: young	?		sheep	Fe: glass
2312	291.5	1	Juvenile: older			pig: u/id	Fe
2313	648.5	1	Adult: mature	?	o.p. - finger phalanx		Ae tweezers: comb: 2 p.p.
2314	28.3	?	Juvenile/adult	?			glass beads
2315	38.5	1	Subadult/adult	?			glass bead
2316	95.0	1	Subadult/adult	?		u/id	Fe
2317*	1206.9	1	Adult: younger mature	?Female	o.arthritis - costo-vertebral: m.v. - wormian		5 glass beads: Ae: s.w.
2318	7.5	1	Infant: young				Fe
2319	70.6	1	Subadult/adult	?			
2320*	1237.0	1	Adult: older mature/older	?Male	o.arthritis - finger phalanges: o.p. - finger phalanx, lumbar: m.v. - tori	u/id	Fe t.s.
2321*	725.6	1	Adult: older mature	?	o.arthritis - axis	sheep - imm: u/id	7 glass beads
2322*	1054.5	1	Adult: young/mature	Female		pig: h/c: u/id	glass beads: burnt pot
2323*	888.9	1	Older subadult/young adult	?Female		fox: u/id	crystal bead: 6 glass beads
2324	332.1	1	Adult	?		sheep - imm	Ae brooch: glass bead
2325	61.6	1	Subadult/adult	?		cattle - u/b	
2326	249.7	1	Subadult: older	?	m.v. - wormian		
2327	449.3	1	Adult	?			Ae: ivory: glass
2328	385.3	1	Adult: young/mature	?			
2329	696.1	1	Adult	?Male			
2330 =2328	45.0						glass
2331	1089.4	1	Adult: mature	?Male	disc degen. - cervical, thoracic: o.p. - thoracic/lumbar	sheep: u/id	glass: burnt pot
2332	433.6	1	Adult: mature	?	o.p. - finger phalanx		20 glass beads: ivory: Ae
2333	733.6	1	Adult: mature	Female			Fe blade
2334	34.5	1	Infant: older				
2335*	1403.6	1	Adult: mature	??Female	hypercementosis: infection? - frontal: o.arthritis - clavicle	u/id	Ae obj.: 7 glass beads: burnt pot: ivory
{ 2336	{ 55.0	1	Subadult/adult	?			
{ 2337	{ 36.2	1	Subadult/adult	?			9 glass beads
2338*	391.1	1	Adult: mature/older	?	tooth loss - trauma		Ae brooch: 12 glass beads: antler ring
2339* A	588.3	1	Juvenile: young			cattle - u/b: pig - imm: u/id	glass
2339 B		1	Adult: young/mature	??Female			Ae: 18 glass beads: s.w.: ivory
2340	1068.7	1	Adult: mature	?		sheep	9 glass beads
2341*	796.5	1	Adult: younger mature	?			Fe tool, tweezers: comb
2342*	1235.5	1	Adult: younger mature	Female		h/c	Ae: antler ring: comb: ivory
2343 =2336	5.4						ivory
2344	41.7	1	Juvenile				Ae: Fe tool
2345$	551.1	1	Adult: mature	?	cyst - lunate: o.p. - foot phalanx		
2346	517.2	1	Adult: mature	?Female			Ae girdle-hanger: 40 glass beads: 2 s.w.
2347*	29.0	1	Older infant/young juvenile				Fe knife
2348	0.0		No bone				
2349*	15.0	1	Infant: young				comb: ivory
2350*	372.8	1	Adult	??Female		beaver	10 glass beads: s.w.: comb: Fe
2351	1383.0	1	Adult: older mature	Male	o.p. - lumbar: disc degen. - thoracic	u/id	
2352	288.6	1	Adult: mature	?		u/id	Fe bars
2353	1782.9	1	Adult	?		horse: sheep: h/c: u/id	6 glass beads
2354	23.9	1	Infant				
2355	833.2	1	Adult: mature	?Female	o.arthritis - atlas: o.p. - cervical	sheep	Ae sheet: 3 glass beads: comb: ivory

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2356	148.5	1	Adult	?			comb: glass bead
2357$	1211.2	1	Adult: older mature/older	?		sheep: pig - imm: u/id	Fe knife
2358	872.3	1	Adult: young/mature	?		dog	Ae: Fe tweezers: bone disc
2359	672.9	1	Adult: young/younger mature	??Female		sheep: u/id	Ae sheet: glass vessel: comb: ivory
2360$	228.0	1	Juvenile: young				Fe razor, knife: glass
2361	642.7	1	Adult: younger mature	?			Fe t.s.
2362	21.8	1	Infant				2 glass beads
2363	716.2	1	Adult: mature	??Male		cattle-u/b: u/id	
2364	671.8	1	Adult: mature	?			Ae tweezers: Fe shears: comb
2365 =2336	0.0						
2366	982.9	1	Adult: young	?		u/id	
2367	602.1	1	Adult: older mature/older	?	destructive lesion - cervical: o.p. - lumbar		Fe blade, nail: 2 glass beads
2368	119.9	1	Juvenile				Ae
2369	60.5	1	Infant: older				
2370	134.6	1	Juvenile: young				Fe knife: glass: 3 p.p.: burnt pot
2371*	1580.5	1	Adult: mature	?Male	cyst - femur		comb
2372*	1030.0	1	Adult: younger mature	??Male			Fe t.s.: comb
2373	0.3	?	?				
2374*	1184.2	2	1) Adult: mature 2) Infant/juvenile	1) ?Female	tooth loss - trauma: o.arthritis - cervical	u/id	Ae brooch: 45 glass beads: ivory
2375	447.1	1	Juvenile			u/id	
2376*	612.9	1	Adult: older mature/older	??Female	benign tumor - temporal: disarticulation - tempero-mandibular: m.v. - tori: disc degen. - cervical, thoracic/lumbar: o.arthritis - thoracic, lumbar: o.p. - sacral		Ag ring: Fe rings (necklace): Ae 3 brooches, fitting: glass beads: s.w.: comb: ivory: burnt pot
2377*	123.7	1	Older infant/young juvenile				
2378	14.8	?	Subadult/adult	?			
2379	71.3	1	Subadult/adult	?		sheep	Ae sheet: Fe nail
2380	789.1	2	1) Adult: young 2) Infant	1) ??Female		u/id	Ae brooch: Fe: 4 glass beads: crystal: ivory: antler pendant
2381	27.1	1	Subadult/adult	??Female			
2382	499.8	1	Adult	?	tooth loss		Ae brooch: 25 glass beads: comb
2383	255.3	1	Adult	?			Fe ring, tweezers: glass bead
2384	897.8	1	Adult: young	?		horse: h/c: u/id	glass
2385	0.0		Missing				Fe oxgoad: glass
2386	824.6	1	Adult: young/mature	?		sheep - imm: u/id	4 glass beads: ivory: comb
2387	585.0	1	Subadult/adult	?			
2388	327.2	1	Adult: mature	Female	destructive lesion - thoracic/lumbar: Schmorl's node - thoracic/lumbar: o.p. - thoracic/lumbar		Ae: 6 glass beads
2389	1348.7	1	Adult: young/younger mature	??Male		sheep: u/id	burnt pot
2390	1169.2		Mostly animal, possible A.A. to 2353			horse: sheep: h/c: u/id	glass
2391	68.4	1	Adult	?			
2392	392.6	1	Adult: young/younger mature	?Female		pig: u/id	Ae sheet: 2 glass beads: s.w.: ivory
2393	1266.4	1	Adult: younger mature	?			comb: bone bead
2394	1154.5	1	Adult: mature			u/id	bone bead
2395	16.6	1	Infant	?		u/id	
2396*	57.5	1	Infant: older		m.v. - tooth crowns	u/id	comb
2397	181.4	1	Juvenile/subadult			p/s	2 glass beads: ivory
2398$	1997.6	1	Adult: young	?		horse: sheep: h/c: u/id	glass bead, vessel
2399	507.7	1	Adult: younger mature	?	dental caries	h/c-u/b	
2400	6.3	1	Infant				glass
2401*	1553.4	1	Adult: older mature/older	??Male	tooth loss: periodontal disease: disc degen. - cervical: Schmorl's node - lumbar: calcined mass - ?lymph node (T.B.)		Ae tweezers
2402*	1013.5	1	Adult: older mature/older	Male	o.arthritis - cervical, thoracic	u/id	comb: glass
2403	880.6	1	Adult: older mature/older	?	tooth loss: disc degen. - cervical: o.arthritis - shoulder	sheep - imm.	Ae: 17 glass beads
2404	929.2	1	Adult	?			Ae tweezers: Fe fitting: antler disc
2405*	139.9	1	Juvenile: young				
2406*	25.4	1	Older infant/young juvenile				Ae sheet: knife blade: 2 glass beads
2407	2.1	1	Infant: neonate/young				
2408	5.6	1	Older infant/young juvenile				glass
2409	111.1	1	Subadult/adult	?			Fe knives
2410	588.0	1	Adult: older	?Female	tooth loss: periodontal disease: o.arthritis - atlas		crystal bead: glass vessel: Ae
2411	295.8	1	Adult: older mature/older	?	o.arthritis - axis, metatarsal		comb
2412	603.8	1	Adult	?			
2413	623.9	1	Adult: mature	?	m.v. - double mastoid		glass bead: p.p.

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2414*	72.9	1	Infant: older				2 combs
2415	78.7	1	Juvenile				
2416	62.1	1	Juvenile/subadult				
2417	629.5	1	Adult	?			5 glass beads: s.w.: comb
2418*	602.3	1	Adult: younger mature	?		sheep	ivory
2419*	1298.7	1	Adult: younger mature	?	o.p. - finger phalanx	sheep	7 glass beads: comb
2420	412.7	1	Older subadult/adult	?	o.arthritis - tempero-mandibular		glass bead
2421	35.0	1	Subadult/adult	?		dog	
2422	881.1	1	Adult: younger mature	??Female			Fe tweezers
2423	1143.8	1	Adult: younger mature	Male			9 glass beads: Ae: antler obj.
2424	116.7	1	Subadult/adult	?			
2425	191.7	1?	Juvenile/adult	?		u/id	
2426	867.0	1	Adult: young/younger mature	?Male			comb: burnt pot
2427	261.9	1	Young subadult			u/id	Ae: 2 glass beads: Fe needle: bone obj.
2428	64.9	1	Subadult/adult	?		u/id	glass
2429	535.6	1	Adult: young/mature	??Female			
2430	1020.4	1	Adult: younger mature	?		sheep: h/c: u/id	
2431	222.3	1	Adult	??Female			3 glass beads
2432*	1612.0	1	Adult: young/younger mature	??Female		horse: p/s: h/c: u/id	Fe buckle: a/b bead: burnt pot
2433	457.5	1	Adult: mature	?Female		pig - neonate	antler ring: ivory: comb
2434	9.5	1?	Adult	?			
2435=2434/?6	173.4					u/id	
2436*	10.6	1	Adult	?			glass bead
2437	}1957.0	1	Subadult	??Male		horse: h/c u/id	Ae
2438	551.7	1	Adult: older mature/older	?	o.arthritis - atlas, axis, ulna: o.p. - thoracic	sheep: u/id	
2439	505.5	1	Adult: mature	?	o.p. - finger phalanges		comb + case: 5 glass beads: bone obj.
2440A=2544	49.0						
2440B=2541	0.0						10 p.p.: glass
2441	123.7	1	Older juvenile/young subadult			u/id	Fe knife
2442	150.1	1	Young subadult				2 glass beads: s.w.: ivory
2443	865.1	1	Adult: mature	?	o.arthritis - atlas, axis	u/id	Fe t.s.: glass bead: comb
2444	381.1	1	Adult: mature	?			2 glass beads
2445	1069.3	1	Adult: older	?	m.v. - wormian: o.arthritis - axis, thoracic: o.p. - cervical, finger phalanx	h/c: u/id	Fe tweezers, clip: antler bead
2446	234.8	1	Adult	?	o.p. - finger phalanx	pig: u/id	
2447	28.2	1	Adult: mature/older	?	exostoses - metatarsal		glass bead
2448	77.5	1	Subadult/adult	?			
2449	1.4	1	Infant				
2450	179.7	1	Subadult/adult	?			
2451*	533.1	1	Subadult: young			sheep - imm.	Fe t.s.: glass: comb
2452	1448.3	1	Adult: older	?Male	periodontal disease: tooth loss - trauma?: o.arthritis - atlas, axis, costo-vertebral, thoracic, lumbar, clavicle: disc degen. - cervical, thoracic: o.p. - lumbar, fibula, hands, feet: exostoses - patella	u/id	Ae tweezers: Fe t.s.: comb
2453	1276.3	1	Adult: mature	??Male	o.arthritis - axis, scaphoid: o.p. - cervical, ulna		Ae tweezers: Fe handle
2454	907.1	1	Adult: younger mature	Female		u/id	Ae cylinder: 8 glass beads: comb: ivory
2455	164.9	1	Adult: young/mature	??Male		u/id	
2456	915.0	1	Adult: young/younger mature	?			Ae wrist-clasp
2457	1672.0	1	Adult: younger mature	?Male			comb: Fe t.s.: bone bead
2458	253.9	1	Adult: mature	??Female			
2459	48.6	1	Subadult/adult	?			
2460	178.4	1	Subadult/adult	?			Ae: 9 glass beads
2461	496.7	1	Adult: mature	??Male			
2462	558.9	2	1) Adult: older mature/older 2) older infant/young juvenile	1)??Female	o.arthritis - atlas: o.p. - cervical, finger phalanges	sheep: u/id	4+ glass beads: Ae
2463	909.1	1	Adult: younger mature	Female			9 glass beads: crystal: comb
2464	1478.6		A.A. to 2483			horse: sheep: h/c: u/id	14 p.p.
2465	167.8	1	Subadult				Fe fitting: Fe obj.
2466*	691.0	1	Adult: mature	??Female	periodontal disease: tooth loss: destructive lesions - cervical: o.arthritis - thoracic		burnt pot
2467	717.3	1	Adult: mature	??Male			
2468	1278.3	2	1) Adult: younger mature 2) Adult	1) ??Male			15 p.p.: burnt pot
2469	1213.9	1	Adult: younger mature	??Male	m.v. - finger phalanx: o.p. - finger phalanx	u/id	2 glass beads: ivory: s.w.

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2470*	135.5	1	Infant: older				
2471	5.1	1	Infant			sheep	
2472	945.7	1	Adult: younger mature	?	Schmorl's nodes - thoracic	sheep - imm.: u/id	
2473	13.4	1	Infant			u/id	
2474	815.8	1	Adult: older mature/older	??Female	o.p. - ulna, finger and foot phalanges: exostoses - femur	pig	
2475	142.7	1	Adult	?			comb
2476	703.0	1	Adult: younger mature	?			
2477	559.1	1	Adult: young/mature	?Male			glass
2478	1584.6	2	1) Adult: mature 2) Adult: young/mature	?Female + ??Male	calculus: o.arthritis - atlas	pig - imm.	
2479*	351.7	1	Older juvenile/young subadult				
2480$	607.5	1	Adult: mature	?	o.arthritis - atlas	pig - imm.: u/id	comb: 3 p.p.
2481	497.6	1	Juvenile			u/id	glass bead: burnt pot
2482*	370.5	1	Subadult: young		m.v. - 3rd centre (metacarpal)	u/id	Fe obj.
2483	1508.4	1	Adult : young	??Male		horse: sheep: h/c: u/id	Ae sheet
2484	1024.5	2	1) Adult: older mature/older 2) Adult: young	??Male + ?	m.v. - metopism: tooth loss: disc degen. - cervical, thoracic, lumbar: destructive lesion - cervical: o.arthritis - thoracic	sheep: u/id	comb
2485	274.0	1	Adult	?	cyst - patella		
2486	2923.2	1	Adult: young/younger mature	?		horse: cattle - neonate: h/c: u/id	
2487	1125.4	1	Adult: older	?Male	tooth loss: dental abscess: disc degen. - cervical, lumbar: destructive lesions		Fe t.s.
2488	172.0	1	Young juvenile				5 glass beads: burnt pot
2489	660.4	1	Adult: mature	?	o.arthritis - axis: disc degen. - cervical		
2490	277.3	1	Adult: mature/older	??Male	disc degen. - cervical		
2491	940.0	1	Adult: older mature/older	?	disc degen. - lumbar		
2492	0.0		No bone				
2493	932.1	1	Adult: mature	?	hypercementosis: o.arthritis - axis: exostoses - ilium, foot phalanx, patella		
2494	403.5	1	Adult: mature/older	?	disc degen. - cervical		
2495	1137.9	1	Adult: older	?	tooth loss: o.arthritis - atlas, axis, cervical	u/id	Fe t.s.: comb
2496$	396.9	1	Adult: older mature/older	?	tooth loss	u/id	Ae blade: s.w.
2497	3508.8		Possible A.A. to 2519	?		horse: h/c: u/id	Fe ring
2498	745.9	1	Adult: mature/older	??Female	tooth loss: dental abscess	sheep - imm.: pig	Ae: 15 glass beads: antler ring
2499	412.3	1	Adult: young/mature	??Female		sheep: u/id	
2500	831.4	1	Adult: older mature/older	?	o.arthritis - axis: disc degen.		comb: 2 antler 'pegs'
2501	228.5	1	Adult: mature	Female			
2502	460.4	1	Adult	?	o.p. - foot phalanx		comb
2503	1041.3	1	Adult: older mature/older	?Male	tooth loss: disc degen. - cervical, thoracic/lumbar		Ae tweezers: Fe
2504	692.8	1	Adult: mature	?		u/id	Ae
2505	0.0		No bone				
2506$	1171.0	2	1) Adult: mature 2) Infant	?	tooth loss	cattle: u/id: horse	Ae brooch: Fe tweezers: Fe: glass
2507	1501.1	1	Adult: mature	Male		horse: sheep: h/c: u/id	
2508$	5.1	?	Subadult/adult	?			
2509	290.4	1	Adult: older mature/older	?	disc degen. - cervical	sheep: u/id	Ae: Fe: glass
2510	163.8	1	Infant/juvenile				Ae: comb
2511*	862.3	1	Adult: mature	?Male		u/id	5 glass beads: ivory: antler s.w.
2512*	904.7	1	Adult: young	?		sheep	2 glass beads: ceramic bead: a/b bead: comb
2513*	502.9	1	Adult: younger mature	?Female			3 glass beads: ivory: Ae
2514	166.6	1	Adult	??Female			
2515	508.6	1	Adult	?		h/c: u/id	glass beads: Ae: antler ring: 17 sheep astragali
2516	673.4	1	Adult: older mature/older	??Male	o.p. - ribs		comb: burnt pot
2517	549.1	1	Adult: older	?	hypercementosis: o.p. - foot phalanx	sheep	Ae: 8 glass beads
2518	81.4	1	Subadult/adult	?			
2519	1646.6	1	Adult: mature			h/c: u/id	Fe t.s.: comb
2520	205.4	1	Subadult/adult	?		u/id	4 glass beads
2521	127.2	1	Juvenile				6+ glass beads: comb: Fe
2522	1290.3	1	Subadult/adult	?		horse: h/c - inc.imm: u/id	burnt sherds
2523	656.5	1	Adult	?Male	periodontal disease		Fe blade
2524	625.6	2	1) Juvenile: young 2) Adult: young/mature	?		sheep - imm: h/c: u/id - imm	25 glass beads: comb

Urn No.		Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2525		32.5	1	Older infant/young juvenile				Ae: glass bead
2526	A+B	287.3	1	Adult: mature/older	??Male	o.p. - rib	catt e - u/b	Fe tweezers: glass vessel: glass beads: Ae glob bone bead
2527		61.7	1	Infant				
2528		490.5	1	Subadult/adult	?		h/c:u/id	
2529		352.0	1	Adult	?		h/c: u/id	
2530$		82.6	1	Adult	?			
2531*		853.1	1	Adult: mature	Female	o.p. - patella	sheep	Ae: 6/8 glass beads: comb: ivory
2532		447.0	1	Subadult/adult	?			10 glass beads: burnt pot
2533$		756.5	1	Subadult/adult	?			Ae brooch
2534*		370.5	1	Juvenile: young			u/id	comb
2535		644.8	2	1) Young juvenile 2) Young subadult				
2536		203.7	1	Subadult/adult	?		horse: sheep: bear: u/id	p.p.: Ae
2537	}	214.5	1	Adult: older mature/older	?		u/id	
2538	}	1492.0	1	Adult: younger mature	?	o.arthritis - atlas, axis, finger phalanx	u/id	Ae: burnt pot
2539		220.4	1	Adult: older mature/older	?	o.arthritis - axis, thoracic		
2540A=2544		78.3						glass
2540B=2541								
2541		420.0	1	Adult: mature/older	Female	o.arthritis - cervical		19 p.p : glass bead
2542		175.0	1	Adult	?Female			
2543		275.0	1	Adult: young/younger mature	?		cattle: u/id	
2544		171.7	1	Adult	?			2 glass beads: Ae
2545		405.6	1	Adult: mature	Female	o.arthritis - lumbar	u/id	5 glass beads: glass vessel: ivory
2546		772.0	1	Adult: mature	Male		sheep: bird: u/id	Ae Fe: glass bead: crystal: ivory: antler s.w.
2547		358.3	1	Adult: younger mature	Male		u/id	
2548		370.4	1	Subadult/adult	?		horse: sheep: dog: h/c: u/id	glass: s.w.: ivory
2549		292.9	1	Adult: young/younger mature	?		h/c: u/id	
2550		82.0	1	Adult	??Female			Ae: 3/5 glass beads: ivory
2551$		1912.7	1	Subadult	?	cyst - humerus	horse: sheep: h/c: pig: u/id	5/6 glass beads
2552		760.6	1	Adult: young/mature	?		sheep	Ae: 3/4 glass beads: ivory: comb
2553		18.7	1	Infant			sheep	
2554		0.0		No bone				2 glass beads
2555*		93.6	1	Juvenile				
2556		279.8	1	Adult: mature	?			
2557		189.4	1	Older subadult/adult	?Female			glass vessel
2558		35.8	1	Infant: older				Ae
2559		16.2	1	Juvenile: young				
2560		881.7	1	Adult: mature	?			Ae: Fe t.s.
2561*		40.7	1	Juvenile: young				3 glass beads
2562*		4.2	1	Infant				
2563		2311.5	1	Adult: older	?Male	tooth loss: periodontal disease: infection? - thoracic	horse: cattle: h/c: u/id	Ae tweezers: Fe t.s.: p.p.: comb
2564		910.4	1	Adult: mature	??Female		horse: sheep: u/id	Ae: Ae tweezers: Fe t.s.: glass
2565		262.6	1	Juvenile		m.v. - tooth root	sheep	2 glass beads
2566*		580.0	1	Juvenile: older				Fe tweezers: glass
2567*		80.7	1	Infant			u/id-imm	Fe: glass
2568		684.9	1	Adult: mature	?Female	pitting - innominate	u/id	Ae: 4 glass beads: comb: ivory
2569		152.8	1	Juvenile				
2570		589.9	1	Adult: mature	?Male	m.v. - tori		a/b objects
2571		15.6	1	Adult: young/mature	?			
2572		134.7	2	1) Young juvenile 2) Older subadult/adult	2) ??Female		u/id	
2573*		1180.0	1	Adult: older	??Female	tooth loss: periodontal disease: o.arthritis - atlas, cervical: disc degen. - cervical, thoracic: destructive lesion - thoracic/lumbar: o.p. - lumbar	sheep: u/id	antler bead: bone cylinder
2574		173.4	1	Juvenile/subadult				
2575		605.9	1	Juvenile/subadult			h/c: u/id	Fe razor
2576		877.0	1	Subadult: young			horse: cattle: sheep: h/c: u/id	
2577		329.9	1	Adult: young/mature	??Female		sheep - imm	bone handle
2578		1124.2	1	Adult	?		horse: h/c: u/id	Fe nail: glass vessel
2579		746.4	1	Adult: young/younger mature	?		h/c: u/ic	Ae: Fe razor
2580		19.3	1	Infant/juvenile				

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2581	33.2	?	Subadult/adult	?			
2582	211.5	1	Adult: younger mature	?			
2583	292.0	1	Juvenile			sheep - imm	Fe tweezers + ring
2584	379.0	1	Adult	?	o.arthritis - axis		
2585	445.2	1	Adult: young	?		sheep - imm: u/id	Ae: 6 glass beads: ivory: comb
2586	1114.3	1	Subadult			horse: sheep: h/c: u/id	3 glass beads: Fe nail
2587	385.8	1	Adult: young/younger mature	?		sheep - imm: u/id	2 glass beads: antler s.w.: ivory: comb: a/b obj.
2588$	753.8	1	Adult: older mature/older	Female	tooth loss: o.p. - lumbar	h/c	5 glass beads
2589*	106.0	1	Young juvenile				
2590$	425.9	1	Adult	Male			glass: burnt pot
2591	1.7	1	Infant			u/id	Ae: glass
2592	620.3		Probably A.A. to 2586			horse: h/c: u/id	glass bead
2593*	732.7	1	Adult: younger mature	?Female		u/id	Ae: glass: ivory: burnt pot
2594*	149.5	1	Older juvenile			u/id	comb
2595	163.5	1	Older juvenile		m.v. - 3rd centre (metatarsal)		Roman coin: Ae: Fe knife: 3/4 glass beads: s.w.: comb
2596	235.4	1	Older juvenile		m.v. - 3rd centre (metatarsal)	h/c	Fe tweezers
2597*	12.5	1	Infant				Fe t.s.: Fe brooch spring: comb
2598	278.4	1	Subadult/adult	?			
2599*	185.5	1	Juvenile		m.v. - 3rd centre (metatarsal)	pig - imm	2/3 glass beads
2600*	698.5	1	Older juvenile		m.v. - 3rd centre (metacarpal)	sheep - u/b	Fe t.s.: 14 p.p.: bone bead: comb
2601*	894.1	1	Adult: younger mature	?Female		u/id	Fe nail: crystal bead: 3/4 glass beads: comb
2602	1.1	1	Infant				
2603	776.2	1	Older subadult/adult	Female		horse: h/c: u/id	
2604	77.3	1	Adult: mature	?			
2605	676.3	1	Adult: older mature	?Male			
2606	23.6	1	Older infant				glass
2607	53.1	1	Subadult/adult	?		cattle: u/id	
2608	99.2	1	Subadult/adult	?		horse: u/id	
2609 =2549	10.6						
2610	128.2	1	Subadult/adult	?		bear: u/id	
2611	398.8	1	Older subadult	?		horse: u/id	a/b bead
2612	1.0	?	?	?			
2613	88.7	1	Subadult/adult	?			
2614	154.4	1	Subadult/adult	?			
2615	1549.5	1	Adult: younger mature	??Female	Schmorl's node - lumbar	sheep: h/c: u/id	2 Fe buckles: Fe razor: comb + case
2616*	873.1	1	Adult: younger mature	??Male	tooth loss		Ae tweezers: comb
2617	239.0	1	Adult	Female			
2618	829.0	1	Adult: mature/older	?		pig: u/id	a/b bead
2619	86.8	1	Older subadult/adult	Male		cattle - u/b: u/id	
2620	14.7	1	Infant				
2621	317.1	1	Adult: mature/older	??Male			Fe blade
2622	511.3	1	Adult: mature/older	?		sheep	
2623	41.2	1?	Adult	?			
2624*	1996.0	?	Possible A.A. to 2625			horse: sheep: h/c: u/id	comb: glass
2625	589.5	1	Adult: younger mature	?		sheep: h/c: u/id	Fe t.s.
2626	831.1	1	Adult: older mature/older	?	tooth loss	sheep - imm: pig - imm: u/id	Fe t.s.
2627	63.2	1	Older infant				comb
2628*	778.4	1	Adult: young	??Female			Ae: glass: antler ring: ivory
2629	968.1	1	Adult: young/mature	?Male	destructive lesion - tibia: proliferative new bone - tibia	sheep: h/c	Fe t.s.
2630	48.3	1	Adult	?			
2631	0.0		Missing				
2632	1285.3	1	Adult: mature	?Male			comb
2633	113.5	1	Young juvenile				comb
2634 =2718	44.6					pig - imm: sheep	
2635$	708.8	1	Adult: mature	?		sheep	glass vessel: 2 glass beads
2636	17.0	?	?	?			
2637	644.1	2	1) Juvenile: young 2) Adult: mature	?			burnt sherds
2638$	904.9	1	Adult	?		horse: sheep: h/c: u/id	Fe: glass-Roman
2639$	82.9	1	Juvenile				Ae

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2640	301.6	1	Juvenile		m.v. - 3rd centre (metatarsal)		comb
2641	71.1	1	Subadult/adult	?		u/id	ivory
2642$	786.4	1	Adult: mature	?		horse: sheep: h/c: u/id	Ae earscoop, frag.
2643*	12.3	1	Infant				Ae: Fe t.s.: comb
2644*	566.5	1	Adult: mature/older	?	o.p. - finger phalanx		Ae: 4+ glass beads: amber
2645	32.4	1	Juvenile				comb
2646	379.0	1/2?	1) Subadult/adult? 2) Juvenile	?		pig - neonate: u/id	Ae: Fe: glass bead
2647	173.5	2/1?	1) Adult: mature/older 2) Juvenile	?	tooth loss: o.p. - finger phalanx		Ae brooch: 3 glass beads: Fe
2648	516.4	1	Adult: mature/older	?	o.arthritis - atlas, axis		Ae: Fe: glass vessel
2649	602.0	1/?2	Adults: mature	?		u/id	Ae: 2 glass beads
2650$	805.9	2	1) Adult 2) Infant/juvenile	?		sheep: h/c: u/id	
2651$	3223.2	1	Subadult/adult	Female		horse: cattle: sheep: u/id	glass vessel: glass bead
2652	22.3	1	Adult	?			Ae
2653	0.0		Missing				
2654$	17.4	1	Juvenile/subadult				
2655	263.3	1	Adult: mature	??Female		sheep: u/id	Ag: comb: 7/9 glass beads: crystal: ivory
2656*	869.9	1	Adult: older mature/older	Female	periodontal disease: disc degen. - cervical: o.p. - finger phalanges: cyst - finger phalanx: o.arthritis - thoracic	sheep: u/id	Ae brooches: Ae bracelet: 40+ glass beads: burnt pot
2657*	1140.0	1	Adult: mature	??Male		sheep: u/id	
2658	1050.3	1	Adult: older	?	tooth loss: o.p. - cervical, thoracic, lumbar, sacral: exostoses - finger phalanx		s.w.
2659	201.7	1	Adult: young/mature	?			glass
2660*	0.0		Missing				Ae: glass
2661	480.0	1	Older juvenile		m.v. - wormian	cattle: sheep	Ae: 12+ glass beads
2662*	875.1	1	Adult: mature	?			
2663	1312.7	1	Adult: young/younger mature	?			2 antler beads: ivory
2664	208.5	1	Adult	?			comb
2665	889.8	1	Adult: mature	?Female			Ae: comb: 3/4 glass beads: burnt pot
2666*	1207.9	1	Adult: younger mature	??Male	Schmorl's nodes - thoracic, lumbar	pig/calf size	Fe
2667	370.0	1	Young juvenile			sheep: dog: h/c: u/id	Ae: Fe tweezers: comb + case
2668*	132.5		A.A. to 2667			dog	
2669	555.3	1	Adult: young/mature	?		u/id	5/7 glass beads: Ae
2670	6.9	?	Adult	?			
2671	936.8	1	Adult: mature	?Female	destructive lesion - maxilla		Fe t.s.: antler disc: antler: burnt pot
2672$	1453.3	1	Adult: young/mature	?		horse: cattle: h/c: sheep: u/id	glass vessel: amber: crystal: glass
2673	552.4	1	Adult: older	??Male	disc degen. - cervical, thoracic: o.arthritis - cervical, shoulder: exostoses - humerus, radius, patella: destructive lesion - thoracic		glass: antler bead
2674	1242.1	1	Adult: older	??Male	tooth loss: periodontal disease: disc degen. - cervical: destructive lesion - cervical: depression - cervical		Ae: comb
2675	836.7	1	Adult: older	Male	periodontal disease: o.arthritis - innominate		
2676	148.0	1	Adult: young	?			Ae tweezers: ivory
2677	1033.3	1	Older juvenile/younger subadult		m.v. - tooth crown, 3rd centre (metatarsal)	cattle: h/c: sheep: u/id	comb: 3+ glass beads: ivory
2678	1864.8		A.A. to 2677			horse: cattle: h/c: sheep: u/id	
2679	396.8	1	Adult: older	?	o.arthritis - axis: o.p. - thoracic/lumbar: disc degen. - thoracic/lumbar	pig	Ae: Fe knife: 4/6 glass beads: crystal: Pit - 5 glass beads: crystal: ivory
2680	35.6	1/?2	1) Subadult/adult 2) Infant/juvenile	?			
2681	0.0		Missing				
2682*	592.2	1	Adult: young/younger mature	?Male		u/id	
2683	435.7	1	Adult	?	m.v. - wormian: o.arthritis - atlas		1/2 glass beads
2684	716.5	1	Adult: younger mature	Female	m.v. - tori, wormian	sheep: h/c	Ae: comb: antler s.w.
2685	903.3	1	Adult	?			antler bead
2686	631.0	1	Adult: mature	?	exostoses - femur		Ae t.s.
2687	23.6	1	Infant				
2688*	502.5	1	Adult: young/younger mature	??Female			Ae/Fe brooches: 35+ glass beads: crystal bead: Ae: antler plaque
2689	411.6	2	1) Older subadult/adult 2) Young juvenile	?			Ae: glass bead
2690	385.0	1	Adult: young/mature	Female	m.v. - mandible		
2691	1192.3	1	Adult: younger mature	Female	o.p. - finger phalanx: destructive lesion - metacarpal		Ae tweezers: Fe t.s.
2692	232.5	1	Adult: young/younger mature	?Female			
2693	115.7	1	Infant/juvenile				
2694*	43.3	1	Older infant/young juvenile				Ae brooch: 2/3 glass beads
2695$	635.9	2	1) Adult 2) Juvenile	1) Male			glass: dec. a/b
2696	494.4	1	Adult: older mature	?Female			
2697	664.3	1	Adult: mature	??Male	exostoses - metatarsal		

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2698	103.9	1	Adult	?			3+ glass beads
2699	12.2	1	Infant				dec. a/b
2700	459.5	1	Adult: young/mature	?		u/id	3 glass beads
2701	1064.1	1	Adult: younger mature	Female			glass beads: ivory
2702	566.8	2	1) Juvenile 2) Adult: mature/older	2) Female	o.p. - lumbar		glass beads: burnt pot
2703*	382.6	1	Adult: mature	??Female	o.arthritis - axis	pig	comb: glass bead: ivory
2704	956.6	1	Adult: younger mature	?Male	o.p. - thoracic	cattle: u/id	Ae bucket fittings: 2 glass beads: ivory
2705	312.1	1	Young subadult			sheep	
2706*	489.8	1	Adult: young/mature	?Female	m.v. - mastoid		comb
2707	598.3	1	Adult: mature	??Female	m.v. - wormian	sheep	Fe brooch pin: ivory: glass
2708	63.1	1	Subadult/adult	?			
2709	615.8	1	Adult: older mature	Male	disc degen. - cervical, lumbar: pitting - cervical: o.p. - thoracic. lumbar: destructive lesion - cervical, lumbar: Schmorl's node - lumbar	sheep	Fe t.s.: comb: burnt pot
2710*	294.3	1	Adult: mature/older	??Male	disc degen. - thoracic		
2711	862.5	1	Adult: mature	?	o.p. - cervical	cattle: sheep	Fe tweezers
2712	810.5	2	1) Older infant 2) Adult: younger mature	2) ??Female			12+ glass beads: Ae: comb
2713*	1351.1	1	Adult: older mature/older	?Male	o.arthritis - atlas	u/id	Fe t.s.: comb: bone bead
2714	103.2	1	Adult	?			
2715	484.2	1	Adult: mature	?	disc degen. - thoracic		s.w.
2716	602.7	1	Adult: mature	?		cattle: h/c: u/id	
2717$	332.0	2	1) Adult 2) Infant	??Male		sheep: u/id	
2718	145.9	1	Adult	?			3 glass beads
2719	255.4	1	Adult	?		sheep: h/c: u/id	antler ring
2720	6.7	1	Infant: young			sheep	
2721	282.8	1	Adult: young/younger mature	Male			Ae
2722	94.4	?	Subadult/adult	?		h/c: u/id	
2723	462.1	1	Adult: younger mature	??Female	disc degen. - thoracic		
2724	65.6	1	Adult	?			
2725	242.3	?	Juvenile/adult	?		cattle: u/id	
2726*	1456.2	2	1) Adult: younger mature 2) Infant	?			Fe shears
2727	1065.4		A.A. to 2732/2756			horse: cattle: h/c: u/id	
2728$	345.7	1	Adult: young/younger mature	?			Ae: 4 glass beads
2729	3.2	1	Young infant/neonate				
2730*	775.6	1	Adult: mature	?	cyst - ulna	sheep: u/id	Fe tweezers
2731	1368.5	1	Adult: younger mature	Female		cattle: u/id	Fe t.s.: 8 p.p.: antler bead
2732	1155.5	1	Adult: younger mature	?		cattle: sheep: pig: u/id	glass vessel
2733*	573.1	1	Adult: mature	?		sheep	4 glass beads: Ae obj.
2734	872.8	1	Adult: younger mature	??Female		sheep	12 glass beads
2735$	180.4	2/?3	1) Infant/juvenile 2) Subadult ? 3)? Adult	?		sheep	
2736	239.3	1	Older juvenile/young subadult				
2737	559.4	2	1) Older juvenile 2) Adult	?	m.v. - 3rd centre (metacarpal)	cattle: sheep	Fe t.s.: glass vessel: comb
2738*	1158.0	1	Adult: young/mature	?			Fe t.s.
2739	398.6	1	Older juvenile		m.v. - 3rd centre (metatarsal)		3 glass beads
2740	973.3	1	Adult: older mature	??Male	periodontal disease: o.arthritis - axis	pig	comb: antler disc
2741	48.8	1	Older infant				comb: antler bead
2742	420.3	1	Adult: older mature	?	o.arthritis - atlas, costo-vertebral, thoracic: disc degen. - thoracic/lumbar: destructive lesion - thoracic/lumbar		Ae: comb: 6 glass beads
2743 =2742	459.4				m.v. - non-fusion (scapula)		2 glass beads: comb: Fe obj.: Ae
2744	2.7	?	?				
2745*	108.9	1	Older infant				comb: Ae: 6 glass beads
2746	8.2	?	?	?			
2747	60.1	1	Adult	?			
2748	683.9	1	Adult: mature	?	m.v. - tooth crown: disc degen. - thoracic: Schmorl's node - thoracic: cyst - radius		
2749 =2738	32.9						
2750	520.8	1	Adult: mature/older	?	o.p. - cervical: o.arthritis - costo-vertebral: exostoses - femur		Fe loop
2751	606.7	1	Adult: young/mature	?		cattle - imm.: pig: u/id	Fe shears: comb: antler objs.: ivory: 3 glass beads
2752	504.0	1	Adult: young/mature	??Female	o.p. - femur	u/id	Fe brooch pin: s.w.: glass bead
2753	739.9	1	Adult: mature	?	o.p. - thoracic: exostoses - rib	u/id	Ae strap end, sheet: 3 glass beads: glass: ivory
2754	1388.6	1	Adult: younger mature	?	Schmorl's nodes - thoracic/lumbar: disc degen. - thoracic	u/id	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2755*	17.5	1	Young infant			u/id	comb
2756	981.6	1	Adult: mature	??Male		cattle: sheep: u/id	Ae sheet: Fe: a/b bead: comb
2757$	767.2	1	Adult: mature	??Male		horse: sheep: u/id	glass: Ae sheet: comb: p.p.
2758	2182.9		A.A. to 2757			horse: h/c: u/id	Ae girdle-hanger: glass: 2 p.p.: comb
2759	869.1	1	Adult: older	?Male	o.p. - thoracic, metacarpal, finger phalanges: o.arthritis - atlas, axis: disc degen. - cervical: hyperostosis - thoracic		Ae: 3 glass beads: ivory
2760	25.5	1	Infant				
2761*	233.8	2	1) Juvenile 2) Adult	?		h/c: u/id	Fe bars: glass vessel
2762	225.0	1	Adult	?		horse: cattle: u/id	
2763	207.4	1	Juvenile: young		m.v. - tooth crown		comb
2764	166.1	1	Adult	?		u/id	comb
2765$	196.8	1	Adult	?	periodontal disease		Ae pendant, wrist clasp: 15+ glass beads: comb
2766	394.1	1	Adult: older mature	?	o.arthritis - atlas	horse: h/c: u/id	hone
2767	328.1	1	Adult: young	?			10 glass beads: ivory
2768*	404.9	1	Juvenile		m.v. - 3rd centre (metacarpal)		
2769	0.8	?	?	?			
2770	92.9	1	Adult	?			
2771	534.3	1	Subadult			u/id	antler obj.: comb
2772	81.4	1	Infant: older				Fe knife
2773	416.7	1	Adult	??Male		u/id	Ae obj.: glass bead: comb
2774	30.9	?	Adult	?		horse	Fe nail
2775*	94.6	1	Infant: older				
2776	2378.2	1	Adult: mature	??Male		horse: h/c: u/id	Ae tweezers
2777*	1742.8	1	Adult: older mature	Male		horse: pig: h/c: u/id	Fe strip
2778 =2762	1180.4					horse: cattle: sheep: h/c: deer: u/id	
2779*	426.4	2	1) Young juvenile 2) Adult: older mature/older	?	o.arthritis - cervical	u/id	
2780	180.8	1	Young juvenile			sheep: u/id	Fe knife
2781	102.7	1	Adult	?	exostoses - femur		glass
2782	255.2	1	Adult	?			
2783$	327.0	1	Adult	?			
2784	19.8	1	Adult	?			
2785	90.9	1	Adult	?			
2786	506.5	1	Adult: young/mature	?			
2787	20.2	1	Adult	?			
2788	1096.8	1	Adult: mature	Male	m.v. - wormian: o.p. - thoracic/lumbar: o.arthritis - atlas, lumbar		Ae: 2 glass beads: bone obj.
2789 =2860	1719.9					horse: h/c: u/id	
2790	117.2	1	Juvenile: young			sheep	Ae wrist clasp, ring, objs., brooch: 7 glass beads
2791	121.0	1	Adult	?		u/id	
2792	676.3	1	Adult: mature	??Male	destructive lesions - thoracic		
2793	1311.9	1	Adult: mature/older	??Male	cyst - lunate		
2794	94.6	1	Subadult/adult	?		sheep	glass bead
2795	101.0	1	Infant			sheep: u/id	8 glass beads: Ae: s.w.
2796	527.9	1	Older subadult	Female	m.v. - Allen's fossa (femur)		Ae brooch: 12 glass beads
2797	281.6	1	Adult: young/mature	?		horse: h/c: u/id	
2798	45.4	1	Subadult/adult	?			
2799	402.7	1	Adult: young/mature	?			
2800	861.0	1	A.A. to 2801			horse: h/c: u/id	
2801	817.9	1	Adult: mature	??Male	disc degen. - thoracic	horse: h/c: u/id	p.p.
2802	238.3	1	Juvenile: young			p/s	9 glass beads
2803	802.7	1	Adult: older mature/older	?Male	o.arthritis - atlas, axis, cervical, thoracic: o.p. - cervical		Fe obj.: glass
2804	403.7		Possible A.A. to 2837	?		cattle - imm: pig - imm.: u/id	
2805	1008.5	1	Adult: older	?	o.arthritis - atlas, axis: exostoses - ilium, femur	h/c: hare: u/id	Ae: Fe rivets: glass
2806	939.9	1	Adult: older mature/older	?	o.arthritis - axis: disc degen. - thoracic/lumbar	u/id	12 p.p.
2807	0.0		No bone				
2808	219.7	1	Adult		Schmorl's nodes - thoracic	h/c	
2809	381.6	1	Adult	??Female		horse: cattle: h/c: u/id	Ae tweezers
2810/2839/2889	33.8					horse: u/id	
2811 =2797	161.8						

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2812	240.2	1	Adult	??Female			3 glass beads: p.p.
2813	779.8	1	Adult	??Male		u/id	antler bead
2814*	1237.6	1	Adult: younger mature	Female	m.v. - wormian	cattle - imm.: sheep - u/b: u/id	Fe clip
2815*	878.0	1	Adult: mature	?	tooth loss: o.arthritis - atlas		45 glass beads on Ae wire: ivory: a/b disc
2816*	1156.7	1	Adult: younger mature	??Female			Ae: 6 glass beads: ivory
2817	1214.4	1	Adult: younger mature	?Female	o.arthritis - axis	bird - raptor claw	Ae brooch: Fe obj.: 15 glass beads: comb
2818	143.0	1	Adult	?			Ae: 16 glass beads: comb: ivory
2819	865.8	1	Adult: younger mature	?		sheep	
2820	840.4	2	1) Infant: older 2) Adult: older	2) Female	tooth loss: disc degen. - cervical: o.arthritis - cervical: o.p. - thoracic/lumbar	pig: u/id	glass: Fe
2821	371.8	1	Juvenile: older		m.v. - 3rd centre (metacarpal)	u/id	18 glass beads
2822	3146.2	1	Adult	?		horse: h/c: u/id	glass vessel
2823	669.9	1	Adult: young/mature	Female		u/id	Ae brooch: 12 glass beads: crystal: ivory: Fe obj.
2824	589.9	1	Adult: mature	??Male	o.p. - cervical, foot phalanx	sheep	glass
2825$	114.3	1/?2	1) Adult 2) ?Infant/young subadult	?		sheep	2 glass beads
2826	1743.6	1	Adult: young/mature	?		horse: h/c: u/id	Ae strap end: glass beads: glass vessel
2827	18.1	?	Subadult/adult	?			2 glass beads
2828	536.9	1	Subadult		m.v. - wormian	pig: u/id	Fe pin
2829$	1607.7	1	Adult: mature	?Female	o.arthritis - atlas: o.p. - finger phalanges	sheep: h/c: u/id	Fe brooch pin: antler bead
2830 =2851	0.0						
2831$	158.3	1	Subadult/adult	?		horse: h/c: u/id	
2832	779.3	1	Adult: mature	?Female		sheep: u/id	Ae tweezers: glass vessel: burnt pot
2833	5.9	1	Young infant				
2834	231.1	1	Adult: mature	?Female			glass: ivory
2835	97.5	1	Adult	?		sheep	Ae strap-end: 3 glass beads
2836	2120.7	2	1) Adult: older mature 2) Infant: older	??Male		horse: cattle - imm.: h/c: u/id	Fe buckle: comb
2837	417.4	1	Adult: young/mature	?		sheep: pig - imm: u/id	Fe shears
2838	242.9	1	Juvenile				
2839	0.0		No bone				
2840	623.1	1	Adult: older mature/older	?	o.arthritis - cervical	horse: h/c: u/id	Fe knife: glass bead
2841	603.8	1	Adult: young/mature	?			glass
2842 =2800	28.3					u/id	
2843	37.5	1?	Subadult/adult	?			
2844	295.7	1	Subadult: older	?	m.v. - wormian		
2845	261.0	1	Adult	?		sheep	
2846	148.7	1	Adult: young/mature	?			Ae
2847	1012.4	1	Adult: mature/older	?		horse: sheep: h/c: u/id: cattle	Ae objs.: amber/glass
2848	1.0	1	Infant				
2849	108.0	1	Adult: young/mature	?		sheep: u/id	
2850	844.6	1	Adult: younger mature	Female		u/id	Ae tweezers: burnt pot
2851$	2424.7	1	Adult: mature	??Male	disc degen. - cervical: destructive lesions - cervical	horse: h/c: u/id	Ae scabbard mount: Ae sheet
2852	362.5	1	Subadult/adult	?		horse: h/c: u/id	
2853	124.5	1	Adult	??Female	tooth loss - trauma		
2854	131.2	1	Subadult/adult	?			comb: Ae
2855	129.9	1	Subadult/adult	?		u/id	
2856	636.2	1	Adult: young/mature	?	disc degen. - thoracic/lumbar	horse: h/c: u/id	Fe: glass: antler obj.
2857 =2777	1110.6					horse: sheep: h/c: u/id	
2858	438.9	1	Adult: mature	Female			7 glass beads: glass vessel: ivory
2859	60.6	1	Infant				comb
2860	483.5	1	Adult: young/mature	?	Schmorl's node - lumbar	horse: h/c: u/id	Ae: Fe
2861	974.1	1	Adult: mature	??Male	tooth loss: o.p. - cervical: o.arthritis - thoracic		
2862	467.0	1	Adult: young/mature	?Female			5 glass beads: Ae
2863	278.6	1	Subadult: young	?	o.p. - lumbar		Ae: comb
2864	0.0		Missing				
2865$	110.1	2	1) Adult 2) Juvenile/subadult	?	m.v. - wormian		Fe: glass bead
2866	180.4	1	Adult: mature/older	?			ivory
2867	241.9	1	Adult: young/mature	?		u/id	Ae brooch: 6 glass beads: comb: s.w.: ivory
2868	19.2	1	Adult	?			2 glass beads
2869	78.6	1	Subadult/adult	?			
2870	157.4	1	Adult: older mature/older	?Female	tooth loss: dental abscess: o.arthritis - atlas	sheep	Fe pin: glass bead

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2871	353.3	1	Adult	?		sheep: u/id	
2872	353.7	2	1) Adult: mature 2) Adult/subadult	?			Fe buckle
2873	269.7	1	Adult: mature	??Female			
2874	119.5	1	Subadult/older juvenile				glass: comb: Ae
2875	800.0	1	Adult: younger mature	?Female			glass: ivory
2876	2423.8	1	Adult: young	Female	cyst - scapula	horse: sheep: h/c: u/id	Ae: glass: comb
2877*	1023.4	1	Adult: older mature/older	?Male	tooth loss: periodontal disease	u/id	
2878	857.3	1	Adult: mature	?			Ae: 3 glass beads: antler ring
2879	30.9	1	Infant				8 glass beads
2880	1123.2	1	Adult	??Male		sheep: h/c: u/id	Ae tweezers: Fe knife: glass vessel: 7 p.p.: Ae: antler handles
2881	259.3	1	Infant		o.p. - thoracic (contamination)	u/id	
2882	14.1	1	Infant				15 glass beads
2883	1354.9	1	Adult: younger mature	?		sheep: h/c: u/id	Ae tweezers: Fe fitting: comb: 15 p.p.: glass bead
2884	438.5	1	Adult: older	??Female	periodontal disease	sheep: u/id	3 glass beads: ivory
2885	165.8	1	Infant/juvenile			u/id	Ae
2886	464.1	1	Adult: younger mature	?		sheep	
2887	0.0		No bone				
2888	79.4	1	Infant			sheep: u/id	4 glass beads: comb
2889	1031.5	1	Adult: mature	Female	o.arthritis - atlas	sheep: u/id	3 glass beads: ivory: Fe
2890*	735.4	1	Adult: young/mature	??Female		fish: bear: dog/fox: u/id	glass bead: comb: ivory
2891	662.8	1	Subadult			horse: u/id	Fe shears
2892*	912.0	1	Adult: mature	?			Ae cylinder: Fe binding: glass bead
2893	420.7	1	Adult: mature/older	?	disc degen. - lumbar: o.arthritis - lumbar: ?pitting/periostitis - clavicle		6 glass beads
2894	207.1	1	Adult	?			glass bead
2895 =2891	743.4					horse: h/c - u/b: u/id	
2896	48.0	2	1) Infant 2) Older subadult/adult	?			ivory
2897$	321.4	1	Adult: older mature	??Male	m.v. - wormian	u/id	Fe bar: Ae
2898	368.8	1	Adult: older	?	o.arthritis - axis, cervical, finger phalanx	pig: h/c: u/id	Ae tweezers: Fe t.s.: 2 a/b beads
2899	569.7	1	Adult: younger mature	??Female	o.p. - thoracic		10 glass beads: s.w.: ivory
2900	348.2	1	Adult: mature	??Male		u/id	Fe tweezers: comb
2901$	263.8	2	1) Adult/older subadult ?2) Infant/juvenile	?		h/c: u/id-?? in A.A.	glass bead: comb
2902	242.3	1	Adult: young/mature	??Female		h/c	
2903	968.5	1	Adult: younger mature	?Female		sheep	Ae brooch: comb: 15 glass beads: ivory: crystal
2904*	378.7	1	Adult: mature/older	?			Ae: 5 glass beads: ivory
2905	556.1	1	Adult: young/mature	?		h/c: u/id	Fe tweezers: glass: Ae
2906	263.4	1	Adult	?			glass
2907	212.3	2	1) Young subadult 2) Infant		2) m.v. - 3rd centre (metatarsal), tooth crown		Fe knife: comb
2908*	207.3	1	Young juvenile		m.v. - wormian		Ae pin: glass
2909=2826?	1775.4	1	Adult: young	?		horse: h/c: u/id	Ae: p.p.
2910*	1085.9	1	Adult: older mature	??Male	hypercementosis: disc degen. - cervical: exostoses - finger phalanx		Fe knife: a/b bead
2911	1500.6	2	1) Adult: older 2) Adult: mature/older	??Female ?Male +	disc degen. - cervical, thoracic, lumbar: o.arthritis - atlas, finger phalanx		Ae brooch: 5 glass beads: comb: Ae: glass vessel
2912*	153.5	1	Young juvenile		m.v. - wormian	sheep: u/id	
2913	682.5	1	Adult: older	?Male	destructive lesion - cervical: disc degen. - cervical: o.arthritis - clavicle	sheep	
2914	9.4	1	Subadult/adult	?		horse	
2915*	824.2	1	Adult: mature	?	o.arthritis - cervical, thoracic: cyst - scaphoid: o.p. - finger phalanges: exostoses - finger phalanges		Ae sheet: Fe tweezers: glass beads: comb: a/b bead
2916*	1545.9	1	Adult: older	Female	?dental caries: o.arthritis - atlas, axis, costo-vertebral: destructive (T.B.?) lesion - thoracic/lumbar: cyst - ulna		Ae staples: burnt pot
2917	413.5	1	Adult: older/mature	?	o.arthritis - clavicles, finger phalanx: exostoses - finger phalanx	sheep	2 glass beads
2918	447.1	1	Adult	?		u/id	Ae brooch
2919	125.3	1	Young subadult				Fe nail: ivory
2920	105.7	1	Adult	??Male			glass
2921	2164.3	1	Older juvenile			horse: h/c: u/id	glass vessel: Ae sheet
2922	420.9	1	Adult: young/mature	Male		u/id	a/b obj.
2923*	25.9	1	Infant				glass bead
2924	33.7	1	Older juvenile/subadult			h/c	Ae sheet
2925	1030.5	1	Adult: mature	??Male	periodontal disease: m.v. - wormian: o.p. - thoracic, lumbar: Schmorl's node - sacral: o.arthritis - costo-vertebral, hip, clavicles: disc degen. - sacral		Ae tweezers: comb
2926$	1417.5	1	Adult	?		horse: sheep: h/c: u/id	

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2927	43.1	1	Infant: older			sheep	Fe t.s.
2928$	2034.9	1	Adult	?		horse: h/c: u/id	Ae strip: Fe obj.: glass vessel: glass beads
2929	606.5	1	Adult	??Male			
2930	612.3	1	Adult: older	?	tooth loss: o.p. - cervical, thoracic, lumbar, lunates, scaphoid, finger phalanges: disc degen. - cervical, sacral: destructive - cervical: exostoses - patella: o.arthritis - shoulder, elbow: cyst - metacarpal	u/id	40 glass beads: p.p.: antler ring
2931	0.0		No bone				
2932	1128.8	1	Adult: mature	?	Schmorl's node - thoracic	u/id	Fe nail
2933	437.7	1	Adult	?		sheep: h/c: u/id	crystal: Ae: antler obj.
2934	95.8	1	Adult: older mature/older	?			
2935$	50.0	1	Adult: younger mature	?		u/id	antler ring
2936	961.2	1	Adult: mature	?		pig: u/id	Fe t.s.
2937$	968.3	3	1) & 2) Adults: mature/older 3) Young juvenile	??Male + ?		p/s: u/id	Ae: 2 glass beads
2938	292.9	1	Adult	?			comb
2939	76.9	1	Juvenile: older				crystal
2940	61.5	1	Adult: mature/older	?	o.arthritis - atlas		
2941	365.4	1	Juvenile		m.v. - 3rd centre (metatarsals, metacarpals)	sheep: u/id	
2942	83.3	1	Juvenile: young				
2943 =2942	40.6					u/id	
2944	1246.1	1	Adult: mature	??Male	cysts - capitate, lunate		a/b bead
2945	778.8	1	Adult: younger mature	?		u/id	Fe razor: antler ring: 5 glass beads
2946	8.3	1	Infant				
2947	259.0	1	Adult: young/mature	?? Female		u/id	Ae: glass beads
2948	700.4	1	Adult: young/mature	?		sheep	burnt pot: comb: ivory
2949	577.4	2	1) Adult: younger mature 2) Infant	1) ??Female		p/s: u/id	Ae: 5 glass beads: ivory: crystal: comb
2950	113.9	1	Young juvenile			u/id	burnt pot
2951	669.5	1	Adult: younger mature	?Female	periodontal disease	u/id	
2952	25.8	1	Adult	?			
2953*	0.0		Missing				Ae sheet: 30 glass beads: ivory
2954	1020.8	1	Adult: mature	?			Ae sheet, tweezers
2955	1075.6	1	Adult: younger mature	Female			Ae: 20 glass beads: ivory: s.w.
2956*	374.1	1	Young juvenile		m.v. - 3rd centre (metatarsal)	sheep	comb
2957	201.3	1	Adult: younger mature	?		dog: h/c	
2958*	32.9	1	Infant: young				Ae
2959*	408.0	1	Adult: older mature/older	??Female	disc degen. - thoracic: o.arthritis - shoulder		2 glass beads: antler ring
2960 =2799	422.6					horse: h/c: u/id	
2961	1087.0	1	Adult: older mature/older	Male	periodontal disease: o.p. - thoracic/lumbar: hyperostosis - thoracic/lumbar: destructive lesion - thoracic/lumbar	pig: bird	Fe tweezers: a/b button
2962 =3153	14.3						
2963$	659.6	1/2?	1) Young adult ?2) Infant/juvenile	1) Female		p/s	Fe obj.
2964	286.6	1	Adult: mature	??Female	dental abscess: secondary sinusitis: cyst - finger phalanx	u/id	glass bead
2965	126.1	1	Juvenile				
2966	64.1	1	Adult	?		u/id	
2967	1016.8	1	Adult: older mature	Male	o.arthritis - atlas, thoracic		
2968	291.6	1	Adult: mature	Male		u/id - imm.	ivory: burnt pot
2969	107.8	1	Subadult/adult	?			
2970$	471.3	1	Adult: mature	??Female		sheep	Ae bracelet: 20 glass beads: glass vessel: comb: worked dog bone
2971	16.6	?	Subadult/adult	?			glass vessel
2972	159.0	1	Adult	?			comb: burnt pot
2973	0.0		Missing				glass bead
2974*	510.3	1	Juvenile: young		m.v. - 3rd centre (metacarpals, metatarsals)		Fe t.s.: glass vessel
2975	144.4	1	Adult	?			Ae: bead
2976	242.7	1	Adult	?			
2977	31.8	?	Subadult/adult	?		u/id	
2978	43.2	1	Juvenile: young				
2979	1030.1	1	Adult: younger mature	?	o.arthritis - atlas	u/id	glass bead
2980	363.3	1	Adult: mature	?	o.arthritis - axis	u/id	comb
2981	631.1		A.A. to 2985			horse: sheep: h/c: u/id	
2982	815.1	1	Adult: young mature	?Female		sheep	Ae brooch: Fe pin: 8 glass beads
2983	34.1	?	Adult	??Female			

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
2984	0.0		Missing				glass beads
2985	1369.0	1	Adult: mature	?	dental caries: Schmorl's node - thoracic		hore
2986	51.5	1	Adult	?			
2987	641.0	1	Adult: older mature/older	?Female	tooth loss: o.arthritis - fibula	u/id	Ae: 10 glass beads
2988	3.8	?	Subadult/adult	?			
2989	1075.1	1	Adult: older mature/older	??Male	dental abscess: tooth loss: o.arthritis - atlas, axis: Schmorl's node - thoracic: o.p. - tibia		antler bead
2990	28.2	?	Subadult/adult	?			
2991	284.6	1	Adult: young/mature	??Male			
2992	591.2	1	Adult: older/mature	??Female	exostoses - ilium	sheep: u/id	9 glass beads
2993 =3163	18.5						
2994	366.3	1	Adult: mature	?	o.p. - thoracic/lumbar		Fe nail
2995*	78.6	1	Older infant			cattle: pig - imm.	30 glass beads: a/b obj.
2996$	595.3	1	Adult: older mature	?	disc degen. - cervical: o.p. - lumbar: o.arthritis - finger phalanx		
2997$	526.6	1	Adult: older mature	?	disc degen. - cervical: o.p. - thoracic: o.arthritis - costo-vertebral		Ae brooch: Fe tweezers: 9 glass beads: comb: burnt pot
2998	670.6	1	Adult: mature	??Female	m.v. - tooth root	u/id	Ae brooch: glass vessel, 4 beads: ivory
2999	441.8	1	Adult: older	?	o.arthritis - atlas, axis: o.p. - ulna: disc degen. - sacral: cyst - lunate		
3000	747.1	1	Adult: younger mature	?		u/id	
3001	176.9	1	Adult: mature	?			
3002	325.5	1	Adult: mature	?	cyst - lunate	u/id	s.w.
3003	1323.3	1	Adult: young/mature	?		horse: h/c: sheep: u/id	
3004	251.9	?	Subadult/adult	?		h/c: u/id	glass
3005	1.7		All Animal			u/id	
3006	452.8	1	Adult: young/mature	?		sheep: u/id	Ae: glass: antler ring: burnt pot
3007	220.5	1	Adult	?			12 glass beads
3008	1762.8	1	Adult: older	?Male	o.arthritis - tempero-mandibular, atlas, axis, cervical, costo-vertebral, hip: Schmorl's node - lumbar: disc degen. - thoracic	horse: h/c: u/id	glass
3009*	1198.7	1	Adult: mature	?	m.v. - tooth root	h/c: u/id	antler obj.
3010 =2676	0.0						
3011	233.8	1	Adult: young/mature	?			Ae: Fe ring: 10 glass beads: ivory
3012	307.2	1	Adult: younger mature	?	destructive lesion - thoracic		glass vessel, bead
3013	975.8	1	Adult: mature	Female		cattle - imm.	s.w.
3014	540.8	1	Adult: mature	??Female	o.arthritis - atlas, axis: cyst - metacarpal		Ae: 3 glass beads: crystal
3015	920.9	1	Adult: older mature	??Male	o.arthritis - atlas: Schmorl's node - thoracic/lumbar: ?trauma - tibia	sheep: u/id	ivory
3016	589.3	1	Adult: younger mature	??Female		cattle - imm.	3 glass beads: ivory: burnt pot
3017	332.6	1	Adult	?		u/id	glass: antler obj.
3018	235.4	1	Adult: mature	?		sheep	comb
3019	440.2	1	Adult: mature	??Female			Ae brooch: Fe coil: 8 glass beads
3020*	565.9	1	Adult: older mature/older	?Female	tooth loss: dental abscess: o.arthritis - atlas		comb
3021	1.7	?					
3022	0.0		Missing				
3023	398.0	2	1) Older infant/young juvenile 2) Adult: young/younger mature	?			5 glass beads
3024	1028.8	1	Adult: older	?Female	o.p. - thoracic, sacral: o.arthritis - atlas, thoracic: m.v. - calcanea		2 glass beads: ivory: comb
3025	434.4	1	Adult: mature	?		u/id	Ae brooch: glass bead
3026	1026.8	1	Adult: older	?Female	disc degen. - cervical, thoracic, lumbar, sacral: o.p. - radius, ulna, finger phalanges		Ae: 25 glass beads: ivory: bone: bead: burnt pot
3027	862.5	1	Adult: young/mature	?		pig: u/id	Ae pin: Fe: glass bead: antler bead
3028*	1045.3	1	Adult: older mature	?		p/s: u/id	Ae tweezers: comb
3029	63.7	1	Infant		m.v. - tooth crown	sheep-imm	Ae sheet: comb
3030	836.7	1	Adult	?		horse: h/c: u/id	glass vessel
3031	21.7	1	Infant/young juvenile				
3032	624.1	1	Adult: young/younger mature	?Female		u/id	3 glass beads
3033	140.6	1	Juvenile: young			u/id	
3034*	276.0	1	Juvenile: young		m.v. - 3rd centre (metatarsals)	u/id	Ae: 12 glass beads
3035	2012.9	1	Adult: mature	Female	o.p. - finger phalanx	u/id	Ae: Fe ring: 24 glass beads: ivory: s.w.: comb
3036	289.6	1	Adult: older mature/older	??Female	disc degen. - cervical		Fe t.s.
3037*	932.0	1	Adult: older mature/older	?	o.p. - thoracic	u/id	a/b bead
3038	972.4	1	Adult: mature	??Male	o.arthritis - thoracic	u/id	Ae t.s.: p.p.
3039	869.0	1	Older subadult	?		sheep: h/c: u/id	
3040	94.7	1	Older infant		m.v. - 3rd centre (metatarsals)	fish	3 glass beads: bone bead

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3041	813.0	1	Adult: younger mature	?		sheep: u/id	15 glass beads: ivory: bone bead
3042	1012.0	1	Adult: younger mature	Male		u/id	Ae: comb
3043$	644.4	2	Adults: mature	Male + ?Female	o.arthritis - atlas: cyst - ulna: destructive lesion + surface new bone - finger phalanx		
3044	53.0	1	Juvenile/young subadult				
3045	192.1	1	Subadult/adult	?		sheep	
3046	10.3	?	Subadult/adult	?		u/id	
3047	511.9	1	Adult: young/younger mature	?			Ae: 4 glass beads: comb
3048$	1091.8	1	Adult: mature/older	?		horse: h/c: u/id	Ae sheet: glass
3049	1478.3	1	Adult: older mature	?		small mammal: u/id	Fe t.s.: comb: burnt pot
3050*	211.2	1	Infant: older		m.v. - enamel pearls		
3051	109.8	1	Adult	?		sheep: u/id	glass bead
3052	578.0	1	Adult: mature/older	?		horse: h/c: u/id	8 glass beads: Ae
3053	595.0		Probably A.A. to 3052			u/id	Ae sheet
3054	468.2	1	Adult: mature/older	??Male		u/id	
3055	378.2	1	Adult: older mature/older	??Female	tooth loss - trauma?: o.arthritis - axis: o.p. - thoracic	small mammal - imm.	2 Ae brooches: 2 glass beads: antler ring
3056	37.2	1	Juvenile: young			sheep: u/id	Ae sheet: 5 p.p.
3057	847.5	1	Adult: mature/older	??Male	o.arthritis - axis		Fe buckle, shears: comb: burnt pot
3058	658.4	1	Subadult: older	??Female		sheep	Fe objs.: comb: antler bead: burnt pot
3059	308.2	1	Juvenile		m.v. - 3rd centre (metatarsal)	dog: u/id	Fe t.s.
3060	28.8	1	Infant: older			sheep - imm.	antler ring
3061	25.9	1	Juvenile/older infant		m.v. - 3rd centre (metatarsal)	sheep	
3062	1559.2		A.A. to 3072		o.arthritis - axis	horse: cattle: sheep: h/c: h/c: u/id some imm.	p.p.: burnt pot
3063	155.3	1	Adult	?			
3064	925.0	1	Adult: mature	??Female	o.arthritis - atlas	u/id	15 glass beads: Ae
3065	5.1	1	Older infant/young juvenile				
3066	1341.3	1	Adult: older mature/older	?Male	o.arthritis - atlas: o.p. - thoracic/lumbar: disc degen. - cervical: cyst - trapezoid		Ae strip: comb: antler bead
3067	1016.4	2	1) Adult: mature/older 2) Young juvenile	1)??Male	tooth loss - trauma: o.arthritis - clavicle: m.v. - scapula		Ae brooch: glass bead
3068	1235.2	1	Adult: mature	?	o.p. - sacral: periostitis - humerus, tibia, fibula		Fe tweezers: comb
3069*	21.4	1	Infant: younger				
3070	1031.2	1	Adult: older mature/older	??Female	tooth loss: o.arthritis - axis: o.p. - thoracic: cyst - fibula		
3071	15.6	1	Older infant/young juvenile				
3072	1345.4	1	Older subadult	?	m.v. - 3rd centre (metatarsal)	horse: sheep: h/c: u/id	Fe t.s.: comb: 2 p.p.: Ae tweezers
3073	0.0		Missing				
3074	26.1	?	Subadult/adult	?			
3075	47.9	1	Infant				
3076*	988.8	1	Adult: young	??Female	destructive lesions - lumbar		comb: 2 glass beads
3077	1078.4	1	Adult: young/younger mature	??Female		horse: h/c: u/id	Ae ring: 9 glass beads
3078	989.2	2	1) Adult: mature 2) Juvenile	?		sheep	6 glass beads: a/b needle case
3079*	172.0	1	Juvenile		m.v. - 3rd centre (metatarsal)	sheep	
3080	0.0		Missing				Ae tweezers
3081	67.3	1	Infant: older			u/id - imm.	
3082	726.2	1	Adult: young/mature	?	exostoses - femur	pig	
3083	15.0	1	Infant: young				bone bead
3084$	27.3	?	Adult	?			Ae brooch: glass beads
3085	877.1	1	Adult: mature/older	??Male	Schmorl's node - lumbar	sheep	Fe tweezers: comb: glass bead
3086	549.5	1	Adult: young	??Female			Fe needle: 6 glass beads: comb: s.w.
3087*	531.2	1	Adult: mature/older	?	o.arthritis - tempero-mandibular, axis, cervical, costo-vertebral, elbow: o.p. - cervical, thoracic: disc degen. - thoracic: destructive lesion - thoracic		
3088	271.8	1	Adult: older mature/older	?	disc degen. - cervical		
3089	11.1	2	1) Infant 2) Adult	?			Fe knife: 4 glass beads
3090	74.0	1	Older infant/young juvenile		m.v. - 3rd centre (metatarsal)		
3091	581.7	1	Adult: young/mature	??Female		sheep: cattle: u/id	Ae brooch: glass bead
3092	0.0		No bone				
3093	0.0		No bone				
3094	1438.3	1	Adult: older mature/older	?Male	o.p. - cervical, thoracic: disc degen. - cervical: o.arthritis - cervical, lumbar, clavicle, elbow		comb: Ae/Fe fitting: antler bead
3095	3.4	1	Infant: young				Ae brooch: 6 glass beads

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3096	427.4	1	Adult: mature/older	?	disc degen. - cervical: exostoses - femur		
3097	65.3	1	Subadult/adult	?			
3098	104.3	1	Adult: mature	?			
3099	76.7	1	Older subadult/adult	?		sheep	glass beads
3100	383.8	1	Adult: mature	??Female			
3101	37.2	1	Older subadult/adult	??Female			Ae: glass bead
3102	113.9	1	Adult: young/mature	?			glass: antler ring
3103	1086.7		A.A. to 3106			horse: cattle: h/c: u/id	
3104*	73.2	1	Older infant		m.v. - tooth crowns		comb
3105	492.6	1	Adult: younger mature	??Male		u/id - imm.	
3106	1011.1	1	Adult: young/mature	?		horse: sheep: h/c: u/id	
3107	354.7	1	Juvenile		m.v. - 3rd centre (metatarsal)		Ae sheet, binding: 2 glass beads: comb: burnt pot
3108	660.7	1	Adult: younger mature	?		sheep: u/id	Ae sheet
3109	298.6	1	Adult: mature	??Male		u/id	
3110	1.6	1	Infant: young				glass bead
3111$	402.8	1	Adult: young/mature	?		u/id	Fe razor: comb
3112	0.5	1	Infant/juvenile				
3113	126.3	1	Adult	?		sheep	
3114	0.0		Missing				Fe - 2 scabbard mounts, buckle, t.s., fittings, objs.
3115	37.8	1	Older infant/young juvenile				Fe brooch pin: 10 glass beads
3116	0.0		Missing				
3117	264.5	1	Adult: mature	??Female		sheep: u/id	glass
3118	829.3	1	Adult: young/mature	?			6 glass beads: burnt pot
3119*	932.9	1	Adult: older mature/older	?	o.arthritis - cervical: o.p. - thoracic: disc degen. - thoracic: destructive lesion - thoracic		
3120	102.2	1	Subadult/adult	?		h/c: u/id	
3121	1389.4	1	Adult: mature	?			glass beads: antler bead
3122	73.6	1	Adult: mature/older	?	o.arthritis - atlas	u/id:	glass
3123	518.6	1	Adult: mature	??Male	m.v. - 3rd centre (metacarpal)		
3124	359.3	1	Adult: young/mature	?			3 glass beads: Ae
3125*	980.7	1	Adult: young/mature	??Male			ivory
3126	918.6	2	1) Adult: younger mature 2) Infant: young	?Female		bird: u/id	Ae brooch: 11 glass beads
3127	101.3	1	Infant				Fe buckle: comb
3128	79.7	1	Subadult/adult	?			
3129	879.4	1	Adult: older mature/older	?	hypercementosis: o.arthritis - atlas, hips: disc degen. - cervical, thoracic, lumbar: cyst - ulna: o.p. - finger phalanx	u/id	
3130	962.3	1	Adult: mature	?	disc degen. - cervical	sheep	Fe tweezers
3131	1845.1	1	Adult: young	?		horse: cattle: h/c: u/id	Ae sheet: glass bead: burnt pot
3132	122.9	1	Young juvenile			sheep: u/id	Fe nail, t.s.: 2 p.p.
3133	217.2	1	Adult: older mature	?			
3134	29.0	1	Young infant/neonate			sheep - imm.	
3135*	104.7	1	Juvenile				
3136	553.6	1	Adult: young/younger mature	?	cyst - lunate	cattle: h/c: u/id	Ae: 2 glass beads: glass vessel: p.p.: ivory: antler bead
3137	6.3	?	Subadult/adult	?		cattle - u/b	
3138	3.2	1	?				comb
3139	585.5	1	Adult: older	?	o.arthritis - atlas, axis: disc degen. - cervical	u/id	Ae: 5 glass beads
3140	1059.5	1	Adult: mature	??Male		sheep	
3141	72.2	1	Subadult/adult	?		u/id	
3142	505.3	1	Adult: mature	?Female	o.arthritis - tempero-mandibular, atlas		glass bead: ivory
3143	247.4	1	Adult: mature/older	?			
3144	573.5	1	Adult: mature	??Female	o.arthritis - atlas		Fe ring, brooch spring: glass: comb
3145	523.0	1	Adult: older mature/older	?	o.arthritis - atlas, knee: disc degen. - cervical: exostoses - femur		Fe scabbard chape: glass vessel
3146	1482.8	1	Adult: older	?	o.arthritis - atlas, axis: o.p. - cervical, thoracic, finger phalanx: disc degen. - cervical	sheep: u/id	Fe t.s.: 3 p.p.
3147	2050.6		A.A. to 3131			horse: cattle: sheep: h/c: u/id	glass: burnt pot
3148	163.5	1	Adult	?		u/id	Roman coin: 4 glass beads: s.w.
3149	52.4	?	Subadult/adult	?			
3150*	24.9	1	Infant: young			h/c	
3151	0.0		No bone				
3152	1223.3	1	Adult: mature	?Female	disc degen. - cervical		
3153	665.2	1	Adult: young/younger mature	?Male			Ae buckle

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3154*	111.1	1	Infant: older				glass
3155*	1136.8	1	Adult: mature	?	tooth loss: m.v. - mastoid: disc degen. - cervical, thoracic: destructive lesion - thoracic: o.arthritis - thoracic		
3156	414.3	1	Adult: young	?		dog	Fe knife
3157	1054.3	1	Adult: mature	??Female	fusion - lumbar		comb: burnt pot
3158	20.1	1	>Infant	?			glass: antler ring
3159	25.6	1	Subadult/adult	?			7 glass beads
3160$	375.4	1	Adult: younger mature	?		horse: h/c: u/id	Ae
3161$	1599.9	1	Adult: young/mature	?		horse: cattle: sheep: h/c: u/id	Ae: 8 glass beads: ivory
3162	2249.1	1	Adult: mature	?	o.p. - thoracic/lumbar: o.arthritis - clavicle	sheep: h/c: u/id	2 p.p.: antler objs.
3163	457.8	1	Adult: mature	?Female			3 glass beads: ivory
3164	96.4	1	Adult	?			
3165	86.2	1	Infant				
3166*	1107.6	1	Adult: older mature/older	?Male	tooth loss: m.v. - 3rd molar: dental abscess: o.arthritis - atlas: o.p. - lumbar: destructive lesion - thoracic/lumbar		
3167	44.7	1	Subadult/adult	?	fusion - lumbar		
3168	171.1	1/?2	1) Infant 2) Subadult/adult	?			glass beads: Ae: comb
3169	1329.0	1	Adult	?		horse: cattle: sheep: u/id	Ae: glass vessel
3170	94.6	1	Adult	?			
3171	64.3	1	Adult	?			
3172	134.9	1	Adult: younger mature	Female		sheep: h/c	crystal
3173	65.0	1	Adult/subadult	?			
3174	369.9	1	Subadult	?		h/c: u/id	
3175	122.9	1	Adult: mature	?	o.p. - cervical		a/b obj.
3176	39.9	1	Infant: young				comb: glass
3177*	6.6	1	Infant: older				comb
3178	594.5	1	Adult: mature	?Female	o.arthritis - axis		2 Ae brooches: 9 glass beads: burnt pot
3179	223.1	1	Adult: older mature/older	?Female	tooth loss	sheep	glass
3180=2650A	6.1						
3181	52.2	1	Adult/subadult	?		u/id	
3182	148.9	1	Adult: older mature/older	?	o.arthritis - cervical		
3183	243.5	2	1) Subadult 2) Juvenile			h/c	Roman coin: glass bead: ivory
3184	926.4	1	Adult: young/younger mature	?Female		sheep: u/id	ivory
3185	5.3	1	Young infant				
3186	0.0		Missing				Fe knife: glass vessel
3187	55.2	1	Adult/subadult	?			
3188	1071.9	1	Adult: older	?	osteophytes - thoracic/lumbar: hyperostosis - thoracic/lumbar		Ae t.s.
3189	704.9	1	Adult: older	?	tooth loss: o.p. - lumbar: exostoses - patella	h/c: cattle	
3190	830.3	1	Adult: older	?	tooth loss: o.p. - ulna, thoracic: disc degen. - cervical: o.arthritis - cervical: infection - patella: exostoses - patella		
3191	99.8	1	Juvenile: young			u/id - u/b	4 glass beads: a/b strap-end: crystal: Ae: ivory
3192	1038.2	1	Adult: older mature	??Female	Schmorl's node - thoracic/lumbar		
3193	1175.4	1	Adult	?		horse: sheep: u/id	glass
3194	1149.1	1	Adult: younger mature	Female		dog: small mammal	8 glass beads: Ae
3195	69.8	1	Adult	?			
3196	73.9	1	Adult	?			
3197*	87.7	1	Infant				Ae brooch: 2 glass beads
3198	332.6	1	Adult: young/younger mature	?			ivory
3199	714.2	1	Adult: mature	?Female	dental abscess	pig: u/id	Ae sheet: 20 glass beads: comb
3200	1588.9	1	Adult: older mature	Female	destructive lesion - lumbar: o.p. - lumbar, finger phalanges		Ae tweezers: comb
3201	132.7	1	Infant: older			pig - imm: u/id	glass
3202	216.0	1	Adult	?		h/c-u/b	Ae: Fe: 4 p.p.
3203	793.8	1	Adult: mature	?	o.arthritis - axis: exostoses - patella		
3204	221.8	1	Adult	?			Ae sheet: comb
3205	211.3	1	Juvenile				ivory: comb
3206	1165.6	1	Adult: mature	?		h/c: u/id	Ae
3207	967.6	1	Adult: younger mature	?Female			Ae: glass bead
3208	19.2	?	Adult/subadult	?			
3209*	386.2	1	Adult: older mature/older	??Female	o.arthritis - atlas		glass bead: ivory
3210	49.0	1	Adult: younger mature	?			
3211	37.5	1	Infant: older				
3212	406.2	1	Adult: mature	??Female	destructive lesion - thoracic/lumbar: o.p. - thoracic		Ae: 6 glass beads: comb

Urn No.	Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3213	19.1	?	Adult	?			6 glass beads
3214	378.2	1	Adult: mature	??Female		sheep	Ae: Fe
3215	564.1	1	Adult: mature	?	o.arthritis - axis	sheep	9 glass beads: ivory: Fe: burnt pot
3216	713.4	1	Adult: young/younger mature	?Male			Fe tool, tweezers, objs.: glass vessel
3217	1412.5	1	Adult: young	Female			3 glass beads: ivory: antler
3218 =3212	291.0						
3219 =3217	0.0						
3220	7.4	1	Infant				
3221	246.9	1	Subadult: older	?		u/id	
3222	134.9	1	Young subadult/older juvenile			sheep: h/c: u/id	glass vessel
3223	194.3	1	Adult: young/mature	?			Fe stud
3224	597.5	1	Adult: older mature/older	?	tooth loss		glass vessel
3225	1385.1	1	Adult: older	Male	tooth loss: disc degen. - cervical, thoracic, lumbar, sacral: destructive lesions - cervical, thoracic, lumbar	h/c	
3226	608.8	1	Adult	?			burnt pot
3227	3.4	?	?				
3228	440.2	1	Adult: young/younger mature	?			
3229	11.0	1	Infant: young				Fe hook
3230	366.4	1	Adult: mature	?		sheep: u/id	Ae: glass
3231	422.5	1	Adult: young	?			Ae: Fe: 15 glass beads: ivory
3232	178.7	1	Older infant/young juvenile			sheep	Fe obj.
3233	721.5	1	Adult: older mature	?	disc degen. - thoracic/lumbar	sheep	Ae brooch: 22 glass beads: comb
3234	332.3	1	Adult	?		sheep	Ae pommel: glass: antler bead
3235	943.7	1	Older subadult	?		horse: sheep: h/c: u/id	glass vessel: 2 p.p.
3236	464.2	1	Adult: mature	?	destructive lesion - cervical		
3237	885.0		Possible A.A. to 3238			horse: h/c: u/id	
3238	940.7	1	Adult	?		horse: sheep: h/c: u/id	Ae
3239	32.7		A.A. to 3241/3242			u/id	
3240 =3239	176.8					horse: sheep: u/id	
3241	2169.0	1	Adult: mature	??Male	m.v. - wormian: disc degen. - cervical	horse: sheep: h/c: u/id	Ae tweezers: Fe shears: glass bead: comb
3242	2586.6	1	Adult: mature	??Male		horse: sheep: h/c: u/id	Ae
3243 A	706.3	1	Adult: older mature/older	?		u/id	7 glass beads: ivory: Ae: Fe
3243 B	88.9	1	Adult	?			
3244	156.4	1	Adult	?			
3245	901.0	1	Adult: younger mature	??Female		h/c: u/id	Ae brooch, girdle-hanger: 50 glass beads: s.w.: ivory
3246	19.6	2	1) Infant/juvenile 2) Adult/older subadult	?			Ae tweezers: Fe shears
3247	189.7	1	Adult	?			
3248	162.2	?	?			h/c: u/id	
3249	723.7	1	Adult: older mature	?	o.arthritis - atlas: o.p./hyperostosis - thoracic: disc degen. - thoracic		Fe staple: glass: ivory
3250	136.2	1	Adult	?			
3251	373.3	1	Adult: mature	?	disc degen. - cervical		burnt pot
3252	872.0	1	Adult: mature	??Female	o.p. - vertebra	sheep: u/id	Ae: 15 glass beads: comb: ivory: s.w.
3253	105.2	1	Juvenile: young				
3254	167.6	1	Adult: young/younger mature	??Female			Ae ring: 10 glass beads
3255	12.7	1	Adult/subadult	?		h/c	
3256	599.1	1	Adult	??Female			Ae: 40 glass beads: comb: antler ring
3257	2007.9	1	Adult: mature	Male	disc degen. - axis, lumbar: destructive lesion - lumbar	sheep	Fe: comb: antler bead: burnt pot
3258	627.0	1	Adult: young/mature	?		u/id	Ae sheet: 10 glass beads: ivory: s.w.
3259	471.4	1	Adult	?		u/id	comb
3260=3258?	4.3						
3261	834.7	1	Adult: younger mature	Female		u/id	comb
3262	243.2	1	Adult/older subadult	?			comb
3263	5.9	?	Adult/older subadult	?			
3264	368.3	1	Adult	?		horse: h/c: u/id	
3265	1309.2	1	Adult: older mature	?	o.arthritis - axis: o.p. - thoracic	u/id	Fe knife: comb
3266	0.0						
3267	50.9	1	Infant				comb
3268	788.9	1	Adult: mature	?	o.p. - thoracic	u/id	comb: burnt pot
3269	843.3	1	Adult: mature	?	o.arthritis - axis	sheep	Ae tweezers: Fe t.s.

Urn No.		Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3270		921.1	1	Adult: young	?		sheep: u/id	glass
3271		1032.8	1	Adult: young/mature	?		horse: h/c: u/id	Ae scabbard mount, rivet, stud
3272		190.8	1	Adult: young/younger mature	?		cattle	glass bead
3273		2180.6	1	Adult: mature	?		horse: sheep - imm: h/c: u/id	glass: Ae
3274		21.1	?	Adult	?			
3275		167.4	1	Adult/subadult	?			Ae tweezers: worked bone
3276*		13.7	1	Infant: young				antler bead
3277$		677.7	1	Adult	?		horse: h/c: u/id	Ae sheet
3278		1051.1	1	Adult: mature	??Female	m.v. - wormian: o.arthritis - atlas		12 glass beads: ivory
3279		3.9	?	?				
3280		861.9	1	Adult: younger mature	?Female			7 glass beads: Ae: comb
3281	=3286	413.4						bone bead
3282		157.2	1	Older juvenile/young subadult				
3283		1298.6	1	Adult: older mature	?		horse: sheep: h/c: deer: u/id	Ae: Fe stud: bone bead: antler peg: comb: antler handle
3284*		13.4	1	Infant: young			sheep	comb
3285		848.8	1	Adult: mature	?		pig: h/c: u/id	antler peg
3286		291.6	1	Adult: older mature	??Male			
3287		769.0	1	Adult: older mature/older	?			
3288		1286.9		A.A. to 3283			horse: sheep: h/c: u/id	
3289		265.2	1	Young subadult	??Male			Ae: 3 glass beads
3290*		119.4	1	Adult/subadult	?		u/id	
3291		602.0	1	Adult: older mature	?	o.arthritis - axis	u/id	
3292		682.5	1/?2	1) Adult: mature ?2) Foetus/neonate	??Female			Fe pin: 4 glass beads: ivory
3293		38.8	2?	1) Infant 2) Adult/subadult	?			
3294		63.5	1	Infant				glass
3295		39.7	1	Adult/subadult	?			a/b obj.
3296		807.4	1	Adult: younger mature	Male		u/id	10 glass beads: Ae
3297		616.7	1	Adult	?			Ae buckle: 15 glass beads: ivory
3298		432.4	1	Adult: mature/older	?			Ae: antler bead
3299		381.8	1	Adult: young	?			antler bead
3300		268.7	1	Adult: mature/older	?	o.arthritis - knee		
3301		209.6	1	Adult	?			Ae sheet: 7 glass beads
3302		760.8	1	Adult: young	?		sheep	glass: ivory
3303		10.2	1	Adult/subadult	?			
3304		685.2	1	Adult: young/younger mature	?		u/id	3 Ae brooches: Fe bar: 20 glass beads: ivory
3305		9.4	?	?				2 glass beads
3306		297.2	1	Juvenile: young				Ae: 7 glass beads: glass vessel
3307		588.4	1	Adult: mature	?	disc degen. - cervical: destructive lesion - cervical		
3308		198.2	1	Older juvenile/subadult				
3309		449.4	1	Adult: young/younger mature	?			Ae: 5 glass beads: s.w.
3310		568.9	1	Adult/subadult	?		horse: h/c: u/id	s.w.
3311		123.2	1	Adult	?		u/id	bone obj.
3312		175.1	1	Adult	?		u/id	Ae needle: 14 glass beads: s.w.: comb: ivory
3313		25.1	1	Adult/subadult	?			
3314	A	244.1	1	Adult: mature/older	?			4 glass beads
3314	B	173.7	1	Adult: young/younger mature	?			Ae wrist clasp: 15 glass beads: s.w.: ivory: crystal
3315		120.4	1	Adult	?			
3316		1912.6	1	Adult: young	?		horse: pig: h/c: u/id	p.p.
3317		888.4	1	Adult: younger mature	?		sheep: bird	Fe needle: ivory
3318		24.8	1	Infant: young				
3319		268.6	1	Adult	??Female			Fe
3320		2554.5	1	Adult: mature	??Female		horse: sheep: h/c: u/id	Ae bucket fittings, tweezers: Fe shears: glass vessel: 6 p.p.
3321		807.7	1	Adult: younger mature	?			s.w.: 3 glass beads
3322		65.8	1	Adult/subadult	?			Ae: 7 glass beads
3323		29.5	1	Juvenile/subadult				
3324		0.0		No bone				
3325		2.6	?	?				
3326	A+B	262.8	1	Adult	Female		cattle	
3327		356.1	1	Adult: mature	?		h/c: u/id	

Urn No.		Total Wt. g.	No of Indiv.	Age	Sex	Pathology	Animal	Gravegoods
3328	=1853	379.6					horse: h/c: u/id	
3329		290.4		?A.A.			horse: h/c: p/s: u/id	
3330		422.9		?A.A.			horse: h/c: bear: u/id	
3331		182.2	1	Adult: older mature/older	?		sheep - u/b	bone bead
3332	=1835	1049.4		A.A. in pit			horse: h/c: cattle: sheep: u/id	Ae sheet
3333		36.3	1	Infant			h/c	
3334		419.0	1	Adult: mature/older	?		u/id	

Chapter 4. Demography

Demography is the study of population statistics and is used to analyse the age and sex structure of populations, birth and death rates, life expectancy *etc.*, and variations within these fields over time; archaeological demography (or palaeodemography) has the additional aim of estimating population size. Archaeological demography, however, is fraught with difficulties and limited in scope. The osteoarchaeologist is always working with groups of dead people, whereas the human geographer (for whom, and by whom, demographic studies have been developed) is generally considering groups of live people, as well as records of the dead. Skeletal samples are not always complete, and are often biased either as a result of 'ritual', burial conditions or recovery. Age at death cannot always be accurately determined (Chapter 2).

A further problem is that the size of an archaeological population and the death rate are unlikely to have remained constant during the term of use of a cemetery, and it is usually impossible to detect how they may have changed, certainly in the short-term. The number of years over which a cemetery was in use may not be precisely known; at Spong Hill a period of perhaps 150–200 years is involved. These points mean that study of population 'dynamics' is beyond the reach of the osteoarchaeologist. However, a general view of mortality rate, sex structure and population size, may be obtained.

I. Numbers

(Fig. 12)

The number of individuals identified at Spong Hill from their cremated remains is 2200, with a probable eighty-four more (see Chapter 2:III). This figure alone makes Spong Hill the largest excavated Anglo-Saxon cremation cemetery in this country (Figure 12) and comparable to the largest of this period on the Continent.

Further to the 2284 individuals identified, there were fifty-eight urns from the 1972–1981 excavations from which the cremations are now missing (Chapters 1 and 3). It would also appear that at least thirty-four cremations were discarded or are now missing from the 1954/1968 excavations. An area in the middle of the northern half of the cemetery (Figs 3, 4 and 5) was so badly disturbed by modern features that individual urns and their bones could not be recognised. The number of urns within this area was calculated from the total weight of sherds as 177 (Hills and Penn 1981). The bone recovered from the area was included with the grid square collections.

Since the discovery of the site in the 18th century (Chapter 1), urns have been removed, either deliberately or during the course of other work. There are records of at least 150 urns having been lifted, but the precise number removed from the cemetery prior to organised excavation will never be known.

On the basis of the above observations, it would appear that a minimum of 421 cremations have been lost over the years from Spong Hill, giving an estimated figure of over 2700 individuals for the original size of the cemetery.

All too often the burial environment or funerary ritual can obliterate or exclude young infant remains from a cemetery. The fragile immature skeleton may be the first to suffer in adverse soil conditions or from site disturbance. The Romano-British, for example, are known to have buried infants of less than one year outside the cemetery, often around the living areas (*e.g.* McKinley 1993a and forthcoming (a)). Cremation of neonates/ young infants in a modern crematorium produces, as with adults, a total skeleton, though much is still in the unossified, cartilaginous stage and therefore does not survive. The remains are obviously very small and fragile, and great care has to be taken during the cremation process in order not to lose the bone (see Chapter 5:I).

In archaeological cremations, such young individuals are often represented by very little other than unerupted tooth crowns and the dense bone of the petrous temporals (ear) (Plates I and II). Collection of such fragile remains from a pyre cremation must have been very difficult, especially if the infant was cremated together with an adult, and therefore with more wood. A greater chance of pulverisation from the increased weight and an increased chance of loss in the greater quantity of pyre debris would result.

In his paper on 'Palaeodemography' (1971), Brothwell presents a rough method to test whether a cemetery 'population' has a sufficient number of young infants to represent a 'normal' population, *i.e.* the number of individuals in each age range one would expect in a living population. A few modern series are used (Brothwell 1971, fig. 2) to show that the proportion of individuals under one year old relative to the total number of individuals under twenty, should be between 1:4 and 3:4. (NB. In the article the ratios were erroneously printed the wrong way round as 4:1 and 4:3, Brothwell, pers. comm.). At Spong Hill an approximation of this ratio was calculated using the numbers of foetus/neonates and young infants set against the total number of immature individuals. This gave a ratio of about 1:9, which would suggest that the number of infants under a year old is much lower than expected. Working from Brothwell's hypothesis, it would appear that at least 100 individuals of less than one year may be missing from the Spong Hill population. It is important to bear the likely discrepancies in mind in any demographic study of the cemetery.

The cemetery was possibly in use for between 150–200 years during the fifth and sixth centuries. More detailed phasing of the site has so far proved difficult. There are some indications that cremation burials in the centre of the cemetery were earlier and that there was a radial development outwards, but there are also some 'early' cremation burials nearer to the edge. So far, it has not proved possible to establish even approximate chronological divisions (Hills, pers. comm.). Demographically there remains only a single view of the cemetery at its time of abandonment at the end of the sixth century. Even very basic population 'dynamics', such as noted by Wahl (1988) at Süderbrarup, cannot be obtained.

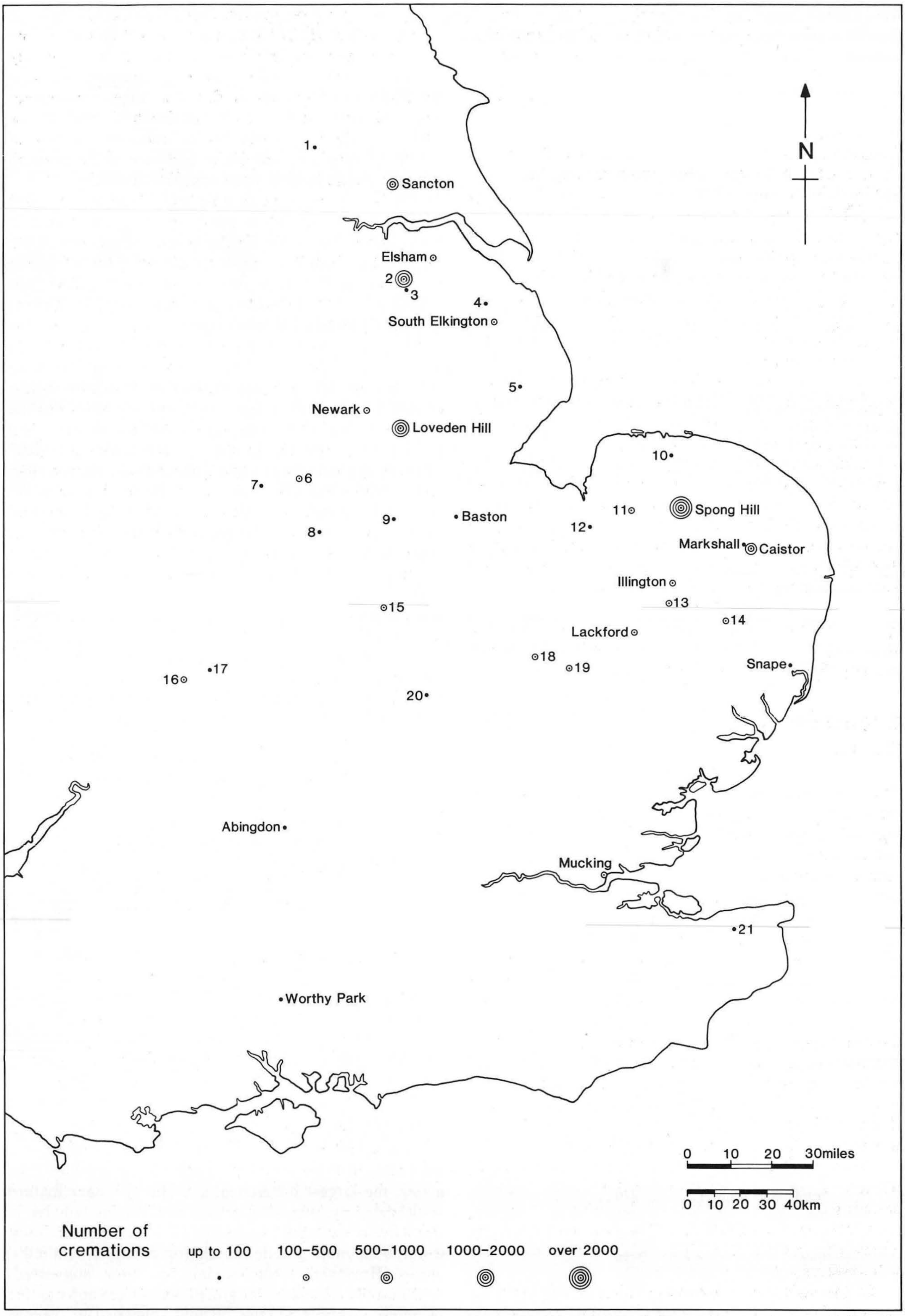


Figure 12 Size-related distribution plot of the major known/excavated Anglo-Saxon cremation and mixed, but predominantly cremation, cemeteries. (See Key for names of numbered sites).

Wahl (1988) found that the later phases of the cemetery showed a preponderance of older adults: the sign of a community fading as the younger people move away.

Key to Figure 12

1. Heworth, Yorkshire.
2. Cleatham, Lincolnshire (pers.comm. Freda Berisford).
3. Kirton-in-Lindsey, Lincolnshire.
4. Wold Newton, Lincolnshire.
5. Hall Hill, Lincolnshire.
6. Kingston-on-Soar, Nottinghamshire.
7. King's Newton, Derbyshire.
8. Thurmaston, Leicestershire.
9. Market Overton, Rutland.
10. Great Walsingham, Norfolk.
11. Castle Acre, Norfolk.
12. Tottenhill, Norfolk.
13. Brettenham, Norfolk.
14. Eye, Suffolk.
15. Kettering, Northamptonshire.
16. Bidford, Warwickshire.
17. Stratford, Warwickshire.
18. Girton, Cambridgeshire.
19. Little Wilbraham, Cambridgeshire.
20. Kempston, Bedfordshire.
21. Westbere, Kent

II. Age

(Fig. 13, Table 3)

Between 96.1–99.8% (depending on whether the 'questionable' multiples are included or not) of the individuals identified could be aged within limits. The need to use age categories rather than age in years (Chapter 2:IV) and the overlap between one or more categories in many cases, severely limits the studies of the age structure of the population.

Age category	Number
foetus/neonate	2
young infant	63
infant	108
older infant	48
infant/juvenile	63
young juvenile	75
juvenile	69
older juvenile	24
juvenile/subadult	22
young subadult	27
subadult	24
older subadult	37
subadult/adult	184
young adult	67
young/mature adult	181
younger mature adult	166
mature adult	345
older mature adult	58
mature/older adult	224
older adult	91
adult	318
Total	2196

Table 3 Numbers of individuals identified in each age category.

It was sometimes possible to attribute a fairly tight age range, particularly for the immature individuals. More often however, an individual could not be definitely placed in one or other discrete category because insufficient evidence survived, and a range of categories *e.g.* 'infant/juvenile' or 'subadult/adult' had to be attributed. The largest overlapping category was that of 'adult', where an individual had obviously reached maturity but no further detail could be obtained.

The *mean age of death* at Spong Hill appears to have fallen in the 'older mature adult' age range. However, if an adjustment is made for the young infants which are likely to be missing, for example, allowing for a 1:4 ratio of infants of less than one year to those individuals between 0–20 yr, the mean age of death would fall in the 'younger mature adult' age range.

The *age structure* reflects a pattern common in archaeological groups and which remained common until this century. The greatest number of immature deaths occurred in the 'infant' age range, with a gradual decline toward the 'subadult' category. In adulthood, there is a further rise, peaking in the 'younger mature adult' category. A good minority of the population continued into 'older' adulthood. The main bias at Spong Hill is in the apparently greatly reduced size of the 'immature' category, as a result of the probable 'loss' of many very young infants.

III. Sex

(Fig. 14)

With very few exceptions, only adult individuals were sexed, and of these, only 38.4% could be sexed with confidence. Of those sexed, 61.2% were females, 38.8% males. This discrepancy of females over males has been noted at other Anglo-Saxon cremation cemeteries: 6.7% more females than males at Sancton (McKinley forthcoming (c)), 22.2% more at Baston (Manchester 1976), 3% more at Loveden Hill (Wilkinson, pers. comm.) and 1% more at Illington (Wells, in prep.). The difference at Spong Hill seems less severe when presented as a percentage of the total number of adults (as with the other sites) the difference then being 8.6% more females than males.

There may be a variety of reasons for this difference. The most obvious is that the 61.6% of the adults at Spong Hill who are unsexed may include more males than females. If so, it would suggest that the other cremation cemeteries which also show a preponderance of females over males, may be subject to the same effect.

The figures may also illustrate a bias toward the sexing of individuals as females, a particular danger with young adults, prior to the development of more robust masculine traits in the males. However, as may be seen from Figure 14, although there are more 'young adult' females than males, the largest difference is in the 'younger mature adult' category, when the sexing of males as females is much less of a danger. It is possible that there is a tendency towards the more gracile morphological traits within the group. However, where sexing has been suggested, well-marked robusticity or gracile traits were apparent. It is more likely that the natural overlap in sexual dimorphism has been accentuated as a result of the cremated state of the remains, with the loss of diagnostic

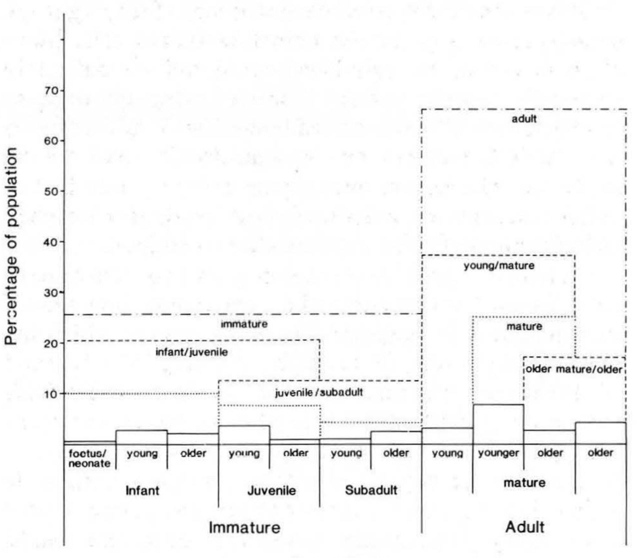


Figure 13 Age distribution within categories as a percentage of the total population numbers.

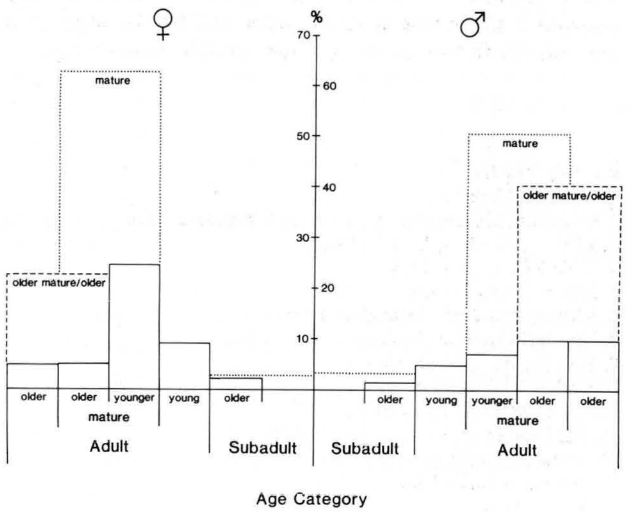


Figure 14 Sex distribution related to age, as a percentage of the total number of females and males.

skeletal elements or only partial recovery making identification tentative.

It should be remembered that more males are born than females (generally a 105% ratio), and that (at least present day) mortality is greater at all ages in males than females (Pressat 1978); presumably, that is, until late old age, *c.* 70 years plus in modern populations, when more females will be dying simply because more have survived. The underlying pattern of past mortality may have been similar, but for females there would have been the additional dangers of childbirth which would increase the number of deaths particularly in the younger adult age groups. Prior to modern medical developments, the greatest danger of death came in infancy, rising again as a subadult/young adult. Therefore, a great number of male deaths may have taken place at the very ages at which the osteologist finds it impossible or most difficult to sex an individual (Chapter 2:V). The apparent bias toward females in the *adult* groups, may, to a certain degree, be a genuine reflection of the sex structure for the *adult* section of the population.

There are obvious differences in the distribution of age at death between females and males. Figure 14 shows the age/sex distribution in the Spong Hill population. Numbers for females and males are each presented as a percentage of their own totals, giving distribution of age at death within the individual group rather than all sexed individuals together. Presented in this way, the male figures do not appear disproportionately low (fewer having been identified) and the age/sex structure is better illustrated. From this we can see that of those sexed the mean age of death for adult females was in the 'younger mature adult' age category, while for males it was in the 'older mature adult' category. A higher percentage of adult males lived into old age than did females. The greater number of female deaths in the 'young' and 'younger mature' categories, could be blamed, as usual, on the spectre of death during or related to childbirth.

IV. Population size

(Fig.15)

The *Crude Mortality Rate* (CMR) is the number of deaths per thousand (or per hundred) per year. It may be calculated using the life expectancy at birth taken from life tables (Ubelaker 1974). It was not possible to construct a life table for the Spong Hill population because 'ageing' was not precise enough and regularly spaced, consistent age intervals were not obtained. Alternatively, the CMR may be derived by comparison with the age distributions of documented populations and several workers have made use of this method for archaeological populations (Ubelaker 1974). In the absence of the necessary information to calculate the CMR at Spong Hill, use was made of Hooton's tables (1920,21) of documented populations, to assess the annual death rate. The tables present percentage of population within three groups: 0–10 years, 10–20 years and 20+ years.They give the average annual death rate in each group for a number of documented populations. The figures in the categories at Spong Hill could easily be adjusted to these groups, and the closest fit could provide a notional annual death rate for the population.

Because some very young infants are probably missing from the Spong Hill population, three comparisons were made: one for the actual figures obtained; one calculated on a 1:4 ratio of very young infants to the total number of immatures; and one at a 3:4 ratio.

1) The actual Spong Hill figures correspond closest with a 24.6/1000 death rate (France 1866–77: Hooton 1920), but a fairly wide discrepancy of too few infants/juveniles and too many adults (both by about 11%) illustrates how far removed from a 'normal' distribution the actual figures from Spong Hill are.

2) A 1:4 ratio also corresponds most closely with a 24.6/1000 death rate. There is still some discrepancy in the infant/juvenile and adult groups but it is narrower than with the actual figures obtained at about 8%.
3) A 3:4 ratio corresponds fairly closely (to within 1%) with a 31.2/1000 death rate (Spain 1865–70: Hooton 1920).

As may be seen, the first two Crude Mortality Rates obtained in this way differ considerably from that obtained using a 3:4 ratio. Both of the former had percentages of infants/juveniles (19.5% and 23.0% respectively) far lower than the lowest percentage shown in the tables of 32.28%. The latter ratio of 3:4 gave 50.8% infants/juveniles, which placed it in the upper half of the percentages shown in the tables.

The Crude Mortality Rate can be used to calculate the population size. Using the formula (Ubelaker 1974)

$$P = \frac{1000\,N}{M\,T}$$

where P is the population size, N is the number of individuals, M is the Crude Mortality Rate per thousand, and T is the time-span of the cemetery.

Once more there is the problem of the probable missing infants. Accordingly, three sets of calculations were made, one using the actual figures obtained, a second on the basis of a projected 1:4 ratio of 0–1 year olds to 0–20 year olds, and a third on the basis of a projected 3:4 ratio.

It is unclear whether the cemetery covered 150 or 200 years, therefore two calculations had to be made in each of the above three sets.

Factors none of the calculations take into account however, include the increased size of the cemetery from missing cremations discussed above; as there are no exact figures these could not be included. Because there is no reliable phasing of the cemetery as yet, it was impossible to calculate for any fluctuations in population size over time, all the calculations are therefore made on the unlikely assumption of an unchanging population size.

1) If the number of individuals is taken as that identified, the population size is calculated as 595 individuals at any one time for 150 years of use, and 446 individuals for 200 years of use.
2) If a 1:4 ratio of 0–1:0–20 year olds is allowed, the population size is calculated as 622 for 150 years of use, and 467 for 200 years of use.
3) If a 3:4 ratio of 0–1:0–20 year olds is allowed, the population size is calculated as 768 for 150 years of use, and 576 for 200 years of use.

A minimum figure of 446 individuals, at any one time, and a maximum figure of 768 is thereby obtained. The *minimum* figure is probably a lower estimate of numbers than would have existed. It does not take into account the minimum of 421 'missing' cremations estimated above, nor does it take into consideration that, whatever the ratio of very young infants to the total number of immature individuals, it was probably higher than that identified (see section I). The minimum figure is also based on a 200 year time-span, which is uncertain. The *maximum* figure also does not take into consideration the 'missing' cremations, but may give a more realistic assessment of the number of very young infants resting on the 3:4 ratio which corresponds much closer with the 'normal distribution' of known populations. It does however, assume only a 150 years use of the cemetery.

Even at its lowest assessment, the population using the cemetery is likely to have consisted of a minimum of fifty-six 'family' units (a unit being classified arbitrarily as eight individuals of varying age), with a possibility of up to ninety-six units being present at any one time. By way of comparison, the *Domesday* records for the parish of North Elmham (Fig. 2), the site of the main later Saxon settlement, records the presence of 41 villeins, 63 smallholders, 24 freemen and 6 slaves. Including women and children, this would give an estimated number of 646 individuals.

What may be deduced about the population burying their dead at Spong Hill? The short answer is very little because of the lack of supporting evidence. It is unfortunate that there has not been the opportunity to excavate the Saxon settlement(s) at Spong Hill; if more were known about the size and phasing of the settlement, it may be possible to make greater use of the figures from the cemetery. It is known that there were two areas of Saxon settlement, one immediately west of the cemetery, and one slightly to the east (fig. 60 in Rickett, forthcoming). Three 'halls' and six/seven sunken-featured buildings (S.F.B.s) have been excavated, but the full extent of the settlement and its phasing is as yet unknown. However, it does not appear large enough from the crop-marks, to have sustained anything like the possible fifty-six 'family' units suggested by the cemetery analysis.

By comparison, at Mucking, in south-east Essex, two Anglo-Saxon cemeteries yielding close to 900 burials were found adjacent to, and co-mingled with, a settlement(s) consisting of at least fifty post-hole buildings and 211 sunken-featured buildings, spanning the early 5th to the early 8th centuries (Hamerow 1988). Analysis has suggested that a shifting hamlet, sometimes possibly more than one, consisting of conglomerations of single farmsteads, is represented. Estimations of population size for the site, based on cemetery and settlement evidence, suggest an average of sixty people per generation (Hamerow 1988). It seems likely, therefore, that the Spong Hill cemetery may have had a relatively large catchment area.

Other Early Saxon settlement evidence from the area is scant and inconclusive (Fig. 2), with crop-marks of possible S.F.B.'s 0.5km northeast of Spong Hill, and two other nearby settlements indicated by Early Saxon pottery scatters and other finds (Rickett forthcoming). Four late Saxon vills were recorded in *Domesday* (Fig. 2).

Evidence of contemporary cemeteries in the area (Fig. 15), is more helpful. Although not fully excavated, the approximate sizes are known (A. Rogerson, pers. comm.) and although some number in the hundreds, none seem to approach the size of Spong Hill. All followed the same ritual: cremation, with a few inhumations; all have similar pot and grave-good types; but little is known of the catchment area or population each served without more settlement evidence.

If we assume, for instance, that the site catchment was based simply on the use of the nearest cemetery, we can predict the population density in the area served by Spong Hill. This would have been between a 5.5–10 mile elliptical area around the site (Fig. 15). Pensthorpe is the nearest cemetery, situated 11 miles north; to the south and

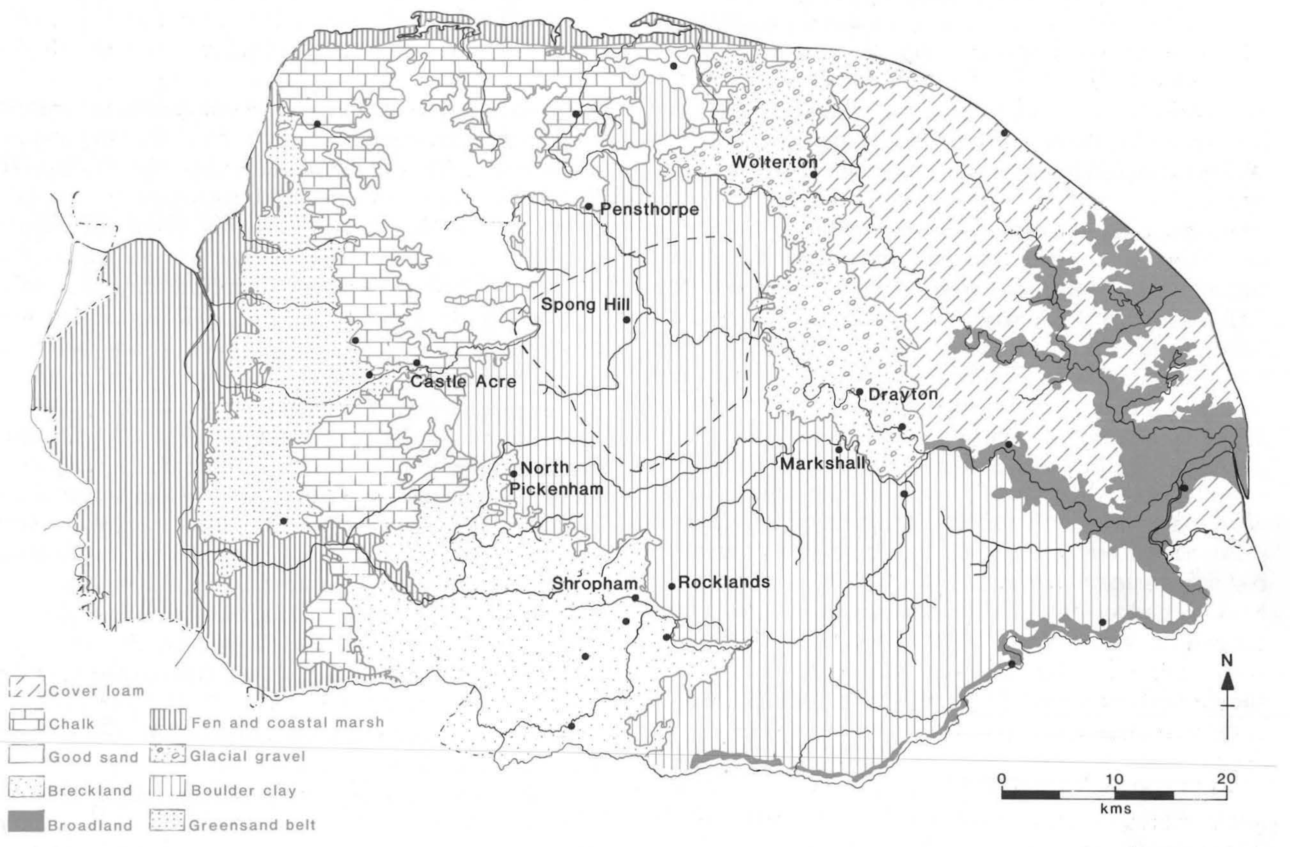


Figure 15 Early Saxon cremation cemeteries in Norfolk, related to soil regions. (Based on map 3, Myres and Green, 1973 and the Soil Survey of England and Wales, Scale 1:700,000).

east the nearest sites are further away, Rocklands being 19 miles from Spong Hill. The apparent importance of Spong Hill as a burial site and religious centre is likely to have resulted in the settlement here being larger than average. Even here, a maximum of ten to twelve 'family' units is likely. Therefore, a minimum of forty-six units, (perhaps twice that number, depending on the variables outlined above), are likely to have been contained within this area, either as small hamlets or single units. This is of course speculation, but is the sort of information one would hope to be able to obtain from the marriage of cemetery and settlement evidence.

These deductions have been made on the unlikely assumption that the use of the cemetery remained constant over time. It is more probable that the cemetery had smaller beginnings, from a core of new settlers, increasing over time.

The use of the cemetery does not appear to have extended into the seventh century (Hills, pers.comm.). The adoption of Christianity may have had some influence: St Felix was sent to be Bishop of the East Angles in 630AD (Wade-Martins 1980), but there is a gap of some thirty years between the two events, making any connection dubious. Later Saxon settlement shifted from Spong Hill to North Elmham, although again, there is some time-lapse between the abandonment of the cemetery and the known occupation at North Elmham, probably in the later seventh century (Wade-Martins 1980). The completion of Catherine Hills's analysis of the phasing and future excavation of the settlement, may help to fill in these gaps and explain the abandonment of the cemetery site.

If more were known about the real size and dates of the other known cemetery sites and about the settlement at Spong Hill, a much firmer basis would exist for understanding how far the cemeteries' sphere of influence extended, and the density and distribution of the early Saxon population in Norfolk. Without the excavation of the early Saxon settlements however, the cause of Spong Hill's apparent ascendancy may never be discovered. Full excavation of other Early Saxon cemeteries in the area would also help to illustrate whether that apparent ascendancy was real or illusory.

Chapter 5. Cremation

The word 'cremate' is a 19th-century derivation from the Latin *cremare*, to burn. The Oxford English Dictionary (1973) definition is given as 'to consume by fire, to burn; specifically, to reduce (a corpse) to ashes.'

There is some discussion at present amongst the Cremation Authorities, as to the correct usage of the word 'ashes' (Bell 1989), to describe cremated bone. The Oxford English Dictionary gives the definition of 'ash' as 'The powdery residue, chiefly earthy or mineral, left after combustion of any substance', note the use of any substance, not just wood as suggested in Alec Bell's article in *The Guardian* 'La crème de la crem' (1989).

According to Holck (1986), 'The strict sense of the word "ashes" means the remnants of inorganic material which are left by complete combustion of organic substances. Their quantity and compound is dependent on the basic material'. He argues that 'during cremations we have learned that the bone pieces which are left may be of some size,...this makes..."ashes" an incorrect term [for] those final bone products.' Why the size of the fragments should negate the use of this term is not clear. Cremated bone *is* the inorganic (mineral) component of bone, left by the oxidation of the organic components of the body; the size of the fragments is irrelevant. We are conditioned to think of ashes as being only fragments of small particle size or 'powdery' (not all dictionary definitions specify 'powdery' *e.g.* Collins 1983) but, technically, there is no limitation on the size; it is the inorganic remnants of oxidation of a substance, whatever that is, which are being described.

Having argued that the use of the word 'ashes' is a correct and acceptable term to describe cremated human bone, the expression 'cremated bone' has been used throughout this volume. This is in order to avoid the confusion usually aroused by the word 'ashes', which most people immediately envisage as the granulated remains which are the final product in modern crematoria, where the remains have been deliberately pulverised.

The expression 'cremated bone', as opposed to 'burnt bone', or 'mineralised bone' implies a *deliberate action*, rather than accidental or incidental burning for example, of animal bone in a domestic fire. 'Cremated bone' is generally used to refer to human remains, but may just as correctly be applied to animal remains which have been deliberately burnt on a pyre (see Chapter 6).

I. Modern cremation

(Figs 16–18, Table 4)

It is essential when studying archaeological cremations not only to understand the nature of cremated bone but also the process of cremation itself. Examination of how the process operates in modern crematoria and observation of the remains, aids understanding of the likely similarities and differences in the process and practices used in the past.

Discretion requires that modern cremation incinerates efficiently, without the production of smoke. Smoke is generated by the incomplete combustion of carbon particles from the organic components of the body tissues and the coffin. The design of modern cremators (Figs 16 and 17) is largely concerned with ensuring the complete combustion of the carbon particles given off during cremation, so that by the time the hot air leaves the chimney, all the carbon is fully oxidized. This process is achieved by the use of a series of air-flows, which also serve as a mechanism for circulation of the hot gases and provide turbulence to aid break-down of the remains. Almost all the crematoria operating in Britain are fired by gas. According to Polson and Marshall (1975) 'Gas has been found preferable to other fuels because it is cheaper and permits greater control of heat; it is the best fuel for providing, at reasonable cost, the right amount of heat when and where required, at any stage of the cremation cycle.' In addition to providing efficient cremations, crematoria also have to be cost effective.

Figures 16 and 17 show the design and principal functions of the Diamond 2000 Cremator (by kind permission of J. G. Shelton & Co. Ltd 1989). This is a single chambered cremator of a type used in several of the crematoria visited by the writer.

Most crematoria have a working temperature of between 500–1000° centigrade; 400° is the minimum temperature needed to ignite the coffin and commence the process of cremation. Temperatures in excess of 1000° are avoided if possible, as this may result in damage to the furnace lining. The temperature is subject to a number of variables.

The time of day is of paramount importance (Fig. 18); the first cremation of the day will obviously start at a lower temperature as the furnace will have cooled overnight. 'The chambers of the cremator are built with an inner lining of refractory material, backed by heat-insulated bricks so as to permit quick heating and reduce heat loss to the exterior. The brickwork is encased in steel plates' (Polson and Marshall 1975). As a result of this efficient heat retention on a week day the furnace may only cool to *c.*300–400° overnight. Over a weekend, however, (as was the case with cremators 'a' and 'b' in Fig. 18), the temperature may fall considerably lower. Some crematoria pre-heat their cremators to a starting temperature of about 400°.

Another variable is the individual being cremated. A certain quantity of body fats is necessary to aid cremation. In fact, once a sufficiently high temperature is reached within the cremator, the gas jets may no longer be required as the body will burn in its own fat and consequently raise the temperature by the heat given off. At the crematoria visited, it was observed that, provided a cremator was at a temperature in the region of 800° C when the coffin was put in, the gas jets were not needed at all. General trends are that females will cremate more easily than males because of their slightly heavier and different fat deposits; the very old and the immature are more difficult to cremate as they usually carry less fat. There are occasionally, however, unexplained circumstances where the usual

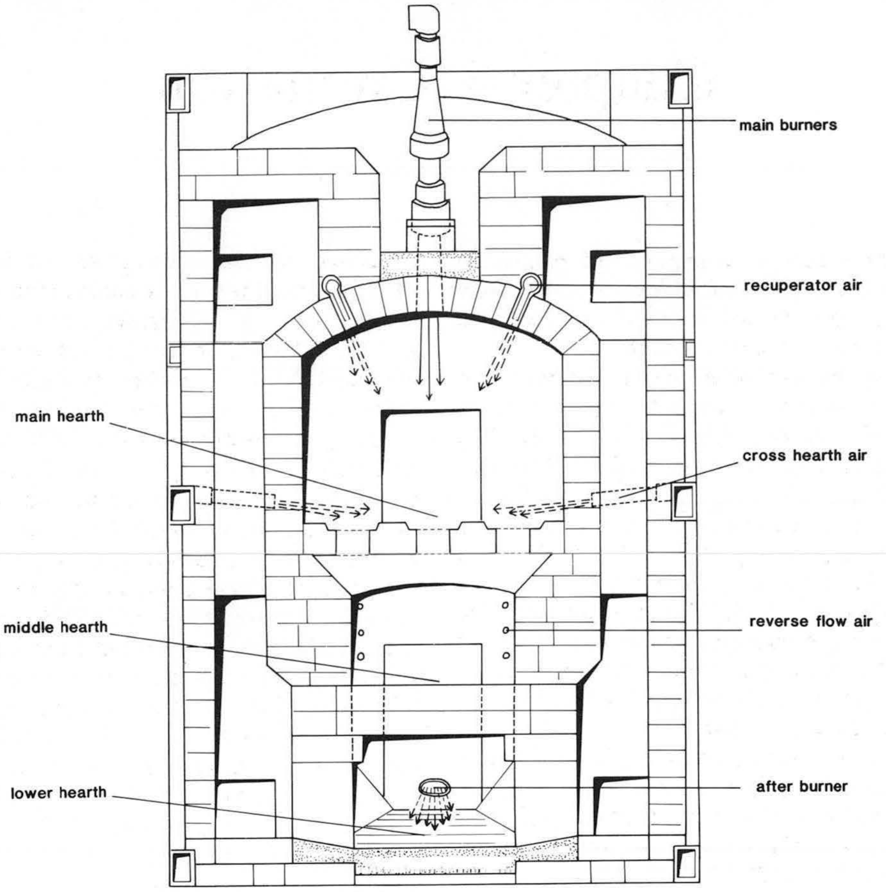


Figure 16 Annotated, schematic diagram of the Diamond 2000 cremator, anterior view. Showing principal structure and components, and demonstrating the direction of gas burners (unbroken arrows) and various air flows (broken arrows). By kind permission of J.G.Shelton & Co.Ltd. 1989.

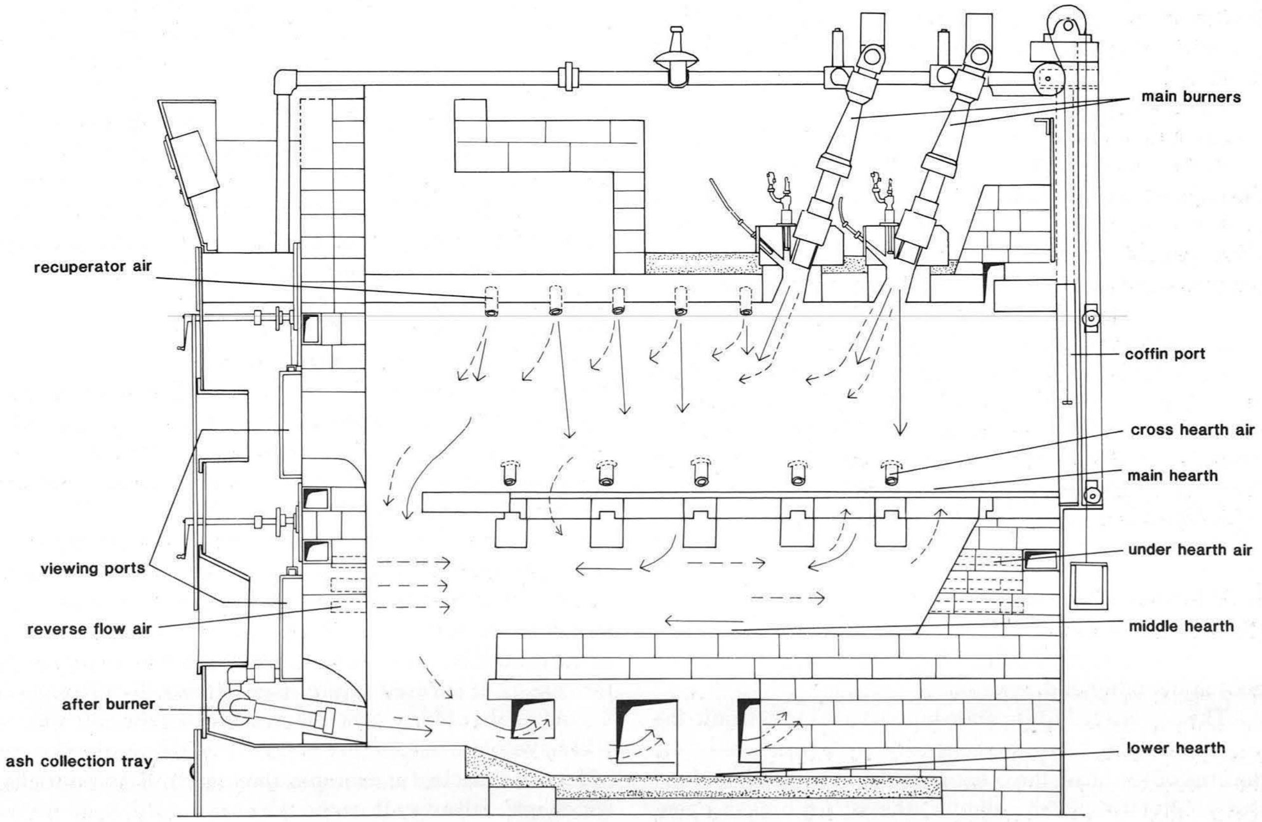


Figure 17 Annotated, schematic diagram of the Diamond 2000 cremator, lateral view. Showing principal structure and components, and demonstrating the direction of air flows using the recuperator air (unbroken arrows), and reverse flow air (broken arrows). By kind permission of J.G.Shelton & Co.Ltd. 1989.

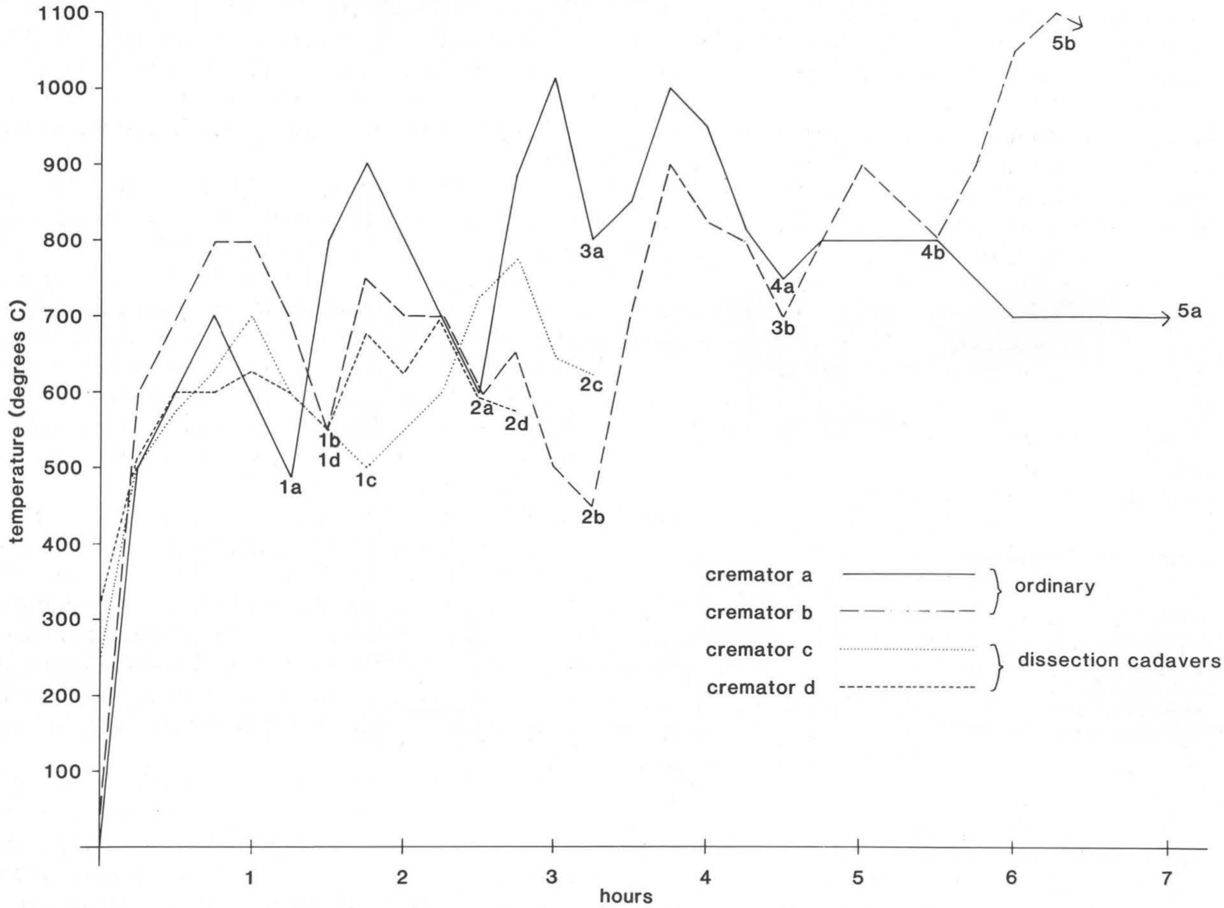


Figure 18 Variations in temperatures noted in four separate cremators (a–d), readings taken at fifteen minute intervals, in one day. Numbers 1–5 indicate the end point of each successive cremation.

pattern is not followed. For example, the fifth 'charge' (coffin) of the day to be put in cremator 'a' ('5a' in Fig. 18) was, in size, age and sex, equivalent to charge '5b' but, for some unknown reason, proved very difficult to cremate. Whereas '5b' needed no gas heat, '5a' had continuous heating throughout the process but still proved most difficult. Such a situation cannot be explained now, let alone in archaeological specimens.

A further variable is the cremator operator. Although the process followed in all crematoria is essentially the same, there are bound to be slight variations in working temperatures, air-flow control *etc.*, depending on personal working practices.

The coffin is placed within the furnace on the main hearth (Figs 16 and 17), which is constructed of special hearth tiles (*i.e.* bricks with large holes in the centre, to enable the circulation of the hot gases and passage of cremated remains down to the middle hearth). The main doors are sealed, any further observation being via a small door at the other end.

The downward firing main burners are ignited onto the top of the coffin. There are generally two burners, one over the area of the head, the other over the axial portion of the body. After about ten minutes, the coffin breaks open, exposing the body to the main flame. Once the temperature of the cremator is sufficient to maintain combustion and the body itself is burning, the gas jets may be switched off. The skill of the operator, using the various air flows, will ensure complete combustion. Secondary air jets situated within the cremator are used to minimise smoke and circulate the hot gases to ensure efficient cremation. The reverse flow operation (Figs 16 and 17) circulates the combustible material around the main chamber, down and across the middle hearth. This also ensures the body is receiving heat from below as well as from above.

There are numerous rumours regarding movement of a body during cremation. A certain amount of movement may take place in the upper leg and upper arm, as moisture is driven out and the larger muscles contract, leading to slight flexing of the limbs. The idea of a body sitting upright however, is purely fictional. Numerous European workers have expressed the belief that the skull vault 'explodes' in consequence of the brains 'boiling' (Holck 1986 and Reverte 1988). To the writer's knowledge this has never been observed, the skull vault usually remains intact until it is raked-down into the middle hearth except for parting at unfused sutures (see below).

After about forty-five minutes, most of the soft tissues will have oxidized, except for some of the thicker layers of fat and muscle, for example, those around the buttocks, which may fall away from the skeleton but still be burning. The skeleton, at this stage, is often still held together by the ligaments. The rib-cage may be upstanding, though empty; hands and feet have been noted as falling away from the limb bones (Evans 1963), still articulated by the strong ligaments. The lower leg has generally finished burning, there being very little soft tissue to aid combustion in this area. The skull also finishes burning before other areas of the body, though complete combustion of the brain may prove somewhat problematic. The vault generally opens along the line of unfused sutures and falls away from the brain, enabling it to burn. If the sutures are fully fused and the vault does not open (until it is moved during the raking down) the brain will just char and need extra time in order to oxidize fully. The axial portion of the body takes considerably longer to burn, as there are more soft tissues in this area.

If oxygen reaching the bone is impeded by the presence of soft tissue, the bone will not burn. There may be dehydration of bone as a result of the high temperature, but combustion cannot proceed without the presence of oxygen. This point may be best illustrated by the bundles of newspaper sometimes used to support the head of the deceased in the coffin which occasionally survive the cremation. The outer sheets will be scorched, but the inner sheets remain unburnt, despite over an hour in temperatures of up to 1000°C. This is because there is insufficient oxygen available between the sheets of paper to allow combustion. There will obviously be some variation in the point at which different bones of the skeleton burn depending on the amount of soft tissue surrounding the individual bones. Additionally, some bones will take longer to oxidize than others because of the level of infiltration by marrow, blood vessels and cartilage, as outlined in section II below. The articular surfaces, vertebrae and particularly the innominates, take much longer to burn as a consequence of the greater quantity of organic material present within them. Hence, long after other parts of the skeleton have finished burning, the innominates may still be seen to be glowing, the inner spongy bone only blackened.

Prior to raking, the remains may be seen laid out on the main hearth as a *recognisable skeleton*, anatomically arranged, except for some of the smaller bones which may have fallen through onto the middle hearth. Once the body is reduced to its 'bony framework', the remains are raked down to the middle hearth, during which process the hot, brittle bone breaks along fractures developed in cremation. On the middle hearth, they are subject to further heat and turbulence from the reverse flow air (Figs 16 and 17), and, if necessary, the after-burners, which aid completion of bone oxidation, and break down and remove any remaining wood ash from the coffin. The operator may then pull the remains forward into an 'ash residue' compartment, in which they may cool and be removed. This movement obviously results in additional breakage.

Cremation usually takes between 60–90 minutes to complete, depending on the time of day (temperature) and the individual (see above). The entire skeleton remains, including the finger and foot phalanges which *do not* get completely destroyed as some have described (Holck 1986), with easily identified fragments up to 25cm in length (femur). Some of the spongy bone may crumble to dust if very well oxidized and dehydrated.

For the cremation of an infant, the coffin is placed in the furnace on a metal tray to enable total recovery of the bone, which otherwise would be very difficult. The air flow has to be reduced to a minimum, otherwise the light, fragile bone would be blown about the furnace, largely pulverised, and impossible to recover.

The quantity of cremated remains from an adult individual may vary between 1600–3600g (Evans 1963), with an average of 2500–3000g. There is little difference in weight between the average female and the average male.

The range in colour of the bone from any one cremation may be great. The bones of the feet and lower leg are often grey and sometimes black/blue inside the spongiosa, resulting from the lack of soft tissue around the bone to aid combustion and the distance from the heat source. The general lack of soft tissue in a thin or wasted individual may have a similar effect. The innominates, vertebrae and inner portions of the articular surfaces may also be blue/black, showing that the process of cremation ceased before all the organic components within the bone were fully oxidized.

There were a few instances where a brittle, black, slaggy substance was seen adhering to some of the bones, particularly at the syndesmoses (ligament insertions). This substance was the charred remains of incompletely oxidized ligament and muscle tissue. It was also noted to occur as free fragments. The author believes this may be the 'curious clinker' noted by Calvin Wells in his observations at one of the crematorium in 1960 (see Chapter 6, pyre debris).

Table 4 shows the frequency of quickly identified bones within six cremations from three cremators. The numbers and figures correspond to the coffin and cremator numbers given in Fig. 18. There were, in fact, probably many more of the small bones of the hands and feet but they were mostly buried in the fine ash and therefore overlooked in this rapid assessment.

From this table, it will be apparent just how much of the skeleton remains in recognisable form, especially as this was only a rapid check, where much was masked by the quantity of fine ash in the collection pan. It is worth noting that at least one elderly female showed considerably less recognisable material than, particularly, the males. This was likely to be as a result of osteoporosity leading to collapse of the spongy bone on cremation (see Chapter 7).

Fragmentation of the bone follows a set pattern. The bones of the skull part along the lines of the sutures and may fragment further into features. For example, the temporal bone may further fragment into mastoid, petrous and basal portions (Figs 8 and 9). The buccal and lingual portions of the mandibular body usually part, sometimes with considerable warping. The rami will often separate from the body and may themselves fragment into their component features, condyle and coronoid process usually parting.

The vertebral bodies separate from the dorsal portions at the lamina. The long bones break into three basic components: proximal and distal ends, and mid-shaft. The carpals and tarsals often remain whole, as do distal phalanges. Metatarsals/carpals and proximal and middle phalanges usually break into two fragments, base and shaft with head, though occasionally the shaft will be with the base.

The cremation of dissected cadavers produces almost exactly the same results as an ordinary cremation. The procedure followed is almost exactly the same, with slight variability because of the condition of the bodies. The

No.	1a	2a	3a	4a	1b	3c
sex	F	F	F	M	M	M
age	85	79	90	54	85	79
Max.skull fragment	110mm		80mm		105mm	50mm
Max. long bone fragment	105mm		120mm	203mm	175mm	120mm
SKULL						
vault	y	y	y	y	y	y
mastoid process		r	l+r	y	l+r	l+r
petrous temporal		r	l+r			l+r
mandible	y	l+r	y	r		y
AXIAL						
vertebrae	16	25	9	24	19	13
innominate	y	l+r	y	l+r	y	y
ribs	6	13	4	23	11	7
sternum					y	
UPPER LIMB						
clavicle	y		y	y	l+r	y
scapula	y	l+r	y	l+r	l+r	l+r
humerus	ppd	ppdd	ppd	ppd	pd	ppdd
radius	ppdd	pp	pd	pp	ppd	ppd
ulna	pp	ppd	d	ppdd	ppd	pd
carpals	3	3	3	3	2	3
metacarpals	4	8	4	4	2	9
phalanges	1	10	8	6	1	5
LOWER LIMB						
femur	ppd	ppdd	dd	ppdd	ppdd	ppdd
patella	l	l+r		l	l	l+r
tibia	pp	ppdd	pd	ppdd	pp	ppdd
fibula				dd		dd
calcaneum	l+r	l+r	l	l+r	l+r	l+r
talus	l	l+r	l+r	l	l+r	l+r
navicular	l+r		l+r	l	l	l+r
other tarsals	2	2	3	3	2	8
metatarsals		2	2	4	1	5
phalanges		1	1	7		6
OTHERS						sesamoid

p = proximal　d = distal　pp\dd = pairs
l+r = left and right　y = present
(For comparative data see Holck, 1986)

Table 4 Bones identified in modern cremations.

cadavers observed by the writer had been preserved in a solution of methylated spirit, phenol, formaldehyde and glycerin, whose effect is largely one of dehydration. Although all of the body was cremated, the bone had effectively been defleshed. The cremation procedure was followed as normal, but the effects of the preservative meant it was necessary to maintain the gas jets throughout. The process of cremation took the same length of time as with the ordinary cremations, the difference was in the much reduced time it took to cremate the bone itself. After about twenty minutes, the bones were still connected by the ligaments. Ten minutes later, the bones themselves were burning and separating from each other. After forty-five minutes, the bone was almost fully oxidized. The bone fragments observed and their pattern of fragmentation was as normal (Fig. 18 and Table 4) but in every case, the colour of the bone was uniformly either white or white with light grey spongiosa. The bone was slightly more brittle than normal but not unusually so.

II. The nature of cremated bone

About 34.2% by weight of the human body is composed of organic substances, largely fats and proteins (Holck 1986). Water is the largest single component at 57.1% by weight. The mineral component represents a mere 5.7% by weight, the vast majority of which is contained within the skeletal framework.

70% of the skeleton is formed by the mineral component, a calcium phosphate, hydroxyapatite: $Ca_{10}(PO_4)_6(OH)_2$ (Glorieux 1982). The other 30% comprises the bone matrix, which is largely the protein collagen (Marks and Popoff 1988). Although the major function of the skeleton is as a supportive structure, it also serves as the major reservoir of calcium and as a storehouse for marrow, as well as being infiltrated by cartilage and blood vessels. There is considerable variation in the amount of this infiltration depending on the site (skull *vs* articular surfaces of long bones) and the type of bone (compact *vs* spongy).

The process of cremation is one of oxidization of the organic, mostly carbon based, components of the body, and dehydration. In order to complete combustion, temperature, oxygen and time are necessary. If for some reason any of these three conditions are not met, complete cremation may not be achieved.

Numerous experiments have been conducted in Europe and America on the macroscopic, microscopic and chemical changes detectable in cremated bone.

Colour

Colour reflects the amount of oxidation of the organic components of the bone, which is partly dependent on the temperature. Shipman *et al* (1984), in laboratory experiments using de-fleshed sheep and goat mandibles and astragali, tabulated changes in colour from black, through shades of blue and grey to white, corresponding with an increase in temperature.

Guillon (1986), found that de-fleshed and dry bone fragments (3cm long fragments of human femoral shaft) initially turned black (charred) when heated over a bunsen burner, then buff/white with increased exposure to the flame.

That colour is not related merely to temperature or time in a strictly regulated manner is illustrated in the considerable variations observed by the writer within individual cremations at Crematoria (see above). The cremation process is aided by the temperature provided other criteria are satisfied.

Crystal structure and mineral changes

Shipman *et al* (1984) also considered the changes in the crystal structure, which reflect the temperatures attained by the bone. They found that the hydroxyapatite mineral remained throughout the temperature range used in the experiments (up to 940°C). The changes observed involved a gradual increase in the crystal size up to 525°C, a large increase in size between 525 and 645°, with virtually no change above that temperature. As the hydroxyapatite crystals dehydrate, the hydroxy bonds break down and reform creating a larger sized crystal.

European workers however, have reported both changes in the mineral form and a reduction, rather than an increase, in crystal size. Lange *et al* (1987) observed a slight reduction in volume between 150–300°C, as the mineral bound water (in the hydroxy-bond) is lost. As dehydration progresses 'pyrophosphate' appears and at 800°C, this combines with the hydroxyapatite to form tricalcium phosphate (Whitelockite) in a solid-reaction. This 'sintering' process at around 800°C has also been observed in other experiments using powdered bone (Pollard, pers. comm. 1991). Lange *et al* maintain that 'sintering' is a result of fusion of the crystal units and leads to a reduction in volume. Pollard (pers. comm.) found that by *c.*1000°C a standard minimum form was achieved. Williams (1989) in a detailed discussion of the 'Chemistry of the calcium phosphates' provides corresponding evidence for these findings.

There is also some disagreement over the melting point of the crystals. Pollard (pers. comm. 1991), Williams (1989) and Lange *et al* (1987) give a melting point of around 1600°C for the bone mineral. Shipman *et al*, give 800°C as the 'fusion or melting point' (the melting point of pure, geological apatite is 1200°C). The discrepancy may merely be one of terminology. According to Mason and Berry (1968) the 'relative fusibility is not necessarily the same as relative melting point.' Although 'localised' melting occurs during the sintering process, this is not the same as the full melting of the mineral.

Despite differences in detail, it would seem that temperature is reflected in the the crystal structure, and changes to it. These changes are directly related to the temperature and unaffected by time or oxygen supply.

Shrinkage

Holck (1986) in his review of the literature, notes variations of between 0–25% in estimates of shrinkage recorded by different workers. Shipman *et al* (1984) found a 'maximum mean percentage shrinkage' of about 15% in their experiments, which was related to temperature. At 550°C they found a range of between *c.*2–6% shrinkage, 5–8% at 800°C and 12–17% at 1000°.

A further consideration is the particular bone involved. Investigations in Europe (Lange *et al* 1987) have provided average shrinkage rates of about 5% in a longitudinal direction for compact long bone shaft, and 12% for the spongy bone of a long bone articular surface. They concluded that areas of bone with a lower mineral content will shrink more (*i.e.* spongy bone has a more open structure with greater infiltration of organic material within the matrix).

With such a range of shrinkage reported by different workers, some maintaining there is none at all, and with so many variables at work, some of which it may be difficult to account for in experiments, estimates of shrinkage, even separate ones for compact and spongy bone, should be treated with caution in archaeological investigations. In all such experiments, including those carried out in modern crematoria, it should be remembered that the temperature reading taken from the furnace/oven may be misleading. In a large oven, particularly one containing burning fats, there may be local variations in temperature, possibly a greater problem in non-cremator ovens with no facility for the circulation of the hot gases. As was demonstrated above, the disposition of body fats in relation to individual bones has a great effect on the temperature of the cremation, which may work on a very localised level. The position of the thermostat must be taken into consideration, and, as pointed out by Shipman *et al* (1984), the temperature of the furnace/oven may not necessarily be the temperature of the bone. Consequently, the humeral and femoral heads of a cremated individual may differ from each other in their percentage of shrinkage. There will be similar problems in working back to estimates of the pyre temperature from the bone.

Fissuring

Dehydration, as well as causing microscopic changes to the bone, also results in visible shrinkage and deformation. Spongy bone shrinks and will fissure concentrically, often with 'parched-earth' cracking in the surface. Compact bone exhibits less shrinkage, but increased fissuring and warping. The fissuring is often characteristic, the pattern being influenced by the structure of a particular bone and the position of tendon and ligament insertions, that is, the direction of forces exerted on the bone. For instance, the femur often has 'U-shaped' transverse fissures down the anterior mid-shaft. The attachments to the bone are probably also largely responsible for the direction of warping (Binford 1963, 1972).

Patterns of fissuring and warping in the bone have been thought to indicate the condition of the bone prior to cremation. As the chemical process is one of oxidation of the organic components of the bone and dehydration, the attendant macroscopic changes will depend to an extent on the presence or absence of those organic components.

Experiments have been carried out by various workers in America. For example, Webb and Snow (1945), Baby (1954), Binford (1963, 1972), Thurman and Willmore (1981), have worked on the different macroscopic appearances of fleshed, defleshed and dry cremated bone. All agree that dry bone is easily differentiated from the rest by its lack of warping, superficial surface checking 'like the patina of an oil painting' (Krogman 1939) and longitudinal fractures. The lack of warping is understandable in bone which will already have dehydrated to a large extent and lost a large proportion of its organic content. Surface 'parching' of the bone may also be explained by the dehydration. Distinguishing between defleshed (recent defleshing or 'fresh' bone) and fleshed bone, is somewhat more difficult. In each series of experiments the defleshed bone and sometimes the fleshed bone were from cadavers preserved in formalin. Krogman, Baby and Binford observed very little difference between the two categories. Krogman and Baby both noted possible incomplete incineration of the fleshed bone, dependant on the position of the bone and the length of time it was burnt. Thurman and Willmore claimed to observe less warping in the defleshed bone, a lack of diagonal fracture and increase in surface checking.

A decrease in the amount of warping and parallel, as against diagonal, fractures may be explained by the lack of muscle and ligament attached to the green bone, exerting force on the bone in certain directions as it contracted during heating. The increase in the amount of oxidation seen in the defleshed bone, together with the increase in surface checking, is due to the oxidation of the bone itself taking place considerably sooner in the cremation process than is possible with fleshed bone. As outlined above, for fleshed bone to burn, the soft tissues must first be largely burnt away. So, obviously, in experiments of this nature, with simultaneous cremation of the two types of specimens, the defleshed bone will burn sooner, and for longer, than the fleshed bone (see section I). It will therefore oxidize more completely in the same time, and surface checking may be more substantial.

In observations made by the writer of the cremation of dissection-room cadavers (*i.e.* entire bodies, but with much of the soft tissue already stripped away from the bone), there was very little difference between the appearance of this cremated bone and those remains recovered from a normal cremation (see above). The size of fragments and lines of fissuring were identical. The main differences were in the increased uniformity of oxidation (as seen in the colour of the bone), the slightly increased dehydration, making the bone very brittle, and the shorter time needed for the bone to reach this state. It should be emphasised that some of the ordinary cremations observed showed both the same colouring and the same degree of dehydration as seen here. The major difference was in the uniformity of oxidation of the bone and the speed at which this was achieved.

Experiments conducted under laboratory conditions illustrate many aspects of cremation, however, the same time and temperature is usually maintained for each set of specimens. A pyre cremation, however, may be subject to numerous variables which may be difficult to account for in examination (see below). Even at a low temperature (*i.e.* at or above the minimum for oxidation, *c.*400°C), provided sufficient time and oxygen were available, the bone could be completely oxidized to look the same as the defleshed bone. If the moisture were driven out of the bone slowly, at a fairly low temperature, the degree of warping and pattern of fissuring might appear very different to bone oxidized rapidly at a higher temperature.

III. Parallels, ancient and modern

The basic process of cremation was the same in the past as it is today, therefore, from observing modern cremations, we should be able to understand much about ancient practices. However, when drawing parallels between modern and ancient cremations, there are certain points which must be considered.

A modern cremation takes place in an enclosed, controlled environment. The oxygen supply is regulated: draught, and to a large extent, temperature, are controlled. With pyre cremation, there would have been a number of variables which could affect both temperature and oxygen supply:

1) The weather; wind strength could cause too much or too little draught, resulting in cooling of the pyre or insufficient oxygen supply to stimulate burning. The vast majority of the heat produced during combustion would be lost to the atmosphere, unlike in a modern crematorium where the hot gases are circulated within the cremator. This means that an open pyre would need to create a higher temperature than a furnace, and burn for longer in order to complete cremation. Presumably, excessive rain could cause considerable problems with an open-air cremation, the season may have affected the lapse of time between death and cremation.

2) The oxygen supply would be cut off if the body was covered in some way, by grave-goods of some kind, for instance. Covering of the body by large fragments of fuel would cause problems, as would coverage of any bones at the base of the pyre by a large quantity of wood-ash built up during cremation.

3) Fuel; in the crematorium the gas jets need only be maintained until the temperature is sufficient for the body to burn unassisted, the temperature being sustained by the heat produced by the burning body. If further heating is needed, the gas is easily reapplied. The important temperature to reach is the ignition temperature of the body fats, hence the practice of adding perfumed oils or *ghee* to some pyres in India, to aid the initial combustion. On a pyre, because so much heat is lost, fuel may need to be added during the cremation process (reported as taking *c.*3 hours for some contemporary Indian cremations, (*Cork Examiner* 1988), or *c.*7–8 hours in an experimental cremation in Europe, (Pointek 1976); this may depend on what is considered 'complete' cremation). If the pyre was unsupervised, there would have been a gradual fall in temperature.

Holck (1986) has produced some very interesting results on the 'thermo-technical' aspect of cremation. He has calculated the amount of energy and the air requirement needed to burn the various body tissues, and the energy produced from burning different species of wood. By using the two sets of energy levels, and comparing them with the amount of energy required for a modern cremation, he was able to calculate that *c.*146kg of pine wood was necessary for a pyre cremation. (For comparison, one of the crematoria visited by the writer uses an average of 210 units of gas per cremation). However, it is known from contemporary pyre cremations, that in practice between two and three times that quantity of wood is needed to cremate a body. The increase is doubtless in direct response to the ineffective heat retention and use in a pyre situation.

4) It is unlikely that a constant temperature could be maintained across the pyre; the centre would be much hotter than the periphery. This would have obvious repercussions on the cremation of different areas of the body. A photograph of a contemporary Nepalese cremation (*Stern* magazine 1975), shows the deceased placed on top of the pyre, with the feet and ankles projecting, where they would be unlikely to cremate at all.

5) Bones falling through the pyre structure after loosening of the ligaments would collect at the base and become buried in the mounting wood-ash, curtailing cremation of the bone through lack of oxygen.

6) Collapse of the pyre structure may cause separation of the bone, depending on the original position of the body in the pyre. Falling timbers would lead to breakage of hot, brittle bone along dehydration fractures.

IV. Historical and ethnographic pyre cremation

(Fig. 19)

Most of the ancient historical references to cremations deal with the disposal of members of the upper echelons of society. Consequently, the proceedings described are probably considerably more elaborate than those afforded to lesser mortals, who constitute the bulk of archaeological cremations.

The cremation of Achilles's friend Patroclos, described in Homer's *Iliad*, *c.*700BC (1974, trans. Rieu), on a pyre measuring 100 feet square and involving the slaughter and cremation of a large number of horses and dogs, can hardly have been an everyday affair. It does, however, emphasise the importance of animals as 'grave-goods', particularly horses and dogs (see Chapter 6:II).

The pyre illustrated in the Greek vase-painting from *c.*500BC (Holck 1986, fig. 2), interestingly shows the same construction as portrayed in B. de Bakkar's illustrations 'Timely Punishment' in 18th-century Netherlands (plate 5 in Schama 1987), in 18th-century Aboriginal cremations in Australia (plate 6 in Hiatt 1969), and in contemporary pyre cremations in the East (*Stern* magazine 1975).

The Old English poem *Beowulf* (Bradley 1982) describes events much closer to home and at a time probably not far removed from that of the Spong Hill cemetery.

> Then the Geatish people erected for him a funeral fire on the ground, one not mean, but hung about with helmets, with battle-shields, with bright mail-coats, as he had asked. Then in the midst of lamenting men laid the famed prince, their cherished lord. And so the warriors proceeded to kindle upon the hill-top a most mighty funeral pyre. Smoke from the wood climbed up, black above the blaze, and roaring flame, mingled with weeping, until, when the swirling of the turbulent air died down, the fire had by then destroyed his bone-framed body, scorched to its core ... Heaven swallowed up the smoke. (XLIII 3136-3156).

The Islamic trader Ibn Fadlan, writing in 922AD (Brøndsted 1965; Foote and Wilson 1979), provides a contemporary account of the cremation of a Nordic chieftain on the banks of the Volga. The body was inhumed for a period of ten days whilst preparations for the funeral were made, the ground being very cold there was apparently little decomposition. The cremation was conducted in a ship, drawn up on land, with wood piled under it to help it burn. Grave-goods included rich clothes, food, drink, horses, cows, a chicken and (cause for considerable detailed reporting) a slave girl.

The 9th-century travellers' tale of the voyages of Wulfstan to the Baltic are recorded in the *Old English (or King Alfred's) Orosius* (Lund and Fell 1984, Swanton 1975). Wulfstan told of cremation amongst the 'Este' (believed to be Poland/Lithuania), where 'after a man's death he lies indoors uncremated among his relatives and friends for a month, sometimes two ... the more wealth they have the longer they lie above ground in their houses.' After a period of 'drinking and gambling' which seemed to extend for as long as the wealth of the deceased would maintain it, the corpse was 'burned up with his weapons and clothes', and 'if one bone is found not completely burned, heavy compensation must be paid'. It is not possible to deduce what proportion of the population qualified for this ritual. Was provision set aside for women and children? As the length of time above ground depended upon the wealth of the deceased, quite a small proportion of the population may have been treated in this way. How much of this tale may be taken *verbatim* is called into question by the claim that 'There is a tribe among the Este that knows how to cause cold, and this is why the dead men there lie so long and do not rot'. It does however, illustrate the fact that cremation may be postponed for some time after death.

More recent historical accounts of cremations in the East also tend to concentrate on the wealthy. The cremation of a Thai princess in 1870, was recorded by Mrs Leonowens (of *The King and I* fame). This sumptuous affair was only afforded to royalty, but shows once again, that cremation need not necessarily follow quickly on the death of the individual. The body of the princess was subject to a complicated process of dehydration for a year prior to cremation.

A recent visitor to Bali informed the writer that she had witnessed the cremation of a body exhumed following a year of inhumation. The body was reduced to a skeleton and the cremation of the bones had to be aided by adding petrol to the pyre. Even so, at the end of the ceremony the bones were largely only blackened (charred, as one may expect: see above).

Dubois and Beauchamp in their volume of *Hindu manners, customs and ceremonies* (1943), describe various cremation ceremonies observed in India during the last century. Again, in most cases, the descriptions are those of princely cremations. They describe in detail the cremation of the king of Tanjore, who died in 1801.

...a square pit of no great depth, and about 12 to 15 feet square, was excavated. Within it was erected a pyramid of sandalwood, resting on a kind of scaffolding of the same wood. The posts which supported it were so arranged that they could easily be removed, and would thereby cause the whole structure to collapse suddenly. At the four corners of the pit were placed huge brass jars filled with ghee, to be thrown on the wood in order to hasten combustion.

The collapse of the structure once the pyre was well alight would have caused the body, placed as it was on top of the pyre, to fall into the main body of heat where the temperature would be sufficient to ignite the body fats. They continue:'two days after, when the pyre was completely extinguished, they removed from amidst the ashes [*i.e.* wood-ash] the remnants of the bones that had not been entirely consumed.' They also describe the cremation pyre of a Brahmin, a somewhat smaller affair than that of the king. 'On arrival at the burning-ground a shallow pit is first dug, about six feet in length and three in breadth...the funeral pyre is erected, and the corpse is placed upon it.' Of other Hindus, they describe how 'On the third day, the heir...returns to the burning-ground,' He 'stirs the ashes with the small stick...looking for any bones that may have escaped the flames.'

In the 18th century, G.A. Robinson wrote extensive journals during his travels around Australia (Hiatt 1969), in which he describes the cremation practices of the Aborigines. He describes how in one case the deceased was bound up and then placed on top of a pyre made 'by placing a quantity of dry wood at the bottom, upon which they laid some dry bark. They then placed more wood raising it to about two feet six inches above the ground. A quantity of dry bark was then laid upon the top.' Once lit, the pyre was left until the next day, when the partly burnt remains were collected and cremated a second time, before being scraped together and put under a grass mound. More complex pyres were sometimes constructed:

> Having procured some short billets of wood about four feet in length, they began to build the pile in the form of a square, [*e.g.* Fig. 19] lapping the ends together at the angle...and raised it to a height of about three feet. They then collected some dry fern and grass and small sticks and thrust them into the immediate space until it was filled to the top, after which they collected some long brush-wood and placed it on end all around the pyre to the height of ten feet, leaving an aperture for the body to be put on. The body was...placed...on the pyre in a sitting position.

He also states that 'If a corpse was not destroyed by the initial firing the remains were raked into a heap and refired... or bashed so that they were more easily consumed by the fire.' In the same paper (Hiatt 1969), there is an account by Collins written in 1798 of a cremation in New South Wales;

> excavating the ground with a stick to the depth of three or four inches, and on this part so turned up were first placed small sticks and light brush-wood; larger pieces were then laid on each side of these; and so on till the pile might be about three feet in height, the ends and sides of which were thus formed of large dry wood, while the middle of it consisted of small twigs and branches.

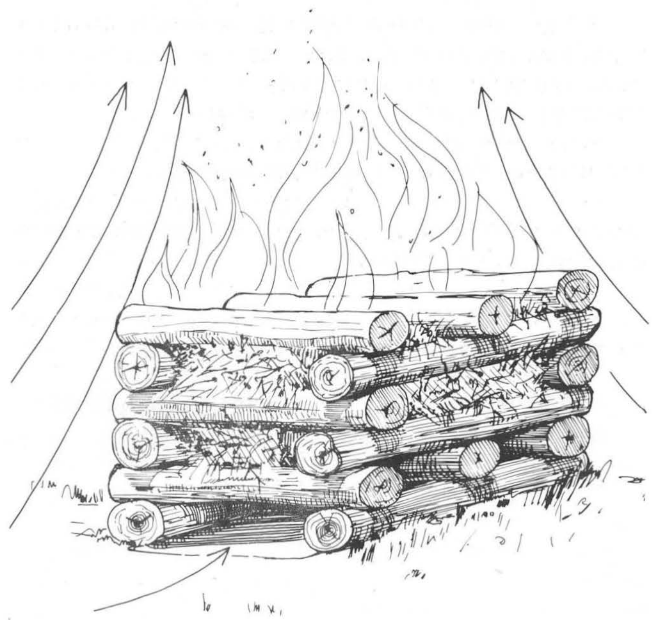


Figure 19 Reconstruction of a pyre, based on historical and ethnographic evidence, showing direction of air flow.

In modern India the use of pyre cremation is still wide spread, though there is now a move to introduce electric crematoria. For those who can afford it and manage to travel to one of the holy cities on the banks of the Ganges, most especially Varanasi, the cremation is conducted by professionals. The pyre construction is of logs, 300–500kg of wood being needed to burn one body (*Cork Examiner* 1988). Wood is an expensive commodity and there have, in recent years, been problems with incompletely cremated remains being cast into the river in an attempt to save on wood (*The Sunday Times* 13.7.86). The deceased is bound to a wooden stretcher which enables the body to be lifted onto the pyre with ease (*The Sunday Times* 1986). Pressure of numbers for use of the burning 'ghats' in the holy cities is such that the remains are cast into the Ganges whilst still hot after three to four hours. Elsewhere along the course of the river, cremations may be conducted by the family of the deceased. Here the process has changed little with the passing centuries, the pyre being left to burn out overnight before the remains are cast into the holy river. Cremations continue throughout the Monsoon period, the pyres being built further up the river banks and made of wood which has been kept covered and dry.

In modern Nepal (*Stern* 1975), the pyres are again constructed of large logs in criss-cross pattern. This provides stability and means the pyre does not collapse at once. As with the Aboriginal cremations, easily burnt brush wood is put inside the structure.

There are several interesting points in this ethnographic evidence.

1) It would seem that pyre structure has been universal across both time and space, a criss-cross framework, of varying size, constructed of large timbers with small brush wood infill. There may be a shallow pit in which the pyre is constructed, of 5–7cm depth. If the pyre were built over the pit, as suggested in Fig. 19, this would provide an under-pyre draught in the initial stages of burning, until it became clogged with wood-ash.

2) The corpse always seems to have been placed on top of the pyre, although further fuel may be added to the sides extending above the body or deliberate inward collapse of the structure may be arranged.

3) Oils of some kind were/are often added to pyres to encouraged a high initial ignition temperature.

4) Grave-goods, in the form of weapons, jewels, clothing, food, drink, animals and even people have been added to the pyre at times.

5) The pyres may have been tended, but there is no indication of additional fuel being added once the cremation is underway.

6) In India, some present day cremations are considered complete after about three hours. The remains are cast *en masse* (*i.e.* all pyre debris together) into the river, beside which the pyres are constructed. Some pyres were left up to three days before the bone was collected; in these cases, the bone was separated from the wood-ash. Collection of the bone took place either *en masse* or was collected separately by hand, sometimes with the aid of a stick to stir up the mixed pyre debris. In the *Aeneid*, Virgil tells how the Trojans '...washed in wine the thirsty ashes of the remains' prior to collection of the bone.

7) Deliberate fragmentation of the bone is only documented in some of the Aboriginal cases.

Chapter 6. Cremation at Spong Hill: technology and ritual

I. Technology

Pyre sites

No pyre sites were found in the excavated area at Spong Hill. This does not necessarily mean there were none in this area since they could have been ploughed-out, or they may have been located away from the cemetery itself, closer to the unexcavated settlements. A (fired?) 'earth' pavement covered with rows of 'Piles' made of 'earth' was recorded at the site in 1746 (Martin) and the finder thought it possible that this was a pyre site. Gurney (forthcoming) however, believes that it is more likely they were associated with a Roman kiln. Alternatively, cremation may have been performed away from Spong Hill. None of the cremations had charcoal in the pits, as found at some Roman (*e.g.* Baldock, McKinley forthcoming (e,f) and Bronze Age sites in Scotland (McKinley 1992, and forthcoming (i,k)). A few of these examples were obviously deposited while hot, demonstrating the proximity of the pyre sites to the cremation pits. On a practical level, it would have been easier to transport an urn, rather than a cadaver (human and sometimes animal), across any distance to the cemetery, particularly if the size of the Spong Hill catchment area was close to that postulated in Chapter 4.

Construction and pyre debris

There is no evidence of the pyre construction, but it is likely that they were built in the same structured manner as the pyres in the anthropological and ethnographic sources discussed in Chapter 5:IV. What is known about the Spong Hill cremation pyres is something of the type of wood used, the type of soil upon which at least some of them were constructed and that at least a few of the sites were used more than once.

Small fragments of charcoal were recovered within 131 of the cremations. The quantities are very small, the greatest weight being 3.0g. The fragments are usually relatively large individual pieces. The charcoal was examined by Peter Murphy (details in Appendix II, microfiche), who found that the fragments from large wood are mainly of oak (*Quercus* sp) with some hazel (*Corylus* sp), hazel or alder (*Corylus/Alnus* sp), hawthorn-group (*Crataegus*-group), pine (*Pinus* sp), ash (*Fraxinus* sp), ?lime (*Tilia*-type) and indeterminate species, whilst twigs and small fragments of uncertain stem diameter include hazel or alder, oak, ash and *Prunus*-type (?sloe). The presence of both large wood and brushwood corresponds with the ethnographic and anth- ropological evidence for pyre construction, the main structure being of large logs in-filled with brushwood to aid initial ignition and open the pyre for the circulation of air.

The woodland within the immediate vicinity of the site probably lay on the boulder-clay soils to the north-west, where the present 'Great Wood' is thought to be a remnant of medieval or earlier woodland, though some of the species may have been growing in hedges (Rickett forthcoming). Unfortunately, no charcoal from the settlement was kept, therefore we do not know how representative the species from the cremations are of the woodland species. Some woods create more heat per kilogram than others and these efficient woods may have been preferred for cremations. Holck (1986) found that of Norwegian species birch, spruce, lime, oak, pine, ash and beech, in descending order, produced the greatest heat kcal/kg., but availability must have been a prime consideration to the Saxons irrespective of pyrotechnics. Elsewhere, the species found in cremations have included beech, poplar, willow, Scots pine and fir, with oak dominating (Wahl 1982). In present day India, sandalwood is the preferred species if it can be afforded, because of its perfume.

Occasionally, burnt flint and small fragments of fuel ash slag were found with the bone: the latter substance was recognised as early as 1713 by Peter Le Neve who mentions 'the sandy Earth vitrified with the strength of the Fire.' The occurrence of this additional pyre debris shows that these cremations at least were conducted on sandy soil and/or soil containing flints. Fuel ash slag is a general hearth slag which is formed when a fire is built over a highly silicaceous soil and is not to be confused in cremations with the elusive 'curious clinker' of Calvin Wells (1960; see Chapter 5:1). X-ray fluorescence analysis of fuel ash slag (including analyses conducted on some from the cremations at Spong Hill) shows it to have a very high silica content (over 60%) and a notable proportion of iron (also from the soil), with various other elements doubtless dictated by the trace elements in the soil and the type of hearth/fire (Evans and Tylecote 1967, Henderson *et al* 1987). The absence of Soda (Na_2O), which forms the alkali flux in glass making, distinguishes the slag from melted glass with which it may be confused. The writer has observed fuel ash slag in numerous cremations from different periods around Britain; it is found in particularly large quantities in cremations from the Northern Isles (McKinley forthcoming (k) and unpublished).

Various European workers have suggested that the presence of this slag results from sand being used to douse the fire after cremation. Other than at centres of professionally conducted cremations in India, there is no ethnographic or anthropological evidence for deliberately curtailing a cremation. Were dousing to occur, it would be unlikely to take place before the cremation process was largely complete, at which point the temperature of the presumably dying pyre may not be sufficiently high to melt the sand *i.e.* about 1000–1200°C, although a solid-state reaction may take place at 800–900° (Gerry McDonnell, pers. comm.) If sand were readily available for use in this way it is likely that the pyre would have been constructed on a sandy site, and the production of fuel ash slag would occur naturally during the cremation.

The geology of Spong Hill, together with large areas to the south and east, is sands and gravels, which could account for the presence of both burnt flint and fuel ash slag in cremations. The occurrence is however, too limited to postulate which cremations are likely to have been performed on the sands and gravels to the south and which on the boulder clays to the north (see Healy 1988, fig. 2).

Previous discussion has demonstrated that the entire cremated remains were rarely recovered from the pyre and inevitably some bone must have remained on the pyre site. If the site was used more than once and the previous cremation debris not completely cleared, then bone from a previous cremation may have been collected with those of a subsequent one. In Chapter 2:III it was shown how, in most instances at Spong Hill, when an intrusive bone was found it could be assigned to a neighbouring urn which had suffered disturbance. There were, however, nine single cremations (1055, 1165, 1191, 1409, 2135, 2633, 2667, 2694 and 2761) where an intrusive bone could not have got in through on-site disturbance or contamination. Intrusive bones of this kind have previously been considered to be 'token' deposits, but it is as likely that they were accidentally collected from a pyre site which was not efficiently cleared prior to re-use. Since the vast majority of the cremations do not contain intrusive bone, this may imply that either a different site was used on each occasion or that the pyre area was usually well cleared. At the Migration period cremation cemetery at Liebenau (Cosack, 1983) it would appear that individual pyre sites were used, the remains being buried in the centre of the pyre area. Despite heavy disturbance, pyre sites were found spread over a large area at Liebenau and provide a contrast to the situation at Spong Hill.

Position of body

There are a number of factors which may have an effect on the efficiency of the cremation process (Chapter 5). Calvin Wells (1960) argued that the frequent low level of burning seen in the vertebrae illustrated that the body was placed directly on the ground. Other workers (Wahl 1982, Holck 1986) have suggested such diverse positions as prone on top of the pyre, crouched, sitting, upright, even bound to a post or dissected (Baby 1954), the theories being based upon the size of pyre sites (European) and the degree of burning to different bones. Ethnography also presents variations in position: a Greek vase-painting of *c.*500BC illustrated in Holck (1986, 6) shows Croesus seated on top of the pyre; Robinson (Hiatt 1969) describes how the Australian Aborigines sometimes bound the corpse in a crouched position prior to placing it on the pyre; Indians and Tibetans appear to place the body supine and extended on top of the pyre; the writer knows of no references to the body being placed beneath the pyre or prone.

If the body were placed directly on the ground then virtually no oxidization could take place as no air would reach the back of the body, and it would be fairly rapidly buried under the build-up of wood-ash. There would also be hardly any need for the careful construction of a pyre (see above) which seems to be designed for maximum stability as a platform to support the corpse, and to keep the pyre open to allow air to circulate.

At Spong Hill, the bone is fairly well burnt, usually of a buff colour, and sometimes the brilliant white associated with full oxidation. Much of the spongy bone survives, entire vertebral bodies being particularly frequent. Some areas of the skeleton often show poorer oxidation (*i.e.* grey, blue, black or even brown colouration) particularly the bones of the lower leg and feet, dorsal vertebrae, and sometimes the proximal femur, innominates and the small bones of the hands. It was also noted occasionally that one side of the skeleton was considerably less well cremated than the other side: from the skull bones down to those of the foot. In at least two cremations, nos. 1045 and 2486, slight black 'sooting' was noted at the ligament insertions on some bones and a fragment of light black 'slag' was recovered. This form of 'slag' has been noted by the writer in other archaeological cremations (for example, Bronze Age cremations from Dorchester and a Romano-British cremation from Wiltshire, forthcoming (l) and (m)), and in visits to modern crematoria. It is apparently charred ligament/muscle tissue, *i.e.* incompletely oxidised (see McKinley forthcoming (j) and in prep.)

Poor burning of the lower leg is not particularly unexpected. Because these bones have little soft tissue covering them they tend not to cremate as fully as other parts of the skeleton (Chapter 5:I). Additionally, if the pyre were constructed slightly too small for the corpse (Chapter 5:III) then the feet and lower leg may protrude, and being on the periphery, they would be in the coolest area. If the pyre were un-tended they might remain poorly cremated. The outward movement of the arms which sometimes occurs (Chapter 5:I) may place the hands in a similar position at the edges of the pyre. Poor oxidation of the innominates and vertebral bodies is probably related to the spongy nature of these bones, with a greater infiltration of organic material. If time for cremation was restricted then the spongy bones would remain incompletely burnt. Poor cremation of the dorsal portions of the vertebrae however, does suggest reduced oxygen supply, as does the poor cremation of one half of the skeleton, implying coverage by debris at the pyre base. In the latter case it is conceivable that the body slipped to one side on the pyre as it collapsed and became partly buried in the wood ash. Uneven burning causing the collapse of part of the pyre and the loss of several bones from its environs was noted in the experimental cremation conducted by Piontek (1976). Overall poor oxidation in a cremation may illustrate some other constraining force to have been at work, for instance, damp wood producing insufficient heat or damp atmosphere having the same effect. Possibly one of the unaccountable events such as were noted at the crematorium may have occurred (Chapter 5:I).

Many of the cremations from Spong Hill contained glass and/or bronze grave-goods. Both materials were frequently found adhering to fragments of bone (or sometimes as stains), most commonly skull (especially the temporal region), the arm bones, bones of the hands and less frequently, the ribs. In most of these cremations the grave-goods represented are glass beads and bronze brooches, which must have remained in position long enough through the cremation to have fused to the bones on cooling. The bones to which these goods have fused are not unexpected, since the beads would be in strings around the neck/across the chest and the brooches placed at the shoulder with the hands, in at least some cases, folded across the chest (an example is the fusion of a metacarpal and cervical vertebra by glass in no. 1895). This implies that little movement of the body took place on the pyre. Had the body been prone or in some way upright, it is likely that the grave-goods would have fallen away from the corpse at a very early stage and been buried in the wood ash: they could not have fused to the expected bones.

The melting point of the various coloured glass beads from Spong Hill would be between 725–900°C (Michael Heyworth pers. comm.) and the bronze, which has *c.* 10% tin content, would melt (run) at about 1000°C (Catherine Mortimer pers. comm.). Melting could take place in either oxidizing or reducing conditions (*i.e.* with or without oxygen), if this could be ascertained it should be possible to tell if the melting took place on the pyre or in the pyre debris at the base.

The degree of burning noted in the bones and the melting of pyre goods suggests that at least some of the Spong Hill cadavers were placed supine and extended on the pyre. It also suggests that not much movement took place, other than a general subsidence as the pyre slowly burnt away, in which case the body would remain in approximately the same position in relation to the pyre structure. It would also suggest that little tending occurred.

Tending

Tending would involve stirring-up and movement of the pyre during the course of the cremation to lift bone out of the wood ash at the base and allow fresh circulation of oxygen, and returning pieces of bone, grave-goods or wood which had fallen away from the pyre. It appears to have been minimal at Spong Hill. The poor oxidation of some bones and adherence of glass and bronze grave-goods to them support this impression. The half-burnt state of some of the other grave-goods reinforces this idea; one triangular comb (complete) was part charred and the other part unburnt; one complete bronze brooch shows melting in one half and none in the other. This would suggest that the goods were originally on the body but fell to the edge of the pyre at some fairly early stage, perhaps partly buried in wood-ash, and were not returned to the pyre by tending.

A lack of pyre tending is attested in ethnographic sources. In neither the *Iliad* nor *Beowulf* is any mention made of the pyre being tended. In the accounts of nineteenth-century cremations in India and Australia (Dubois and Beauchamp 1943, Hiatt 1969), once the pyres were set alight no further movement of the structure took place until the ashes were gathered together sometime within the following one to three days. In Australia, Robinson tells how the remains were sometimes re-burnt if the first cremation was not too successful. In modern India a certain amount of tending does seem to take place, at least in the professionally conducted cremations, though it is unclear to what extent, or at what stage. So the probable lack of tending at Spong Hill is not an unusual feature.

Duration

The duration of the cremation is likely to have been until the pyre burnt itself out; Piontek (1976) found this to be about ten hours in his experiment which corresponds fairly well with the 'overnight' period given in ethnographic sources. In present-day India there is variation depending on whether the cremation is conducted by professionals in the cremation grounds or by the family. In the former, pressure of numbers dictates that the cremation may be curtailed prior to burning out by *en masse* deposition of the ashes into the river; in the latter, the pyre is usually left overnight. The adherence of the glass beads and bronze globules to bone in the Spong Hill cremations implies that the ashes were either left to cool or deliberately cooled prior to collection. There is a reference in Virgil's *Aeneid* (Vi. 228–230) to the deliberate cooling of Misenus's cremation pyre: 'When at last the cinders fell in and the flame sank to rest, they washed in wine the thirsty ashes of the remains.' It should be emphasised that it was only after the pyre had burnt itself out that this cooling took place. It may well be that a similar process was followed at Spong Hill, though not necessarily using wine.

Temperature

The temperature of the pyre would have varied during cremation and across the pyre area; the centre must have been considerably hotter than the edges. That the temperature was similar to that in modern crematoria is illustrated by the fact that the bone is cremated, the occasional presence of fuel ash slag and melted grave-goods, and what we know of the energy produced by quantities of burning wood (Holck 1986). The evidence may be summarized as follows:

a) A minimum of 400°C is needed to cremate the body.

b) The production of fuel ash slag is dependent on a temperature of 1000–1200°C to melt the silica/iron in the soil.

c) Melted glass and bronze grave-goods, some of which had reached a liquid state, show temperatures of 700–1000 °C were achieved.

d) Holck (1986) has shown that under ideal conditions 146kg of wood will produce the same amount of heat as is used to cremate a body in a modern electric cremator (in Scandinavia) and two to four times that quantity of wood is used in modern pyre cremations in India.

Therefore, a minimum temperature of 400°C and a possible maximum of 1200°C was probably attained by the pyres at Spong Hill.

Fragmentation

It has long been believed that there was deliberate fragmentation of the bone after cremation prior to burial of the remains. The writer does not feel that such a procedure is indicated by the condition of any of the cremations examined personally and certainly not in those at Spong Hill. Most of the bone from the Spong Hill cremations was greater than 10mm in size. Over 50% of the bone remained in the largest sieve (10mm) or was equally divided between the 5 and 10mm sieves (see Chapter 2:II). The largest size fragment was 120mm (long bone) with an average maximum fragment size of 42mm (this includes the maximum fragment sizes from infant and juvenile cremations which lowers the average). This amount of breakage could be achieved during cremation, collection of bone for burial, and post-deposition disturbance including excavation (see McKinley forthcoming (b)).

The maximum fragment size noted at modern crematoria was *c.*250mm, a figure much reduced by varying the amount of raking/movement of the remains by different operators after completion of the cremation and in the ash residue compartment. Bone fissures and breaks during the cremation process as it dehydrates (Chapter 5:I) and any additional movement of the hot brittle bone as the pyre collapsed would fragment it further. If the bones were collected (see below) individually by hand, further breakage would follow as the collector(s) moved across the pyre site or if they raked the pyre debris to expose bones hidden in the wood ash. If the cooling process was hastened by pouring water over the ashes, or dropping them in water, then the bone may split along the heat fractures.

Recent work by the writer on undisturbed Anglo-Saxon (forthcoming (c)) and Romano-British cremations (forthcoming (f) and (m)), demonstrates that fragment sizes noted in cremation reports represent the size of fragments at the time of excavation, not necessarily the size of deposited fragments. The cremation from Purton (McKinley forthcoming (m)) had become waterlogged at some unknown point during burial. The bone fragments, being neither dry, nor brittle, and very well protected from disturbance, had retained what was probably their original size at time of deposition. 99.1% of the bone was identifiable with the majority of fragments being in excess of 30.0mm and a maximum fragment size of 140.0mm. With urns excavated by the writer from Sancton (forthcoming (c)) and Baldock (forthcoming (f)), despite great care, the dry, brittle bone fragmented along dehydration fissures during removal from the urns. Where a site has been plough damaged or otherwise disturbed, the fragmentation of the bone will be further increased.

Collection

The Spong Hill cremations, like the majority of archaeological cremations, are clean, that is with no charcoal staining, and include very little other pyre debris; there has obviously been a deliberate collection of bone and grave-goods and possibly deliberate cleaning. All the cremations, except for the very young infants (see Chapters 2 and 5) and a few of the disturbed cremations, contain fragments from all four skeletal areas (Table 7, microfiche). There is no indication of a deliberate bias in the skeletal areas collected other than may be explained by either the ease of identifying fragments of the skull increasing the percentage of identifiable fragments in this area; the loss of spongy bone as dust from exceptional dehydration or from osteoporosis (see Chapter 7) giving a low percentage in the axial areas; or a low percentage in the limb categories because of the difficulty in identifying certain fragments of long bone. A selection of bone from all skeletal areas was collected, often including the very small bones of the hands and feet, on occasions the hyoid bone (Fig. 10) and even, in one case, a fragment of gall stone (no. 1259).

Piontek (1976) claims that the collection of even the smallest remains from the pyre debris in his experiment was not difficult, but does not give the weight or percentage of remains collected or the time taken. The mode of collection is not always specified in ethnographic sources. The *Aeneid* merely tells us that 'Corynaeus collected the bones.' *Beowulf* states that 'What remained from the fire they cast a wall around'; a similar method was followed by some of the Aboriginal Australians (Hiatt 1969) who scraped the remains together and covered them with grass, sticks or earth. Sometimes the Aborigines scraped the remains into a pit 'sixteen or eighteen inches in diameter, and eight or ten inches in depth' (Hiatt 1969). In 19th-century India, following a royal cremation (Dubois and Beauchamp 1943)

> when the fire was completely extinguished [after two days], they removed from amidst the ashes the remnants of the bones that had not been entirely consumed, ...to throw them into the sacred waters of the Ganges...Amidst the ashes, too, were picked up small pieces of melted gold, the remains of the ornaments worn.

The mode of collection followed for the less exalted was similar. It should be noted that in each case the cremation was left (overnight) to cool naturally.

It would seem reasonable that the bones from the Spong Hill cremation pyres were gathered in a similar way, each bone being recovered individually as the collector(s) moved across the pyre, possibly raking the ashes as they went to expose the bones. Picking out even the smallest fragments of bone and grave-goods from the ash of about a ton of wood cannot have been a rapid job to perform, and restriction of time (and possibly inclination) may explain the wide range of weights of bone recovered from different cremations. A range of 117.2–3105.1g of bone was recovered from the undisturbed urns of single adults at Spong Hill, some of which contained varying amounts of animal bone as well as human. Such a variation in weight can only be the result of different quantities having been collected, for whatever reason. There is no correlation between quantity of bone and age or sex of the adults. It may simply have been that bad weather discouraged fuller recovery of the remains, or that the status of the individual was somehow reflected in the effort expended on their cremation, including the collection of the bones.

The urns used for adult cremations vary only slightly in size and would have held the vast majority of the cremated bones had they been collected; however, Figures 20–27 show that the urns were rarely used to full capacity and the bone varied in density within the vessels.

Recent examination of the waterlogged cremation from Purton (see above, McKinley forthcoming (m) and in prep.), may indicate another reason why the urns contain such varying quantities of bone. The bone from this cremation is largely blue-black in colour indicating incomplete oxidation and the urn contained several large fragments of soft tissue 'slag', up to 90.0mm long and 40.0mm deep. Under normal burial conditions, this light, brittle black 'slag' may have been lost. On the rare occasions the writer has noted its presence in other cremations, the fragments have been very small. It was also noted at the crematorium that other incompletely oxidized soft tissue may also remain at the end of the cremation (Chapter 5:I). If such charred soft-tissue, or any other organic remains were originally included in an urn, they may decompose during burial leaving gaps in the fill. This may particularly explain gaps lower down in the urn fills, *e.g.* cremation 1395 (Fig. 24), although most of the bone, except for the patella, which was blue, seems to have been fairly well oxidized. An urn which may now appear to have been only partially filled, may have originally been used to capacity.

Unfortunately, the evidence of the Purton cremation came too late for the correlation (if any) between efficiency of cremation (colour of bone) and weight of bone/capacity of urn used, to be analysed for the undisturbed cremations at Spong Hill, but it may be a worthwhile future exercise.

What was done with the 'excess' bone from the pyre not included in the burial remains unknown. There are no pyre sites to examine to see if it was merely left there, although intrusive bone in some of the cremations could imply that was the case (see above). At Liebenau (Cosack 1983), bones were recovered from the cremation pyres and were occasionally found to join with those in the associated urn, though it is not clear what percentage of the cremation was recovered from each. In the 19th century, Robinson (Hiatt 1969) notes one instance in which quantities of remains were collected into separate skin bags and given as amulets, and it may be that 'tokens' were distributed in this way at Spong Hill.

It is possible that the fuel ash slag occasionally found in cremations may have been collected in mistake for melted glass beads but there is no plausible reason why charcoal and/or burnt flints should have been included in the deposits: all three materials were probably collected by accident. It is odd that careful collectors, able to recover even the tiny foot bones from a pyre should mistake these materials for bone or grave-goods. It is possible that alternative methods of recovery were sometimes used.

There are various references to bones being sprinkled with wine (*Aeneid*) or thrown into water tanks (India: Dubois and Beauchamp, 1943). The use of wine or water in these instances was intended to cool and cleanse not to douse the fire; the latter process has been suggested by several European workers (Wahl, 1982) who believe pyres were sometimes deliberately extinguished using water, wine, milk or sand. This additional 'purification', as it was seen, may have been linked with the collection of the bone from the pyre if there was to be, for instance, *en masse* deposition of pyre remains into water. In this way the heavier bone, flint, grave-goods *etc.* would sink leaving the majority of the light wood-ash floating on the surface where it could be somehow skimmed off. The required remains would thereby be separated out, cleaned and cooled, and easier to collect. A similar collection, cleaning and cooling method using winnowing rather than water may also have been used. Such suggestions, however, are difficult to prove. Experiments on the ease of collection of different bones and fragmentation using the different methods would provide interesting information and is one area of research the writer hopes to pursue in the future.

Deposition

There is nothing to suggest that collection of the bone and its deposition in the urn was done in any specific anatomical order. Several European authors claim to have observed bones in the urns in anatomical order, implying that collection commenced at the feet and worked up to the skull, assuming that the body had been extended on the pyre (Wahl 1982). More frequently, however, a random arrangement of bones within the urn is found.

The contents of a number of the urns from Spong Hill were emptied in 20mm spits during post-excavation (not by the writer), the bones from each layer being bagged separately. The writer examined a sample of these from the undisturbed urns (see Details of Cremation Identifications, archive). Figs 20–27 illustrate a selection of these 'layered' urns showing the density and position of human and animal bone, and the position of any grave-goods or stones within the urn fills. Each layer is annotated to show the area of the skeleton within that layer (skull, axial, upper or lower limb), the distribution of different individuals where there is more than one in a cremation, and the distribution of animal species. As the urns were excavated before the osteological investigations commenced only vertical distribution could be seen. A mixture of different skeletal areas is apparent throughout the depth of each urn.

A very small number of the undisturbed cremations had deposits of bone in the urn pit. This was usually animal bone from the cremation, rather than human. In most of these cases it would appear, looking at the bone density and distribution within the urn, that the whole bone collection would have fitted inside, there was generally some animal bone in the urn already. This may serve to support the suggestion that the fill sometimes included incompletely oxidized soft tissue or other organic remains (see above). It also shows that, at least occasionally, bone was carried to its place of burial in the cemetery in some other way than in the urn.

II. Ritual

(Figs 20–28, Plates VII–XVI)

There is nothing to suggest that the cadavers were 'treated' in any way prior to cremation; the bodies were whole and articulated. Inhumation burials have shown that 'women went to the grave in the 5th–6th centuries in undergarments, gown, cloak, shoes and headgear, and ... may have been wrapped in a shroud'; the males, it would seem, were possibly 'buried naked, except for a substantial leather belt' (Samson 1988 review of Owen-Crocker). There is no evidence of what garments were worn by those to be cremated at Spong Hill but the grave-goods found with an individual may give some indication.

Grave-goods

Grave-goods, or more correctly, pyre- and grave-goods, were recovered from 67% of the cremations at Spong Hill. This compares with 64.9% from Elsham (Richards 1987), 60.0% from Sancton (McKinley forthcoming (c)), 59.9% from Newark, 46.3% from Caistor, 37.8% from Loveden Hill, 34.0% from Illington, 31.2% from Mucking, 22.0% from South Elkington and 21.3% from Lackford (Richards 1987). It should be noted that Richards published his findings before the writer had commenced work on Spong Hill or Sancton, hence the figures of 63.7% and 56.0% he quotes for those sites are now incorrect. At Spong Hill, although each cremation was checked at least twice for grave-goods in post-excavation and many fragments recovered, many others were missed. Small fragments of worked antler and bone are particularly difficult to pick out amongst a mass of cremated bone and were often overlooked by the non-specialist (see McKinley forthcoming (h)).

201 new grave-goods were recovered during the osteological examination, and fragments from 329 existing grave-goods, often quite large quantities, were also found (this situation was repeated in examination of the Sancton cremations, where ivory particularly had been overlooked in the earlier excavations). As two of the catalogues of urns and grave-goods had already been published before the writer commenced work on the

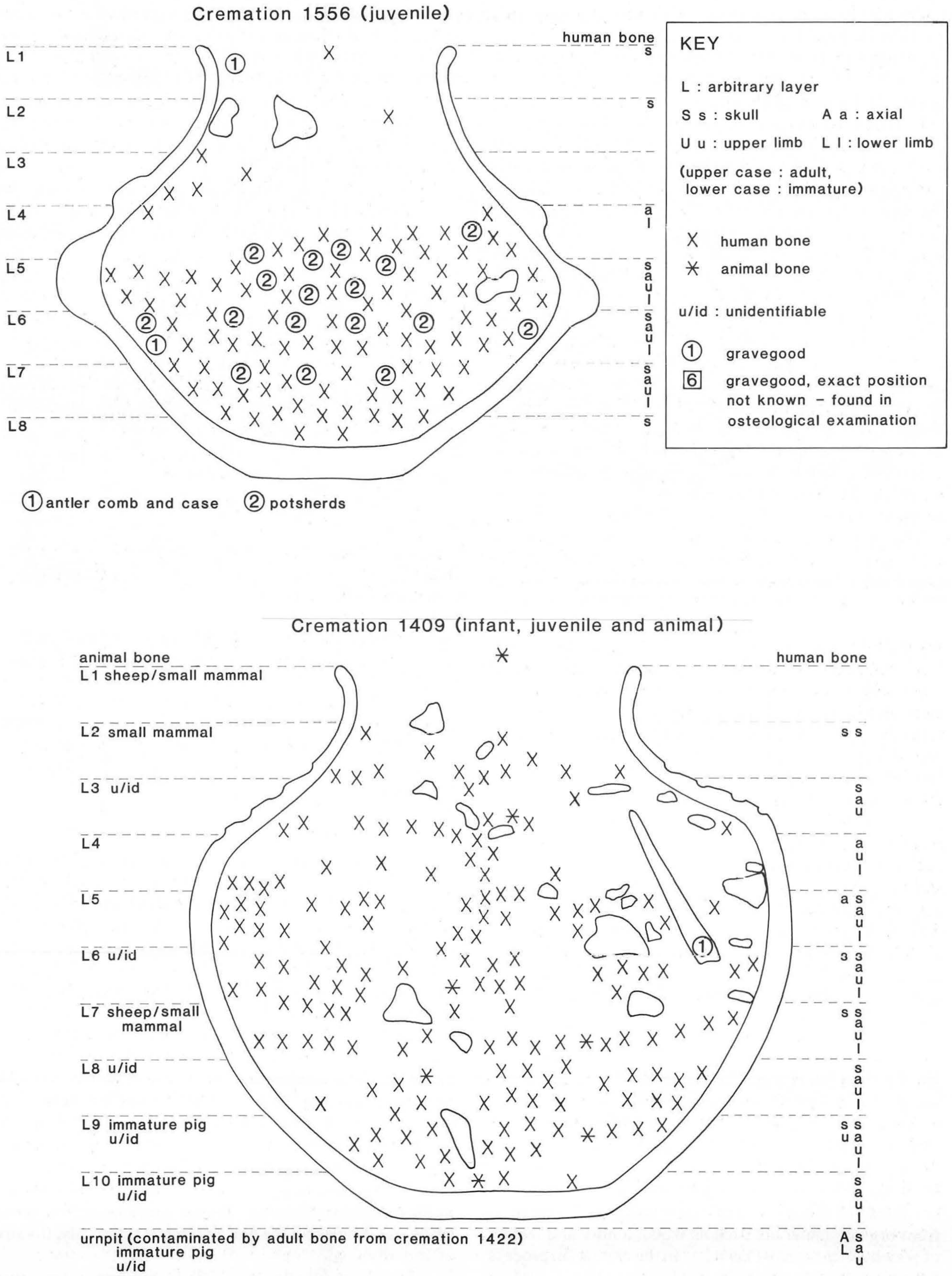


Figure 20 Annotated diagram of cross-sections through a) urn 1556 and b) urn 1409 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

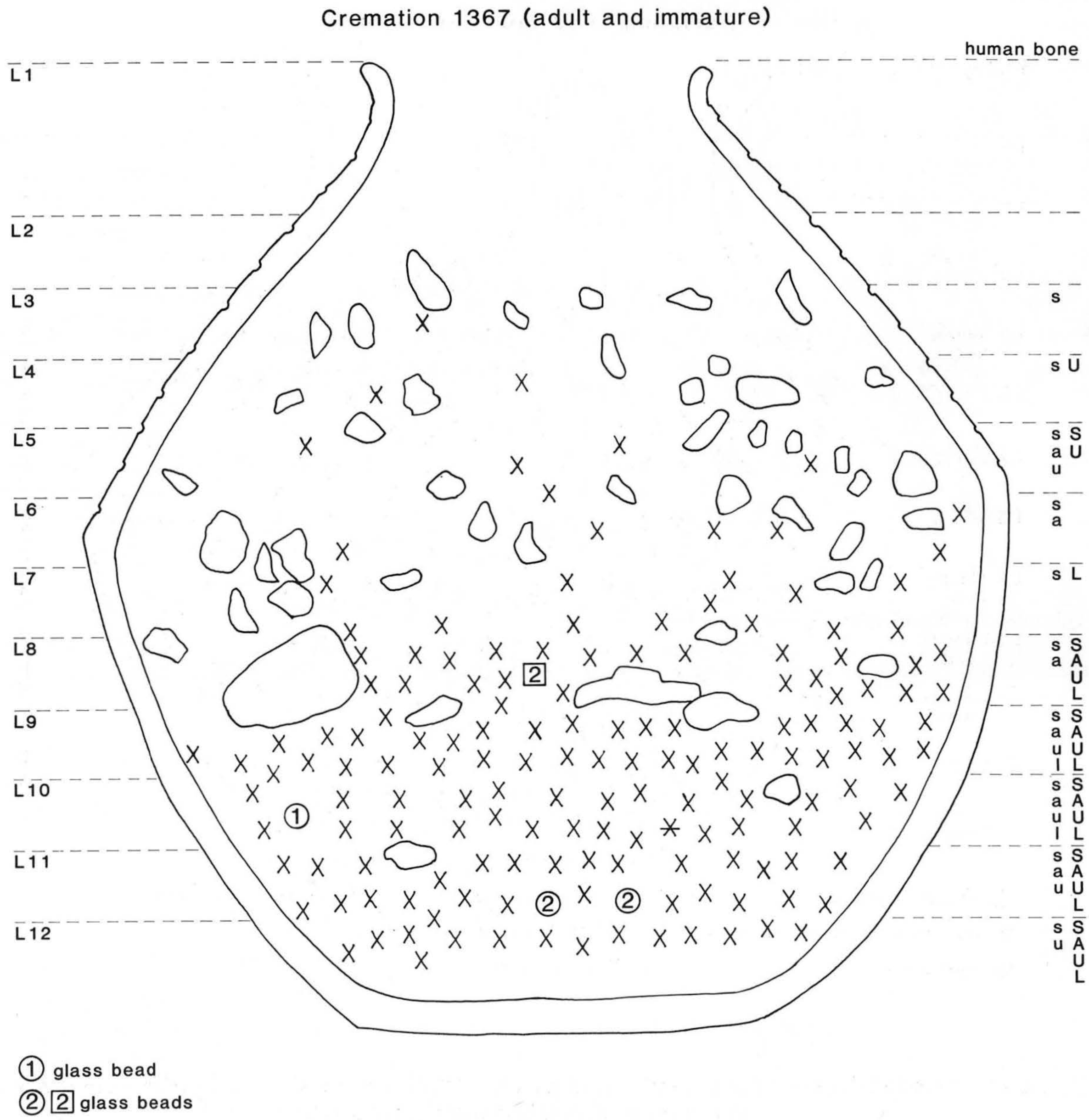


Figure 21 Annotated diagram of cross-section through urn 1367 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

project (Hills 1977 and Hills and Penn, 1981), these finds entailed substantial re-drawing of grave-goods and publication of addenda (in microfiche, Hills *et al* forthcoming).

It is inevitable that not all grave-goods were recovered from the pyre in the same way that not all of the bone was collected. This does not refer only to those objects made from organic materials such as wood, amber and leather, of which all traces have been lost in the cremation process. The percentages of grave-goods per cremation given above can only, therefore, represent a minimum number. At Liebenau, Cosack (1983) argues for 100% of the cremations being provided with grave-goods, but that the vast majority were left on the pyre rather than being collected for deposition in the urn. No percentages are given, just a few examples, which do show the presence of far more goods on the pyre site than in the urn. At another Migration Period cemetery (Cosack 1983) it is claimed that melted metal grave-goods were collected from the pyre for re-use as raw material.

Catherine Hills (pers. comm. 1990) has carried out a preliminary investigation of the relationship between grave-good type and the age, and more especially, the sex of an individual.

85% of the females and 70% of the males identified had grave-goods. Some of these could not be used in the analysis as they were in multiple cremations, which could cause confusion. Of the major grave-good types, none was found to be completely exclusive to one sex (C. Hills, pers. comm.). Several types were found only in graves of one

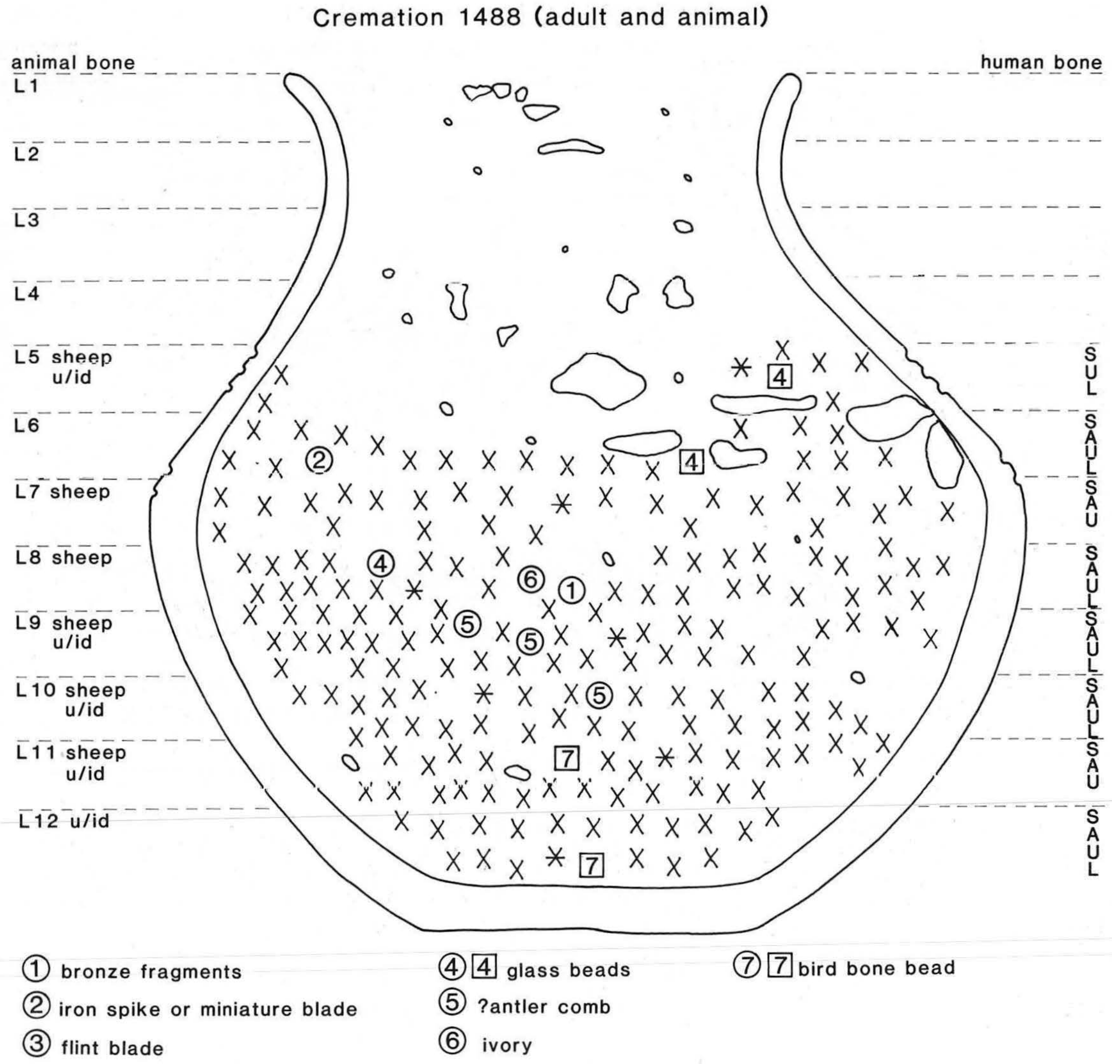


Figure 22 Annotated diagram of cross-section through urn 1488 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

or other sex, but the numbers in these cases were very low, therefore the results have to be treated with caution. Some types were found more often with one sex than the other.

1) Most brooches and all collections of more than ten beads were with females.
2) All five of the earscoops from sexed graves were with males.
3) More female than male: bronze fragments — brooches/necklace loops, *etc.*; spindle whorls; ivory; crystal; bronze rings; antler rings.
4) More male than female: iron tweezers, shears, bar/nail/rivets; bronze tweezers; razor/knife/blades; antler/bone beads and worked antler/bone objects.
5) There is very little difference in the distribution of bronze sheet — ?bowls and buckets; glass vessels; worked flint; playing pieces; re-burnt pot sherds; combs of all types; iron rings and fragments.

Hills found that 33% of *all* the female cremations have two or more diagnostic grave-good types (40% of those with grave-goods); 6% of all the female cremations have two or more male type grave-goods (7.3% of those with grave-goods). 16% of *all* male cremations have two or more diagnostic grave-good types (23% of those with grave-goods); 8% of all the male cremations have two or more female grave-good types (12% of those with grave-goods).

Generally, the diagnostic 'female' grave-goods are much better defined and reflect what has been found in contemporary inhumation cemeteries. Diagnostic 'male' grave-goods are elusive; cremations do not show the same characteristics as the inhumations of the time. Male inhumations are characterised by weapons: spears, shields, swords, but not so the cremations; there is no indication of the presence of full sized spears or shields. Of the eight fragments of sword fittings found (some in Table 2 as bronze fragments only) in the cremations which can be sexed, two are female and one male. This may simply be a matter of practicality, in that it would be difficult to include even the cremated remains of such weaponry in a cinerary urn. Cremations also differ from inhumations in the occurrence of miniatures (shears, tweezers, razors), which are most often found with males.

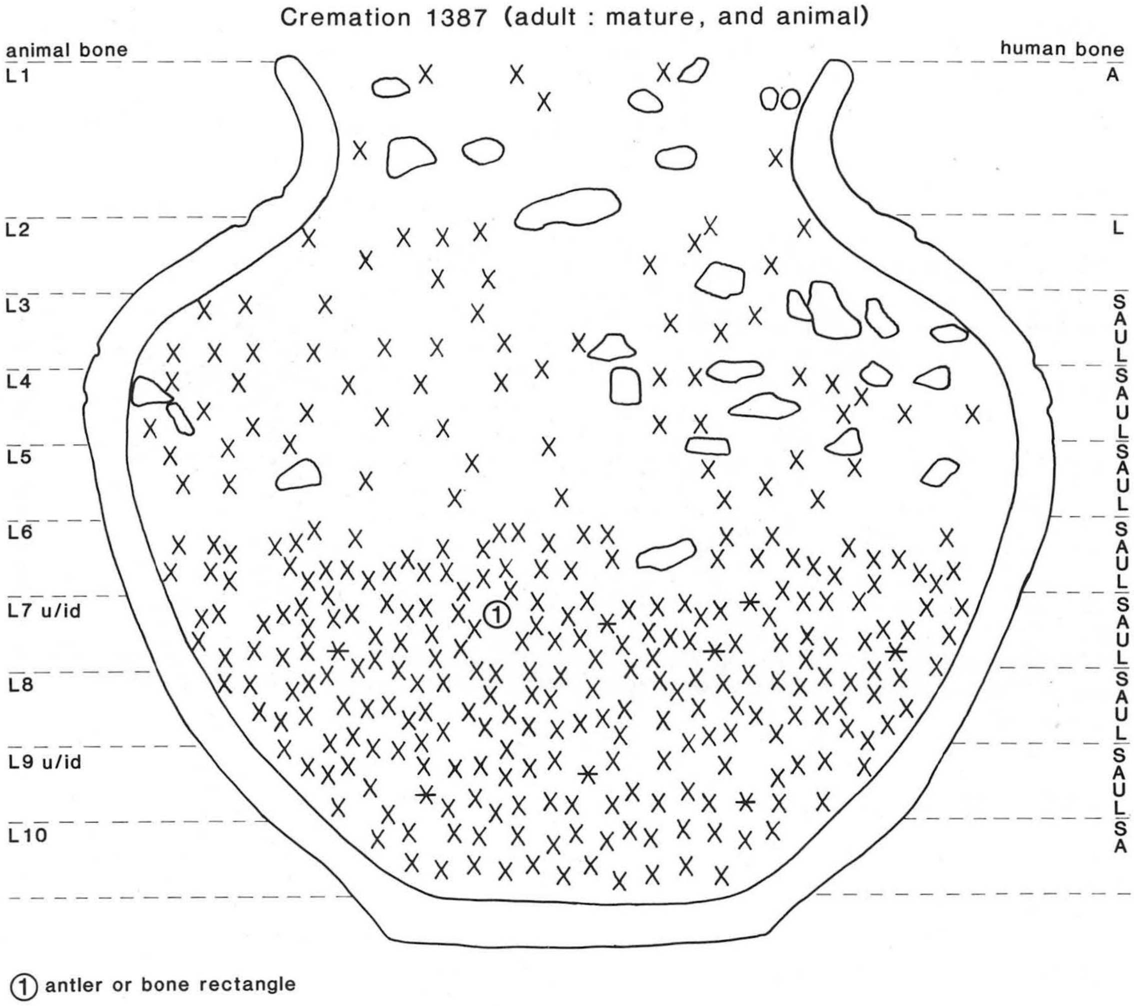


Figure 23 Annotated diagram of cross-section through urn 1387 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

Hills has also looked at the infant cremations, of which, discounting the duals, 53% had grave-goods. Infants appear to be fairly close to females in the range of grave-goods found with them, except for sets of miniatures including the only three miniature spearheads?/?arrows from the cemetery.

An overlap in distribution between the sexes of those grave-goods predominantly characteristic of one sex or the other demonstrates that the rules are not as hard and fast as was once believed; at one time the presence of grave-goods characteristic of both females and males in the same cremation would have automatically led to the conclusion that two individuals of different sex were represented. There may be a variety of reasons for the overlap: an undetected young infant of the opposite sex may have been cremated with the adult (the genuine dual cremation of adults is unlikely to be overlooked); one or more of the grave-goods may have been accidentally included in the cremation in the same way that intrusive bone (Chapter 2:III) is sometimes included; gifts may have been placed on the pyre by relatives and friends; or the situation may not have been so simply based on sex alone as we are prone to assume. 'Dr. Ellen Pader has noted artefacts closely associated with females occurring in the graves of young males...the possibility of transvestism is side-stepped by the [as usual] warning that graves may have been mis-sexed' (Samson 1988). The excuse of failings in osteological procedure cannot always be used (Henderson 1989). Further detailed analysis of the Spong Hill material by Catherine Hills and a generally more open outlook by other workers, may show the situation in a more realistic light.

The vast majority of the grave-goods from the Spong Hill cremations had been burnt to some extent. This may vary from very minor melting/warping of glass and bronze, and slight scorching of antler and bone, to total liquidation of the former substances and mineralisation of the latter. The extent of burning of grave-goods has not really commanded the attention it deserves both at Spong Hill and in other cemetery studies. The degree of burning may tell us much about the position of individual grave-goods on a pyre and correspondingly about the pyre technology (see above). To assume automatically that the lack of any apparent burning of an object illustrates that it was not on the pyre shows a lack of understanding of pyre cremation.

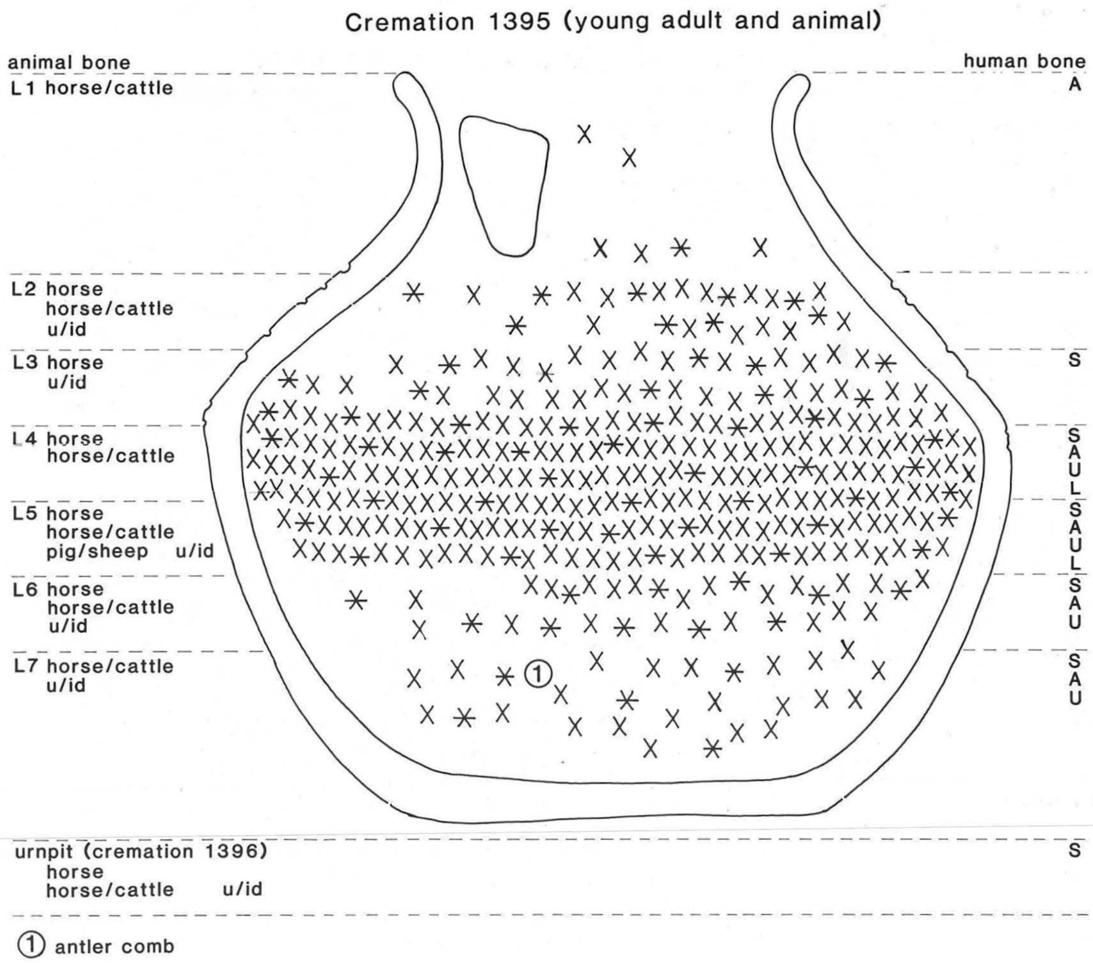


Figure 24 Annotated diagram of cross-section through urn 1395 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

The antler, bone and ivory grave-goods from Spong Hill were looked at in detail (Hills pers. comm.); all were burnt except for one antler ring (3.4%), one spindle whorl (1.4%) and seventy-nine combs (24.0%). Of the unburnt combs most were triangular, though not exclusively. Of the bronze grave-goods, almost all the brooches showed some burning, but many of the toilet sets appear unaffected. Individual glass beads from a large number in one cremation may vary considerably in the amount of melting seen. The ironwork was difficult to assess because microscopic examination is needed to ascertain whether it has been subject to heating or not. Metallurgical analysis of the iron artifacts from the cremations at the Loveden Hill cemetery (McDonnell 1989) demonstrated that the iron had been annealed and showed needle structures, suggesting the objects may have been on the pyre. It would be useful to examine some of the ironwork from Spong Hill and other cremation cemeteries to confirm the significance of these results from Loveden Hill.

Ivory bag rings were presumably attached to the waist; the bags probably contained spindle whorls, playing pieces, perhaps combs *etc.* and would, therefore, be unlikely to escape the pyre; they are, in fact, always burnt. Necklaces of glass beads with bronze brooch fasteners are also usually burnt, being in a position where they could not easily slip off the pyre. Some of the combs however, may have been used as hair ornaments, in which case they may soon have fallen off the pyre as the hair rapidly burnt away. Lack of apparent burning does not necessarily reflect the absence of a particular grave-good from the pyre; even in a modern crematorium personal ornaments (*e.g.* a wedding ring) have been recovered largely unblemished from a cremation having dropped off early in the process to a cooler part of the cremator.

The presence of other less tangible grave-goods, particularly foodstuffs, is suggested by the occasional fragments of re-burnt Saxon pot sherd recovered from cremations and the very rare recovery of charred nutshells and cereal grains. A minimum of ninety-three cremations contained fragments of re-fired Saxon pottery (with a smaller number containing fragments of glass vessels); this suggests that vessels containing some kind of food or drink offering were placed on the pyre. Cereal grains were recovered from nine of the urns (identifications by Peter Murphy, see Appendix II) and include five grains of hulled barley (*Hordeum* sp), one wheat grain (*Triticum* sp), one oat grain (*Avena* sp) and two indeterminate grains. Nutshell fragments equivalent to approximately two hazel nuts (*Corylus avellana*) came from cremation 2535. These remains may represent food offerings or their inclusion twenty-two playing pieces and an antler handle; the fragments of glass vessel and antler handle match those in urn 1915 and fragments of playing pieces from the two urns join together. It is interesting to note that so many of the grave-goods were put in the animal accessory vessel.

2) Two similarly small size vessels, nos 2667 and 2668, were together in a pit. Both were largely undisturbed and touching. The former contained 379.1g of bone, the latter 132.5g. No. 2667 mostly contained the remains of a young juvenile, together with a few fragments of sheep and horse/cattle size bone, and fragments from all skeletal areas of a dog (see Appendix I). No. 2668 contained a few fragments of vault from a young juvenile, the rest of the bone being fragments from all skeletal areas of a dog. There is no duplication between the dog bones from the two vessels and the size corresponds, this undoubtedly being the same animal.

3) In two apparently separate but adjoining pits were the largely undisturbed urns 3062 and 3072, both containing fragments of an older subadult. The majority of the 1559.2g of bone in no. 3062 is of horse, cattle, sheep and unidentified animal bone, and much of the 1345.1g of bone in no. 3072 is of horse, sheep, horse/cattle size and unidentified animal bone, but the latter contains more of the subadult bone than the former with no duplication of the bones. As with nos 1911/15, fragments of playing pieces recovered from both urns were found to join.

Animal accessory vessels are not unique to Spong Hill, though they may not have been recognised as such elsewhere. At Baston (Manchester 1976), at least two cremations were of animal bone only, a further four being mostly animal. At Sancton there were three, possibly five (McKinley forthcoming (c)), cremations consisting of animal bone only and several others containing mostly animal bone. At least some of these are probably animal accessory vessels (animal species analysis is presently ongoing for Sancton). The observation made by Wilkinson (unpublished) that some of the cremations from Loveden Hill contained much more animal bone than human may also indicate the presence of animal accessories. Harman (1989) noted at Newark that some horse cremations were given separate burials but placed beside an urn containing a human cremation. Occasionally a few fragments of human bone were present in the horse burials. These too would seem to suggest animal accessory vessels similar to those at Spong Hill. In Europe, cremations consisting mostly or wholly of animal bone have also been found (Wahl 1982).

The assemblage of species in the cremations does not reflect the order found in the adjacent settlement (Bond, forthcoming) where, from the contemporary Saxon sunken-featured buildings and pits, the animal species consist almost entirely of the usual domestic animals. Cattle are most numerous followed by sheep, with horse and pig occurring in roughly equal numbers. The range of species in the cremations and the parts of the animals represented are not a reflection of the normal Saxon economy (Bond this volume).

With only one exception, that of no. 1725 where two dogs of different sizes were found, there is not more than one animal of a species in each cremation (including animal accessories). The skeletal elements, condition of the animal, and apparent pre-cremation treatment of the carcasses reflects the ritual significance of each species (see Appendix I for details).

a) Horse: the animals are usually young adults/adults and the elements present indicate that the whole animal was placed on the pyre, no butchery having taken place. These points differentiate horses in the cremations from those few recovered from the settlement where there was evidence that they had been butchered for meat (Bond forthcoming).

b) Cattle: the majority were young animals of less than 3.5 years, with a few calves *e.g.* no. 1926. There was evidence for dismemberment but all parts of the animal had been placed on the pyre, not just joints of meat.

c) Sheep: there was a greater range of ages than with the other species including two lambs and a ten year old sheep, but the majority were between 1–3.5 years. The greatest amount of butchery was noted in the sheep bones, especially in the ribs. Either joints of meat, or whole but dismembered animals were being placed on the pyres (Plate VIII).

d) Pigs: most are young animals, 16% less than one year old and five 'suckling pigs'. The animals appear to have been dismembered and all parts placed on the pyres, although the 'suckling pigs' were whole.

e) Dogs: these were usually mature animals (except for one of the no. 1752 dogs) and had been placed on the pyres whole (Plate IX).

f) Bear: these were represented by one or more third phalanges only, which must have been either amulets (though none were pierced for suspension) or may indicate the presence of a bearskin (Plates VII and X).

g) Other domestic animals include fowl and goose which were probably eaten; other wild animals include fox (Plate XI), beaver, hare, fish and bird, some of which were probably used for meat, some (such as the two pierced raptor claws, Plate XII) as amulets and others are debatable.

At Newark and Elsham (Harman 1989) most of the sheep and pigs were represented by isolated bones or as joints of meat, with a few whole piglets; some of the horses were also whole animals. In Europe, in most cases, only part of an animal was interred with the deceased (Wahl, 1982), and the animal bones are most often from immature animals not adult ones, implying that they were used for meat. Bear claws are not infrequently found in cremations in Europe where it is considered that bear furs were wrapped around the corpse on the pyre; the Lapps used to use bear furs, amongst other materials, as shrouds (Gräslund 1980). The use of bear furs as a wrap for the corpse prior to cremation has been questioned by Holck (1986), who correctly points out that a bearskin, being so thick, would cut off the oxygen supply and thereby, the cremation process. There would seem no reason however, why such a fur should not be placed somewhere on the pyre, either draped or folded.

The custom of horse burials was common in much of Europe from the Iron Age onwards. Between the fifth and eleventh centuries, burials of whole or, less commonly, of parts of horses were concentrated in central Germany, most markedly in North-West Germany and the Netherlands settled by the Frisians and Saxons (Gräslund 1980), and mostly found in association with males. Horses were found in twenty chamber-graves at Birka (8th–9th century) and similar sites in Sweden (Gräslund 1980), most often though not exclusively, with males. In the seventh century, according to Bede a good horse was regarded as a status symbol amongst the Angles. Todd

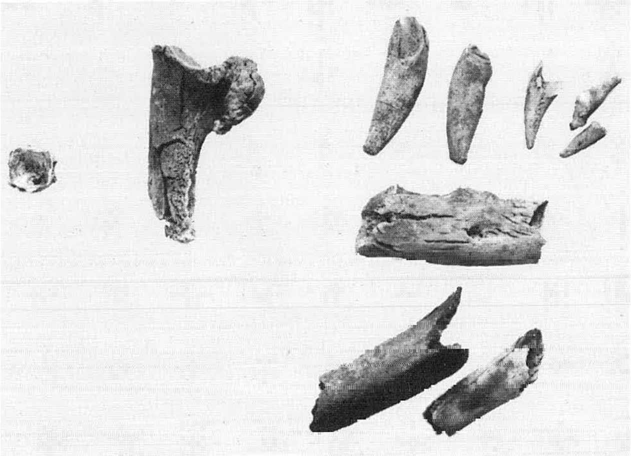


Plate VII No.2890. Fragments of (left to right) fish vertebra, bear claw, fox/dog teeth and mandible.

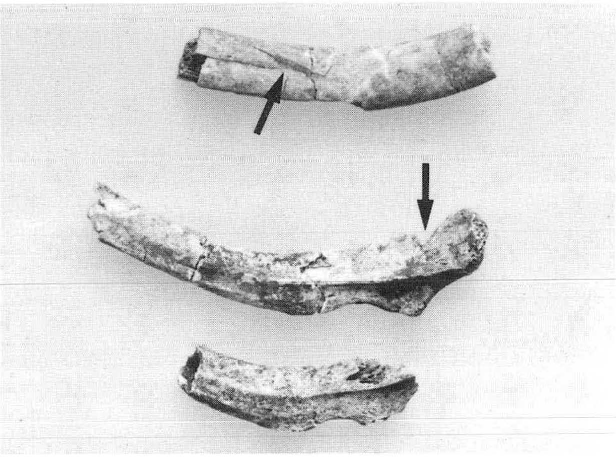


Plate VIII No.3140. Butchered sheep ribs.

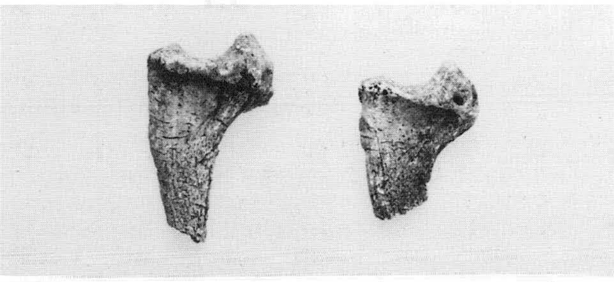


Plate X No.2610. Pair of bear claws.

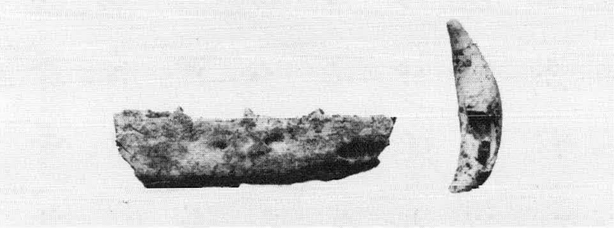


Plate XI No.1475. Fragment of fox mandible and canine.

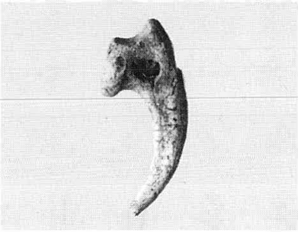


Plate XII Pierced raptor claw from no.2817.

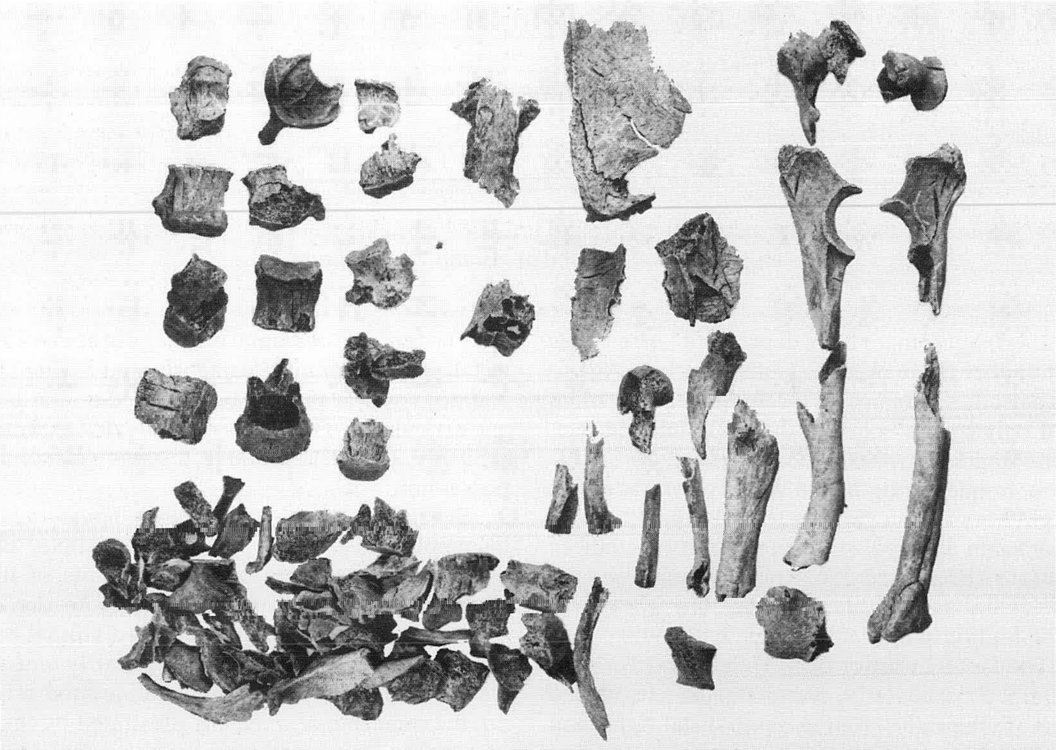


Plate IX No.43. Dog. Fragments of (left to right) vertebrae, skull and long bones. Reproduced at 85% actual size.

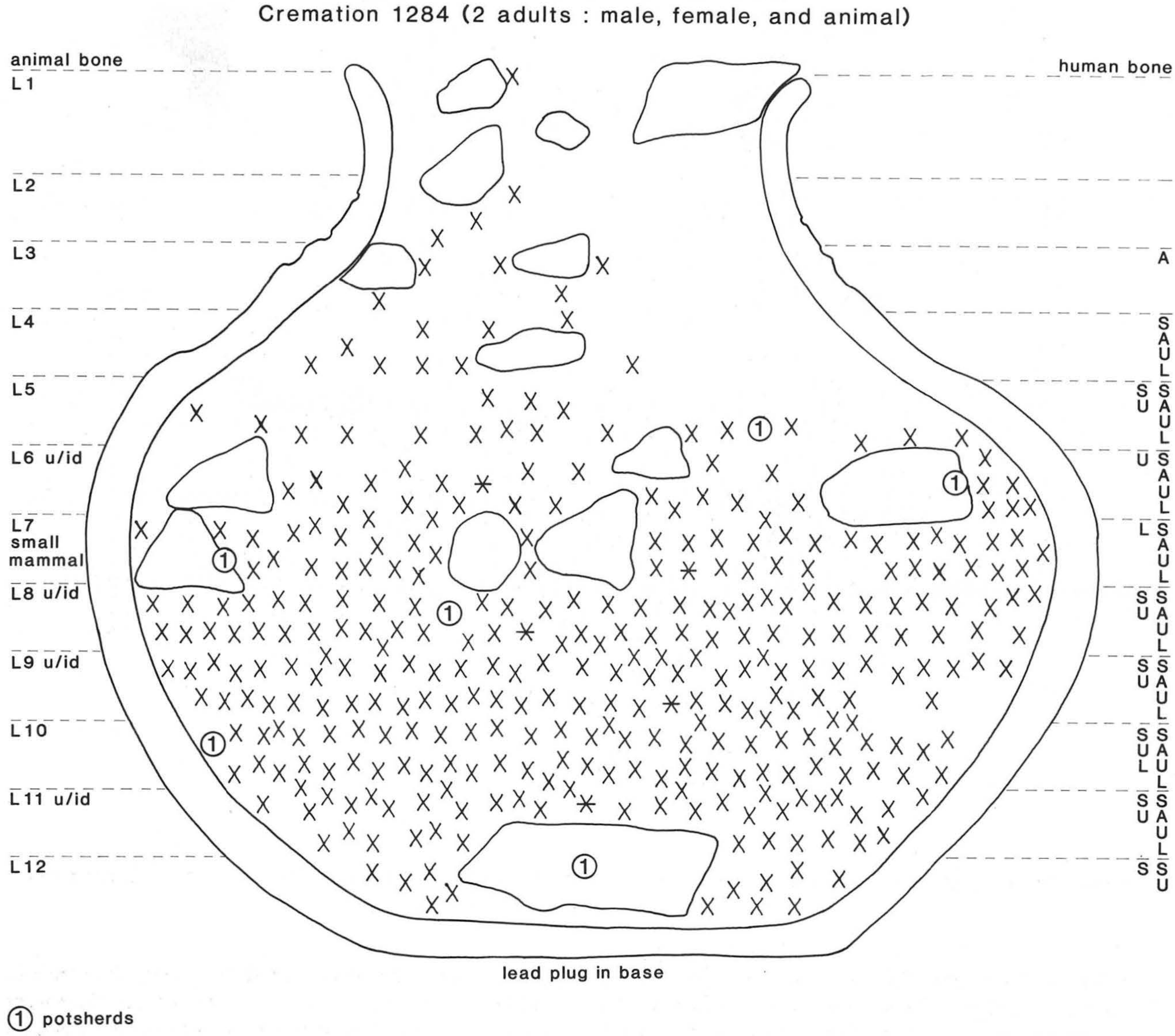


Figure 25 Annotated diagram of cross-section through urn 1284 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

(1975 and 1980) notes that votive deposits of horse bones greatly outnumber those of other animals in Iron Age to Migration-period Germany. The animal was often represented only by the bones of the skull, tail and feet, that is by the fragments discarded in butchery.

Dogs too, frequently figured in votive offerings at this time, though there is no evidence for them having been butchered or eaten. Ibn Fadlan's contemporary account of Rus cremations (Brøndsted 1965 trans.) emphasises the importance of animals as grave-goods. The horse was prized most highly, with cattle, dogs and poultry also esteemed. The Vendel warrior from Vallentuna (Sjosvard *et al* 1983, fig. 5 particularly) was cremated surrounded by his horse (to the right), four dogs (to distal right) and no less than twelve raptors (placed between himself and his horse at his feet), together with several joints of meat from sheep, cattle and pigs (placed beside his head).

The function of animal offerings in cremations appears to fall into one of three categories. At Spong Hill, horses and dogs appear to have been placed on the pyres whole and articulated. They were not intended as food but were probably, as indicated above, a status symbol or personal possession.

Sheep, cattle and pig however, showing dismemberment with either the whole carcass or sometimes, in the case of sheep, joints of meat, were probably intended as food offerings to the dead. The inclusion of the entire dismembered animal on the pyre rather than just joints seems to be a fairly unusual feature (see above). That these were genuine food offerings and not the remnants of a feast is illustrated by the total lack of any fine knife marks on the bone indicative of meat being cut from the joint. The degree of oxidation of the animal bone would be misleading if used to indicate

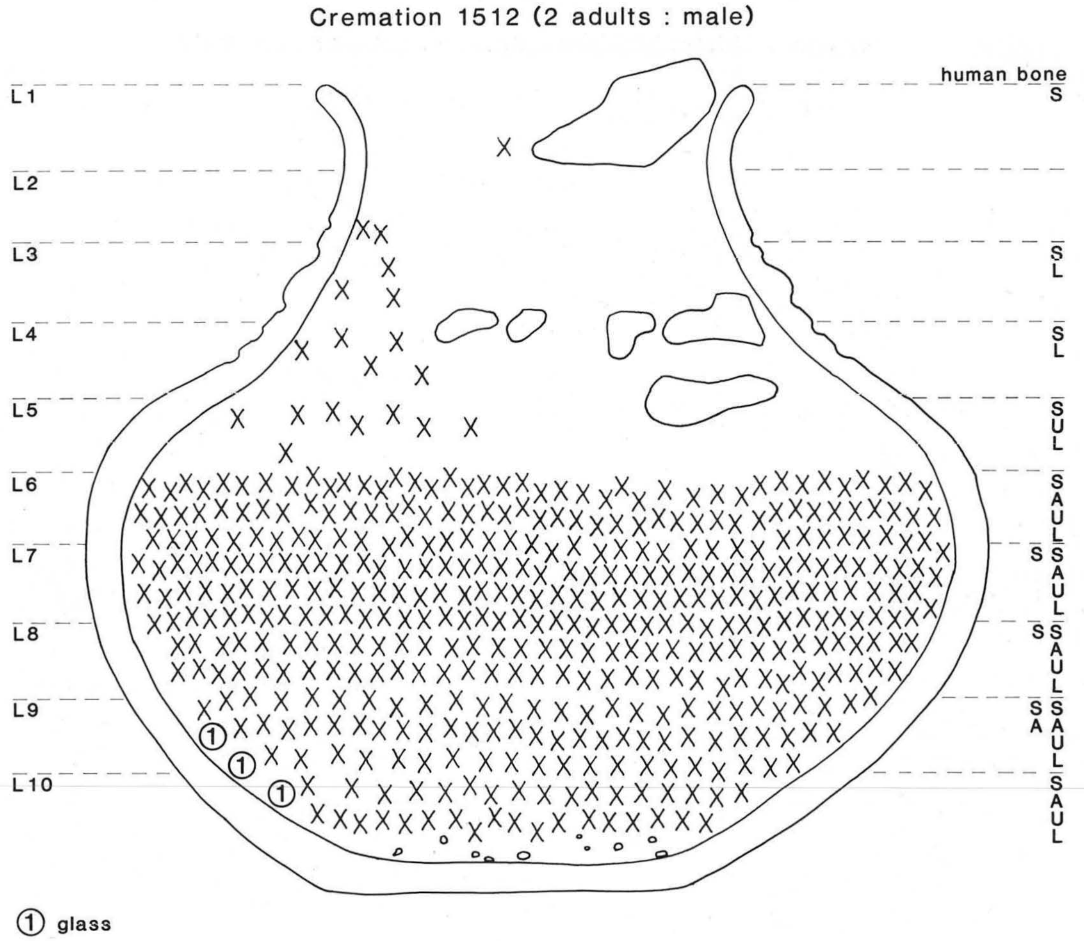


Figure 26 Annotated diagram of cross-section through urn 1512 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

whether the bone were fleshed or not. As discussed in Chapter 5, although defleshed bone oxidizes further over the same period of time than fleshed bone up to a point, there is no guarantee that the left-over bones from a funeral feast would have been added to the cremation pyre at the same time as it was lit; if the feast commenced at the same time as the cremation and the food debris was thrown on at a later stage, it may show the same amount of burning as the fleshed bone, or conceivably even less if it was a late addition and the pyre had burnt low, and it may immediately have been buried in the wood ash.

Amulets form a third category of animal bone in cremations, and these should perhaps be discussed with grave-goods rather than with the animal bone as a whole. Bear phalanges may have been connected to furs or not, but were probably of status or ritual significance. The same may be said of the raptor claws which were clearly pierced for suspension. Several pig carpals also appear to have been pierced for suspension, though pigs would hardly seem to be in the same ritual/status league as bears or raptors (unless the bones of a boar?).

Numbers of sheep astragali apparently used as playing pieces since they occur in large numbers with no other sheep bones, have usually been classed as grave-goods.

Wahl (1982) has commented on the fact that animal bone often shows different grades of burning than the human bone in the same deposit; frequently they are less well burnt. He suggests this may be because they were added to the pyre later than the body or were burnt on a separate, less efficient fire. The writer believes the latter is unlikely to have been the case at Spong Hill. In some cremations there is conclusive evidence that the animal was on the same pyre; animal bone in cremation 1318 is bronze-stained from the bronze sheet and has glass fused to it from glass beads in the cremation; cremation 1475 also has glass fused to the animal bone, and in cremation 3199 a fragment of pig rib is fused to a fragment of human bone by melted glass.

The degree of burning to the animal bone was very similar to that of the human in most cases, horse and cattle bone excepted. The horse bone shows a wide range of burning but is often less well cremated than the human bone, some, for example the sesamoid in no. 2822, being only charred. Some of the cattle bone also shows poor burning (discounting the few fragments of unburnt animal bone that was recovered with some cremations, usually cattle teeth, which was probably contamination from elsewhere rather than a deliberate deposit: see Appendix I). The poorer cremation of horse and cattle is perhaps not surprising since both are considerably larger animals than humans and will therefore take a correspondingly longer time to cremate. Additionally, it is likely that the animal(s)

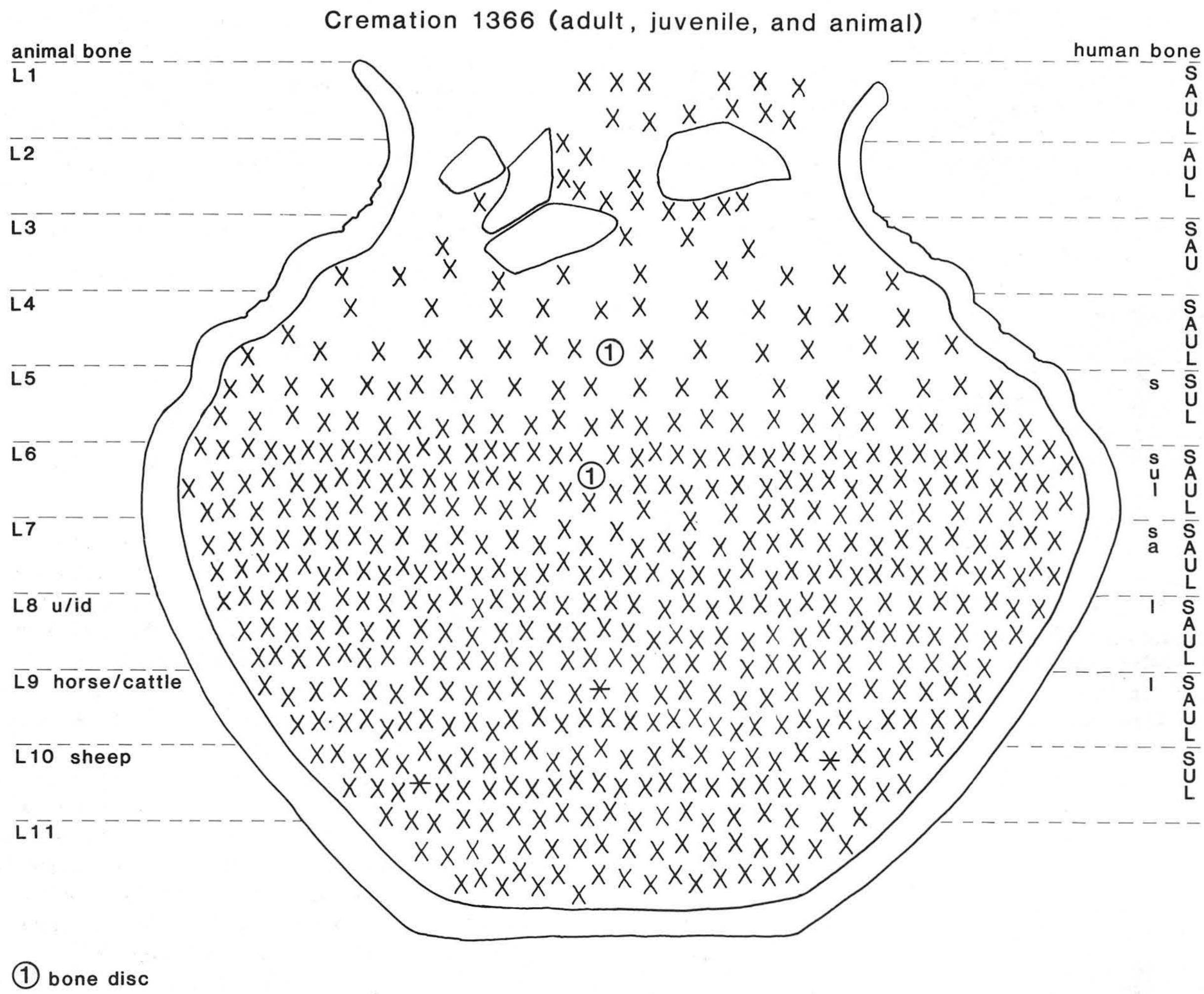


Figure 27 Annotated diagram of cross-sections through urn 1366 showing density and distribution of human and animal bones, skeletal areas and grave-goods.

was placed to one side of the human, closer to the edges of the pyre where it would not have received the same amount of heat. With both horses and cattle it is highly unlikely that the poor cremation is due to the animal being added later to the pyre. Putting an entire horse on a roaring pyre would have been a dangerous task.

It is clear from Figs 20, 22–25 and 27 that where animal bone is present in a cremation, it was well mixed with the human bone; this strengthens the impression that human and animal were cremated on the same pyre and the remains collected together at random. However, the human and animal remains may have been collected separately or together in a different receptacle to the final urn. That there was at some stage some separation of animal and human bone is suggested by the animal accessory vessels, where there has obviously been some conscious effort to deposit most of the animal bone in one urn and the human in the other. This implies one of several possibilities:

1) Animal and human were cremated separately and could have later been mixed in the same urn, or part of each put in one of two urns/urn and pit.

2) There was one pyre but the collector(s) had the ability to differentiate between animal and human bone and could separate them if necessary.

3) A single pyre was used but the animal was placed to one side or end where it could easily be collected separately if necessary (lack of tending minimising mixing: see section I above), some of either the human or the animal bone being accidentally included with the other in animal accessories due to slight overlap or mixing during collapse of the pyre. The remains may have been kept in a separate receptacle (see below), and in some of the cremations with animal bone deposited in the pits, they must have been.

The writer favours the latter explanation for the majority of cremations at Spong Hill in view of the other evidence on fusion of grave-goods, burning to animal bone and the layout suggested by finds from other cremation (Sjosvard *et al* 1983) and inhumation (Gräslund 1980; Wilkinson, unpublished) cemeteries. The occasional use of separate pyres cannot be entirely ruled out however, in view of the few urns containing animal bone exclusively, though it is possible that in these cases very careful separation of the animal from the human bone may have taken place.

Wilkinson (unpublished) believed that the presence of animal bones in the sample of cremations he examined from Loveden Hill was more a feature of adult male burials; none of the female graves had more than one species. Wells claimed there was a pattern of distribution of animal bones in the Illington cremations dependent on age and sex, but does not elucidate further. At Newark, Harman (1989) found that all cattle remains were found with adults, pig and sheep were found with all age groups and horse was mostly with adults though not exclusively. At Elsham (Harman 1989) pig was found mostly with adults and horse only with subadults and adults. Horse burials and cremations in Europe are noted as being predominantly with males (Hässler 1978, Gräslund 1980) and bear claws exclusively so (Holck 1986), though Gejvall and Persson (1970) state that they occurred with both females and males at Helgö (6th–9th century).

The pattern of distribution of different species at Spong Hill bears some similarity to other sites. All the figures for distribution are limited in that dual cremations were excluded, 'subadult/adults' had also to be excluded, as were the unsexed adults. The results are therefore an indication rather than an absolute (NB. for 'sheep' read 'sheep/sheep-size').

Infants: of 203 eligible, 69 (34.0%) have animal bone.
29 (42.0%) sheep
6 (8.7%) horse/cattle
5 (7.2%) pig/sheep
3 (4.3%) pig
2 (2.9%) bird
1 (1.4%) each dog, horse and cattle
Only one cremation contained more than one species (1.4%); dog with sheep (no. 1287).

Juveniles: of 131 eligible, 47 (35.9%) have animal bone.
15 (32.0%) sheep
5 (10.6%) pig
4 (8.5%) each pig/sheep, horse/cattle and cattle.
2 (4.2%) horse
1 (2.1%) each bird, deer and dog
Three have a minimum of two species (6.4%); sheep with pig, horse with cattle and horse with pig.

Subadults: of 65 eligible, 44 (67.7%) have animal bone.
14 (31.0%) sheep
12 (27.0%) horse
4 (9.1%) horse/cattle
3 (6.8%) pig
2 (4.5%) fox
1 (2.3%) each bird and cattle
Six have a minimum of two species all including horse. Two have a minimum of three species, both horse with sheep. (18.2%) multiple species.

Females: unquestioned only. Of 83 eligible, 44 (53.0%) have animal bone.
15 (34.1%) sheep
11 (25.0%) horse/cattle
7 (15.9%) cattle
6 (13.6%) pig
5 (11.4%) horse
2 (4.5%) dog
1 (2.3%) each pig/sheep, deer and bird
Seven have a minimum of two, three a minimum of three species (22.7%).

Females: all. Of 356 eligible; 168 (47.2%) have animal bone.
71 (42.3%) sheep
23 (13.7%) horse
20 (11.9%) pig
18 (10.7%) horse/cattle
11 (6.5%) cattle
7 (4.2%) pig/sheep
5 (3.0%) bird
3/4 (1.8-2.4%) dog
1/2 (0.6-1.2%) fox
1 (0.6%) each beaver, fish, bear, deer
Twenty-two have a minimum of two, six a minimum of three species (16.7%).

Males: unquestioned only. Of 59 eligible, 36 (66.0%) have animal bone.
14 (35.9%) sheep
7 (17.9%) horse/cattle
5 (12.8%) horse
4 (10.3%) cattle
3 (7.7%) each pig and pig/sheep
2 (5.1%) bird
1 (2.6%) dog
Seven have a minimum of two, one a minimum of three species (20.5%).

Males: all. Of 235 eligible, 122 (51.9%) have animal bone.
40 (32.8%) sheep
25 (20.5%) horse
13 (10.6%) horse/cattle
11 (9.0%) pig
9 (7.4%) each cattle and pig/sheep
4 (3.3%) dog
2 (1.6%) bird
Eighteen have a minimum of two, two a minimum of three species (16.4%).

The most obvious distinction is in terms of age:

a) Infants and juveniles have a lower than average percentage of cremations containing animal bone, and a much lower than average number with more than one species.

b) Subadults have a noticeably higher than average number of cremations containing animal bone. They are more akin to the adult cremations in range and percentages of different species, showing a much higher percentage of horse than any of the sexed adult cremations (see below). They also show nearer the average number of cremations with more than one species similar to the adult cremations.

c) Infants and juveniles (particularly the former), have very few large animals associated with them, a trend also noted at Newark and Elsham (Harman 1989). A large percentage of sheep/sheep size was found, especially with infants; interestingly, this is the only species where joints of meat rather than the whole dismembered carcass were indicated. The paucity of large animals with infants and juveniles is probably purely practical in that a whole horse or cow on a pyre would considerably dwarf the human corpse, increase the size of the pyre needed, and cause considerable difficulty with the collection of the human bone, which in the case of infants would already have been difficult.

A few points relating to sex were also noted, but figures should be treated with caution. Less than 50% of the adult cremations were sexed, the figures presented here are therefore only a guide.

a) There seems to be a general trend that slightly more male cremations than female ones include animal bone, a point also noted by Wilkinson at Loveden Hill (unpublished).

b) A slightly higher percentage of males appear to have horse associated with them, but the difference between male and female is not sufficient to say that it is predominantly a male trait, such as is suggested by remains from Europe (Hässler 1978, Gräslund 1980).

c) There is generally a wider range of species found with females. The two foxes were both found with older subadult females. This may however be biased in a number of ways *e.g.* large number of unsexed adults, lack of collection from the pyre of small, fragile wild animal bones.

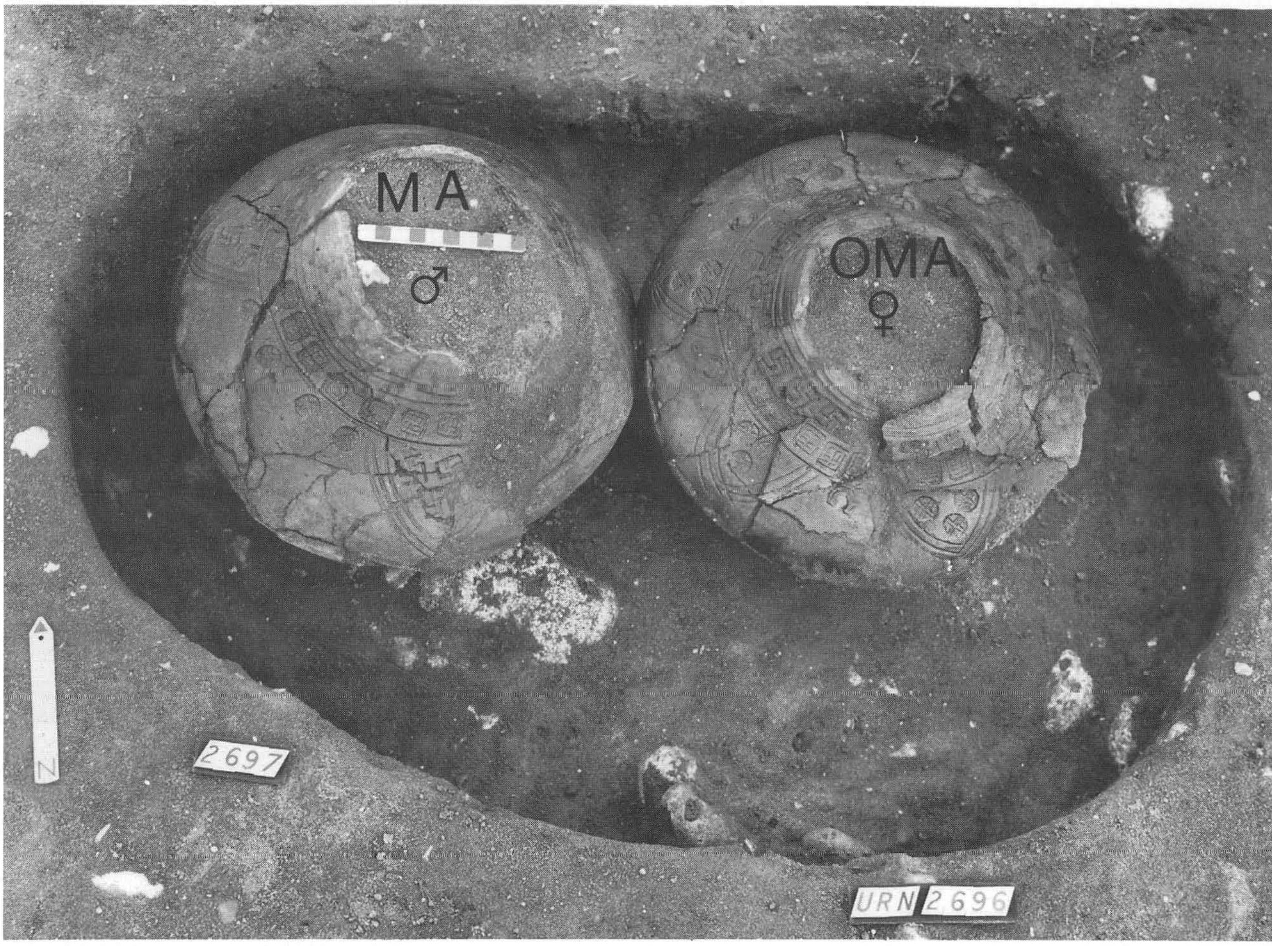


Plate XIII Urn nos 2697 (mature adult male) and 2696 (older mature adult female). Contemporaneous burials in a joint pit. (Note similarity in style, stamps and design of urns). Reproduced at 93% actual size.

Other general points:

a) Unlike Loveden Hill (Wilkinson unpublished), the presence of more than one species in a cremation is not related to sex, but maybe related to age (see above).

b) Bear claws are noted as being exclusive to male cremations/graves in Europe except at Helgö. Unfortunately at Spong Hill, of the five cremations containing bear claws only one could be sexed, that being a possible female.

c) Other species were fairly evenly distributed in terms of both age and sex with just slight variations from the average in certain groups.

Dual cremations

There are ninety double cremations at Spong Hill, 4.1% of the individuals identified, though fourteen (0.6%) are only possibles. From other contemporaneous cremation cemeteries in England the figures are: 6.0% from a sample at Loveden Hill (Wilkinson, unpublished), 6.8% from Newark (Harman 1989), 4.5% (7.2% if 'possible' multiples are included) from Sancton (McKinley forthcoming (c)) and 1.9% from Illington (Wells 1993). Figures from contemporaneous European cremation cemeteries are very similar: 0.4% from Hamfelde, 1.2% from Süderbrarup (am Markt), 3.2% from Rossdorf and 8.3% from Preetz (Wahl 1988). The predominant dual cremation is that of an adult of either sex with an infant or juvenile.

At Spong Hill, of the ninety dual cremations, 7.8% were of two immature individuals, 70% were of an adult with an immature individual and 22.2% were of two adults.

a) Seven cases of two immatures together; two infants with juveniles, two infants with subadults and three juveniles with subadults.

b) Five adults with foetus/neonates; one adult is female, the others are unsexed.

c) Twenty adults with infants; five adults are females the rest are unsexed.

d) Eleven adults with infants/juveniles; two adults are females, the rest are unsexed.

e) Twenty-one adults with juveniles; two adults are males, three females, the rest are unsexed.

f) Five adults with juveniles/subadults; one adult is female, one male, the rest are unsexed.

g) One adult female with a subadult.

h) Twenty cases of two adults together; seven are a female plus a male, five females with an unsexed adult, four males with an unsexed adult and four with neither adult sexed.

There is nothing to prove any relationship between two individuals though one assumes there must have been

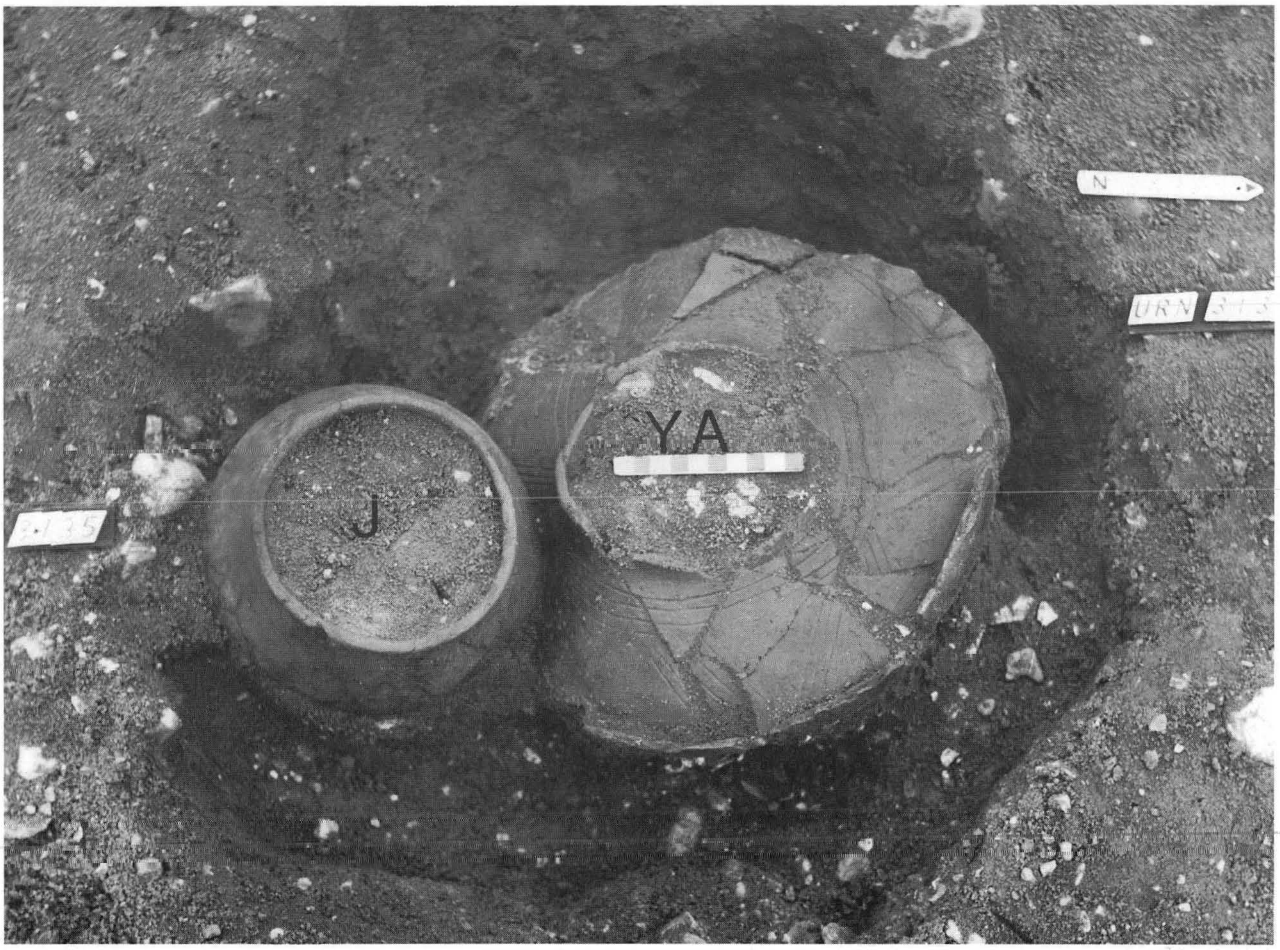


Plate XIV Urn nos 3135 and 3131 in one pit. Juvenile (J) and young adult (YA). Probably contemporaneous burial. (Note much smaller size of juvenile's urn).

for them to have been placed so close in death. The obvious relationship of mother and child may be suggested where the younger mature adult female (no. 2138) is together with a neonate/young infant but it cannot be conclusive. The deposition of older adult females or males with infants or juveniles may not be so direct a relationship, but the individuals may still have been close members of the same family, as may the immature individuals deposited together. Two adults, particularly where they are of opposite sex is likely to arouse speculation. The elderly couple (no. 2911) present visions of a marriage continuing after death, but yet again there can be no proof that this was so.

The question of human sacrifice invariably presents itself, some writers have suggested gruesome rituals akin to the Indian practice of Suttee for some of the dual cremations. There is evidence of this having taken place amongst the nobility of the Rus living along the Volga (Ibn Fadlan, 922: see Foote and Wilson 1979 and Brøndsted 1965), the Slavs and Poles in the Middle Ages (Wahl 1982) and more recently amongst the élite in India (Dubois and Beauchamps 1943). There is nothing in the more contemporaneous account of cremation in *Beowulf* to suggest such a practice and nothing to support the idea that human sacrifice was practised by the ordinary Early Saxon at Spong Hill.

It is highly probable that, at Spong Hill and in other cremation cemeteries, a proportion of the dual cremations must have been mothers with young infants who died during or following complicated childbirth. This is most likely with the five adults identified with foetus/neonates and with at least some of the twenty adults with infants. The incidence of this particular type of dual cremation was probably much higher than it appears from those identified. During the discussion on demography (Chapter 4:I) it was demonstrated that a number of neonates/young infants were likely to be missing from the Spong Hill population. These missing individuals may have been overlooked in dual cremations because:

a) Foetus/neonates/young infants of less than one year are found in single cremations and therefore must have qualified for the same cremation rites as other members of society. This is in contrast to some groups, *e.g.* the Romano-British, who buried such young infants outside the cemetery area. It is not impossible that some could have been treated differently to others for any number of reasons, *e.g.* personal inclination of a parent or family.

b) Where they do occur alone they, and other infants and juveniles, are contained in distinctively small urns (Fig. 20, Plates XIV and XVI). If they had for some reason been concentrated in disturbed areas of the cemetery with no attributable bone, their small urns would have illustrated their presence.

c) The age distribution within the cemetery does not show any bias towards certain areas of the cemetery being reserved for infants.

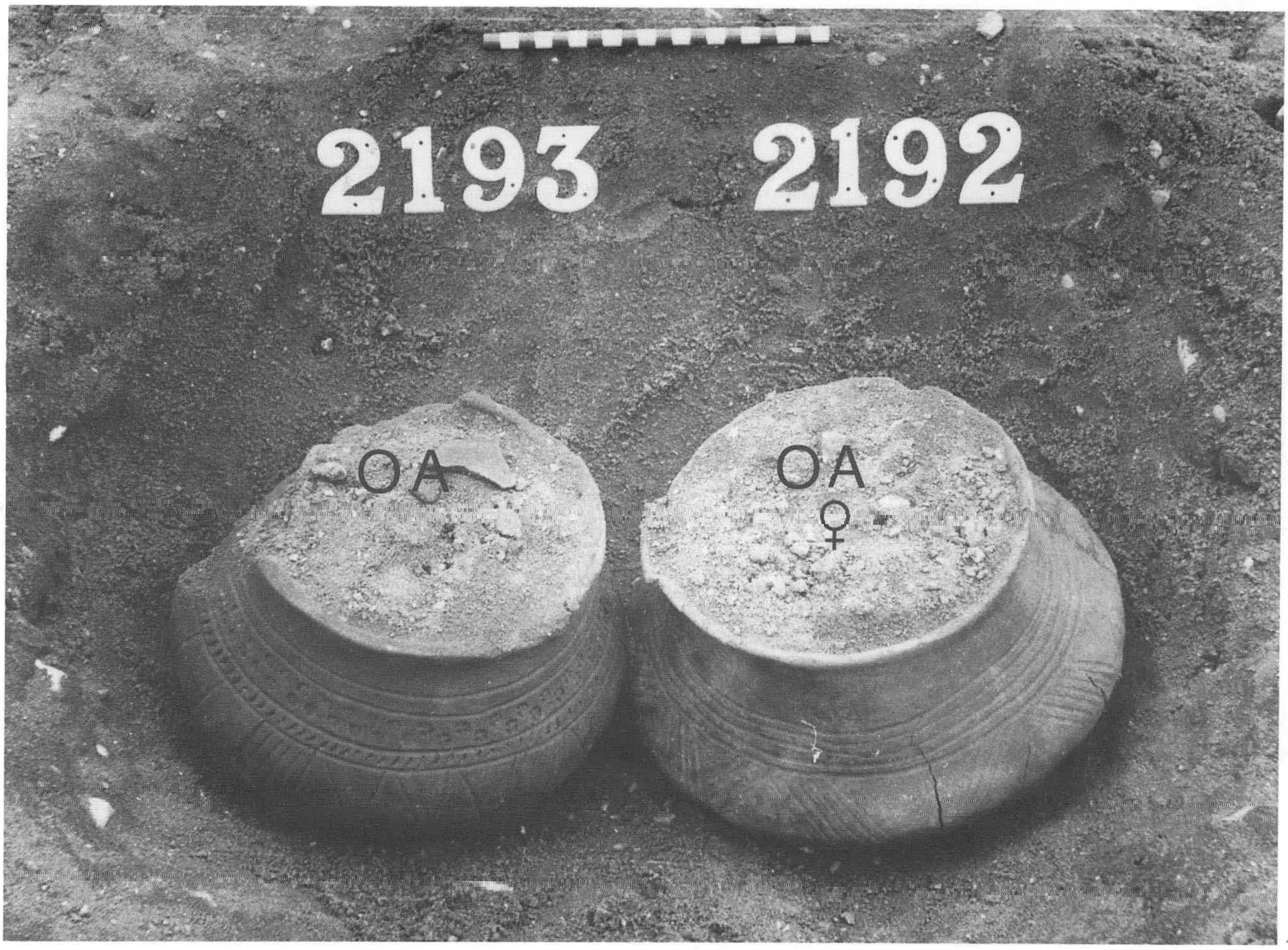


Plate XV Urn nos 2193 and 2192, two older adults. Contemporaneous burials in a joint pit. (Note similarity in style of urns and some of decoration).

d) The entire cemetery was excavated.

The writer feels that missing infants are likely to have passed undetected in dual cremations. Collection of the very small, fragile bones of a young infant or neonate cremated with an adult must have been immensely difficult, considering the additional pressures from the increased amounts of fuel, weight, time and pyre debris, and the fact that the entire remains of even the adult individual were never collected (Chapter 4:I).

Figures 20, 21, 25, 26 and 27 show cross-sections of urns containing multiple cremations excavated in spits. Not every fragment of identifiable bone could be attributed to one individual or the other where the two were of a similar age, so it is difficult to say if there is more of one than of the other, but what will be apparent is the equal distribution of the two individuals in each case throughout the urn. It is quite clear that the remains of one individual were not deposited in the urn before the remains of the second as there is no layering of the bone; if a dual cremation took place the bones of one individual were not collected separately from the other, or if separate cremations took place at different times, the bones from the first cremation were not placed in the urn before the other. Either dual cremations were mixed during collection from the pyre, or if the cremations took place at different times, the remains from the first must have been placed in a different receptacle prior to being mixed with those from the second in the urn prior to burial (see 'Animal bone' above). Even with the single cremations the remains may not have been put into the urns immediately after cremation. They may have been housed in a different receptacle prior to the final burial urn in much the same way that they are in modern crematoria. If this were so, the time lapse between cremation and burial could have been days, weeks or months. There is no ethnographic or anthropological evidence to suggest that remains were kept above ground for longer than a few days after cremation.

The writer favours the idea of genuine dual cremations in the majority of cases, judging from the random position of bone within the urns. However, the case would be difficult to prove either way. There is no way of telling from the condition of the bones whether they were burnt on the same pyre or not. Colour differences in the bones have sometimes been used for this purpose but are unreliable indicators, being subject to so many variables (Chapter 5).

Burial

Burial of the cremations was almost exclusively in upright pottery vessels (urns). The size of the urns is fairly uniform, with the notable exception of infant and juvenile individuals deposited in much smaller urns than those of subadults and adults. (Details of the vessels may be found in the catalogues Hills 1977, Hills and Penn 1981, Hills *et al* 1984, 1987 and forthcoming).

During excavation it was not always possible to locate an urn pit, especially in areas of disturbance, but the urns

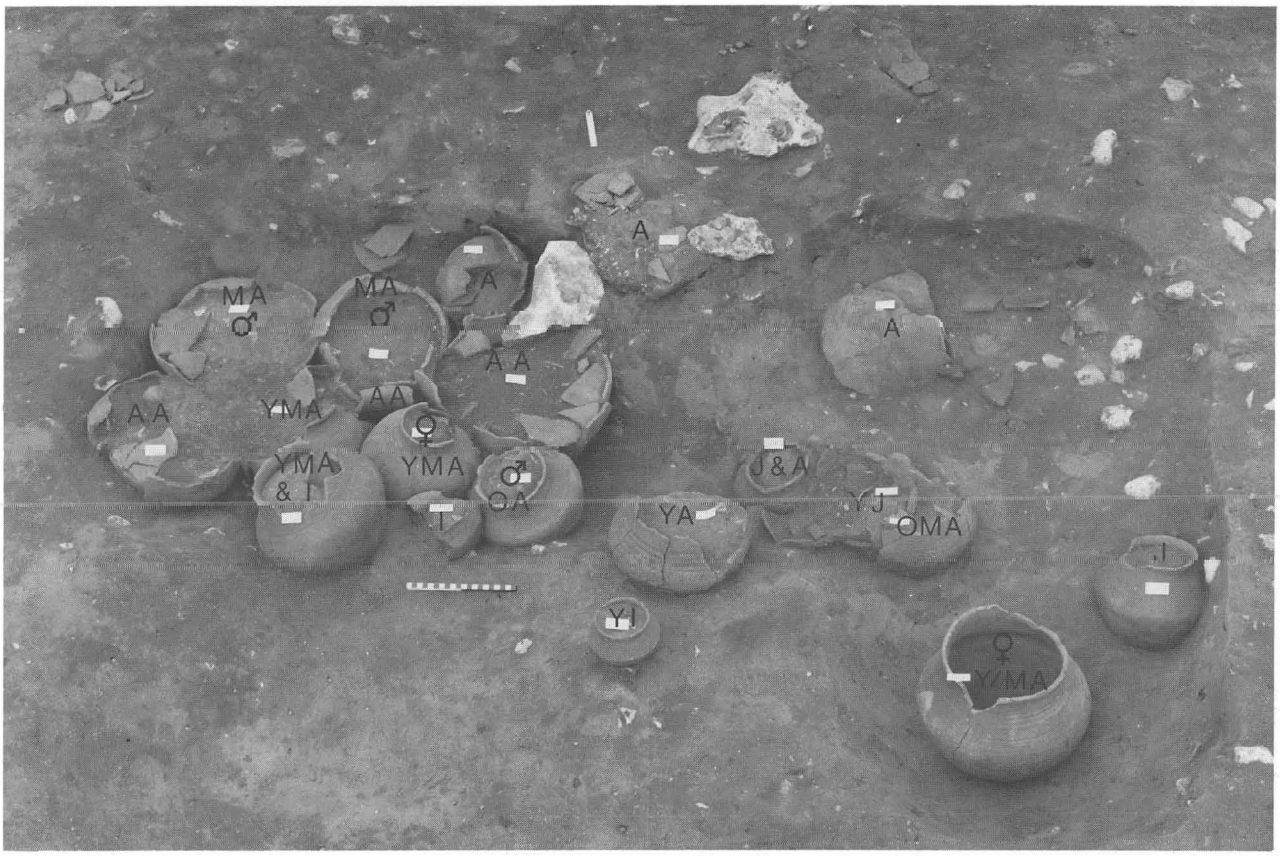


Plate XVI Annotated group of twenty urns in two/three? adjoining urn pits. Includes urn nos 2706, 2726–7, 2731–2, 2755–57, 2759–68 and 2778 in the southern area of the cemetery (Fig.7). YI = young infant; I = infant; YJ = young juvenile; J = juvenile; A = adult; YA = young adult; YMA = younger mature adult; MA = mature adult; OA = older adult; AA = animal accessory vessel. Sex indicated where identified. Reproduced at 86% actual size.

may have been deposited singly in a pit, or in groups of two or more. Occasionally some bone from the cremation had been deliberately deposited in the pit fill beneath or around the urn; these were erroneously labelled as 'un-urned cremations' during excavation. Some of the urns had pottery lids on them *e.g.* no. 1531; others may have had lids of skin, textile or wooden plugs.

Of those cremations marked as 'un-urned' in the catalogues, none indicated conclusively a deliberate deposition of cremated bone without a vessel.

a) Most were found to be spills from other disturbed urns.

b) A few were obviously redeposited following deliberate emptying of the urn contents by grave-robbers, for example no. 2130, where four individuals were identified from a heap of bone. There were thirty empty urns recovered during excavation, one of which was intact and lying on its side, reinforcing the notion of urns being deliberately emptied and discarded by grave-robbers.

No. 3033 was a young juvenile in a small vessel placed within urn 3032, on top of most of the bone, a young/younger mature adult female (see figure 142, Contents of Complete Cremations in Hills *et al* forthcoming).

Organisation of the cemetery

There is nothing to suggest any organisation of the cemetery in terms of age or sex of the individuals. There are problems in interpretation relating to the lack of phasing but a situation based on the use of 'family plots' is indicated.

There are many instances of two or more urns being buried within the same pit, often respecting previous deposits. In some instances urns may have been deposited at the same time but, in others, subsequent burials within the same pit have been made respecting previously deposited urns. Plates XIII, XIV and XV show what were probably contemporaneous or near contemporaneous depositions of two urns in one pit. A similar occurrence was noted by Wilkinson in a sample examined from Loveden Hill (1980), referred to by him as 'Paired cremations'. In none of these cremations at Spong Hill was there any indication in excavation of the pit having been re-cut to receive the second urn. The deposition of a juvenile with an adult individual, or two adults of similar age and one of each sex, suggests a family relationship of child with parent and married couples. There is, of course, no proof of such suppositions but to be placed so close together in death may reasonably be assumed to indicate some close relationship in life.

Dual burials of urns within one pit indicate one of three possible events:

a) The individuals in each urn may have died at the same time as a result of related trauma or disease, have been cremated separately and then buried together in their respective urns within the same pit.

b) The second death and cremation may have occurred before the first urn was deposited in the ground but some time after the first individual's death and cremation.

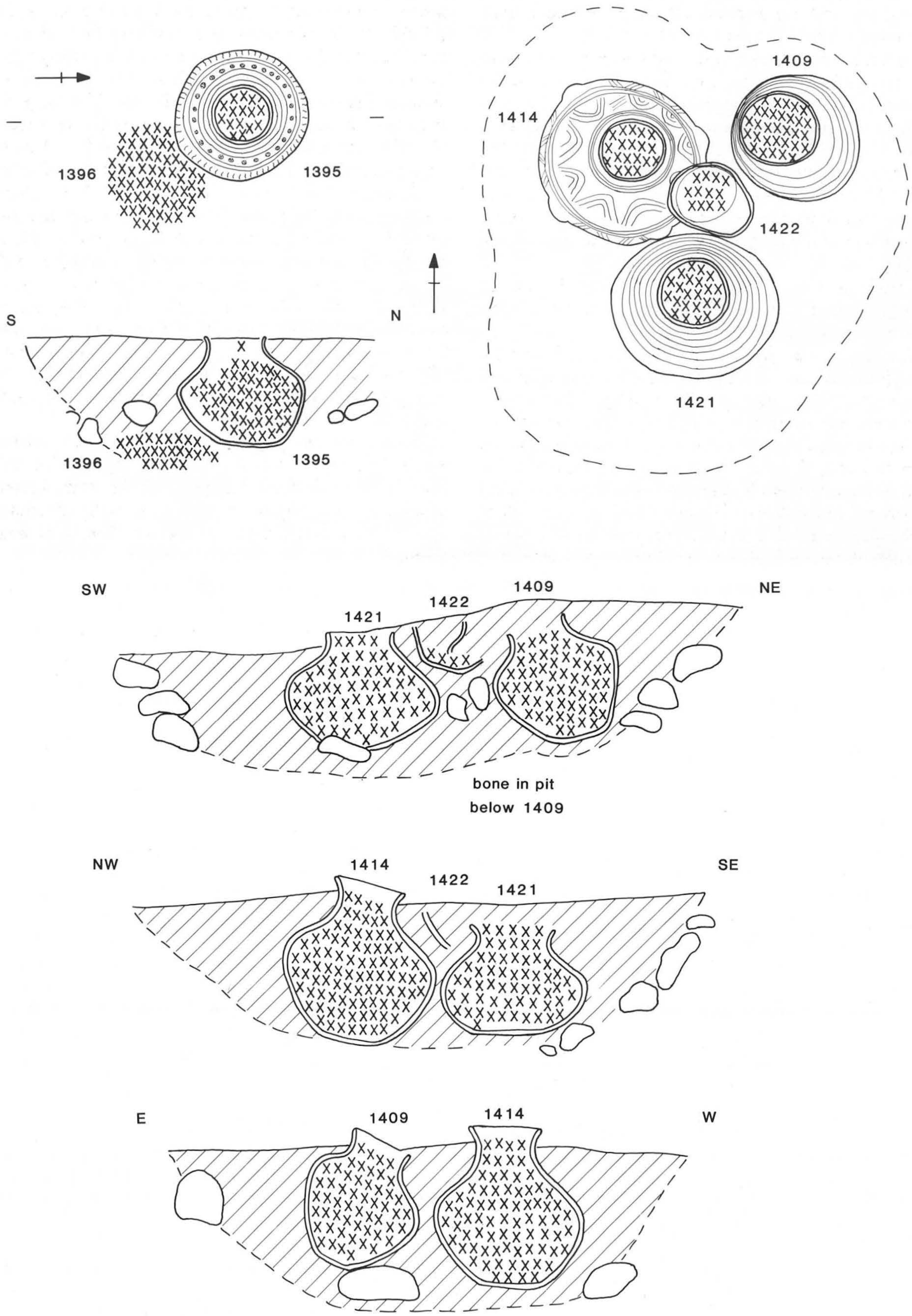


Figure 28 Plans and sections of cremation group 1395/1396 (a) and group 1409, 1414, 1421 and 1422 (b–e).

c) An urn pit large enough to take more than one urn was dug, the first urn inserted but the pit left open until one or more additional urns were placed in it.

In the first case, it seems odd that the cremations were not done together as is suspected to be the case with the dual cremations; the second possibility implies that urns were kept for some time before burial, a factor already indicated elsewhere; and the third suggests that the cemetery may have been scattered with open pits or pits covered over in some way, though in view of the soil type at Spong Hill (rather loose sand and gravel) there would be a limit as to how long a pit would remain open before silting up.

There is no reason why a combination of these three possible practices may not all have been current within the cemetery.

The impression of 'family plots' is reinforced by larger groups of urns within apparently communal pits such as that illustrated in Plate XVI. This shows two–?three connected pits, the largest and clearest of which contained eleven urns: the individuals are of a range of age and sex, there is one dual cremation and three animal accessory vessels; the urns largely respect each other (they have suffered compression from agricultural disturbance) though it is possible that at least one urn may have been placed on top/over one of the animal accessory vessels. The close grouping of the urns, which do not cut or overlie one another, implies a relationship between the individuals. In this event it is unlikely that all eleven burials occurred at the same time and it is probable that a large pit was originally dug and then covered in some way following subsequent deposits of urns. The large flint nodules to the top of the photograph may be the remnants of cairn markers, others of which were found in less disturbed areas of the site *e.g.* nos 2199 and 2193–2192.

A similar 'family plot' is shown in Fig. 28:b–e, where a young adult male (no. 1414) with animal accessory vessel (no. 1421), a mature adult female (no. 1422) and older juvenile plus possible second immature (no. 1409) were buried together in a single pit. In this case, the young adult male with animal accessory vessel and the immature individuals were obviously deposited some time before the mature adult female (this urn, being higher in the pit fill, has been more damaged by ploughing). The implications of this deposit are obvious though impossible to substantiate.

More complete phasing of the site will considerably aid the interpretation of the cemetery organisation and it may be that detailed analysis of the stamp-groups, decoration and style of the urns will illustrate a relationship between the urns based on 'family' or area of origin.

Chapter 7. Pathology and morphological traits

Pathological lesions and cremated bone do not tend to be synonymous in the minds of most palaeopathologists, since cremations are purported to present few lesions. Up to a point, this attitude is a valid one; however, there are specialists in Europe, where the presence of large 'urnfields' have ensured that cremations receive a slightly higher profile than here, who have been producing detailed pathological reports on cremated bone for some time (*e.g.* Grimm 1982, Kühl 1982, 1988, Kühl and Remagen 1985). In Britain, Dr Jonathan Musgrave, in his work on the Greek cremation believed to be that of Philip II of Macedon (1985), used the pathological lesions and morphological variations in the bones in order to prove their likely origin.

The main problem with a cremation is that it rarely presents the complete skeletal remains of an individual. Although there is a general tendency for certain bones to be represented, each cremation will contain slightly different proportions of, for instance, vertebrae, phalanges and skull fragments. This problem is compounded on a site which has suffered disturbances, with the loss of deposited bone. There may be difficulties with diagnosis when the complete skeletal remains are not available.

Lesions (the changes to bone in response to disease or trauma) are easily enough described, but may be difficult to explain. Lesions of similar appearance may be the product of different diseases, and it is only by examination of the skeleton as a whole, and by assessing how different lesions throughout the skeleton may relate to each other, that some diagnoses may be obtained.

Fragmentation and warping in cremation may also be a problem, particularly in deciphering whether a structural change is a lesion, or the product of burning (Musgrave 1985 on such problems of interpretation with Philip of Macedon). Patterns of fragmentation and warping are, however, fairly consistent within the different bones in most cremations (Chapter 5:II). With experience, it becomes easier to identify those changes which have taken place as a consequence of the cremation process, rather than as a result of pathological change.

The nature of the lesion itself may produce further difficulties in arriving at a diagnosis. Osteoporosity is a major example. This is a disease involving the thinning of the internal structure of the bone, often leaving quite large spaces in the webbed spongiosa. It may have particularly disastrous results in the articular surfaces of the long bones. During cremation, articular surfaces affected by this disease would tend to crumble to dust under the effects of dehydration and external pressures on the weakened structure. Thus, the affected bone, and evidence of other diseases such as osteoarthritis which may have been present, would be lost. Females, particularly the more gracile individuals beyond the menopause, are most prone to this problem. (The writer has noted in several modern cremations that the remains of gracile, elderly females have lacked articular surfaces amongst the identified bones, not a usual occurrence in modern cremated remains. This is most likely as a result of osteoporosity within the spongy bone).

Similarly, any disease resulting in gross destructive lesions, substantially altering and weakening the internal structure of any bone, would render that bone prone to loss by the same mechanisms. This would be particularly true of spongy bone, which would collapse and be collected as dust only. Consequently, in studying the pathology of cremated bone, the gross destructive changes associated with the late stages of some chronic diseases may not be seen or conclusively recognised. It is probable that some well-aligned fractures may prove difficult to detect in cremated bone. Fissuring of the bone from dehydration during the cremation process, may follow lines of weakness within the bone structure, and if so, it would render the lesion very difficult, if not impossible, to detect. Much pathological information will therefore be lost in cremations.

On commencing the analysis of the cremations from Spong Hill the writer was advised not to waste too much time on pathology and that this section of the analysis may even be excluded from the publication. The error of this advice became apparent as the project progressed, and the quantity and diversity of the lesions discovered have made the publication of this material essential. Although all lesions were noted and described, the usual procedure of recording presence/absence of all bones was not followed, which has limited the meaningful discussion of the pathological information recovered, as has the inability to sex many of the individuals identified. Nor was there sufficient time to do full justice to some of the more interesting aspects of pathology observed. The writer is aware of the deficiencies in the findings as presented here but feels it is essential that they are publicised so that cremation pathology is given more attention in future, rather than being simply dismissed as a waste of time.

30.6% of the individuals identified at Spong Hill had some form of pathological lesion or morphological variation. A note of the affected bone with the type of lesion or, where possible, the diagnosis, may be found under each urn number in Table 2 (Chapter 3). Full descriptions of the lesions may be found in the archive.

I. Pathology

Refer to Figs 8–10 for elements and features of skull and skeleton.

Dental diseases

(Plates XVII, XVIII)

The various diseases which may affect the teeth and their supportive structure will usually form a large part of any pathological report from an inhumation cemetery. The lesions are relatively common and easily recognised; teeth are subject to high recovery, even in soils which will often destroy much of the other bone. This is not so with cremations however, as the crowns of erupted teeth are rarely recovered (Chapter 2:IV). Consequently, much of

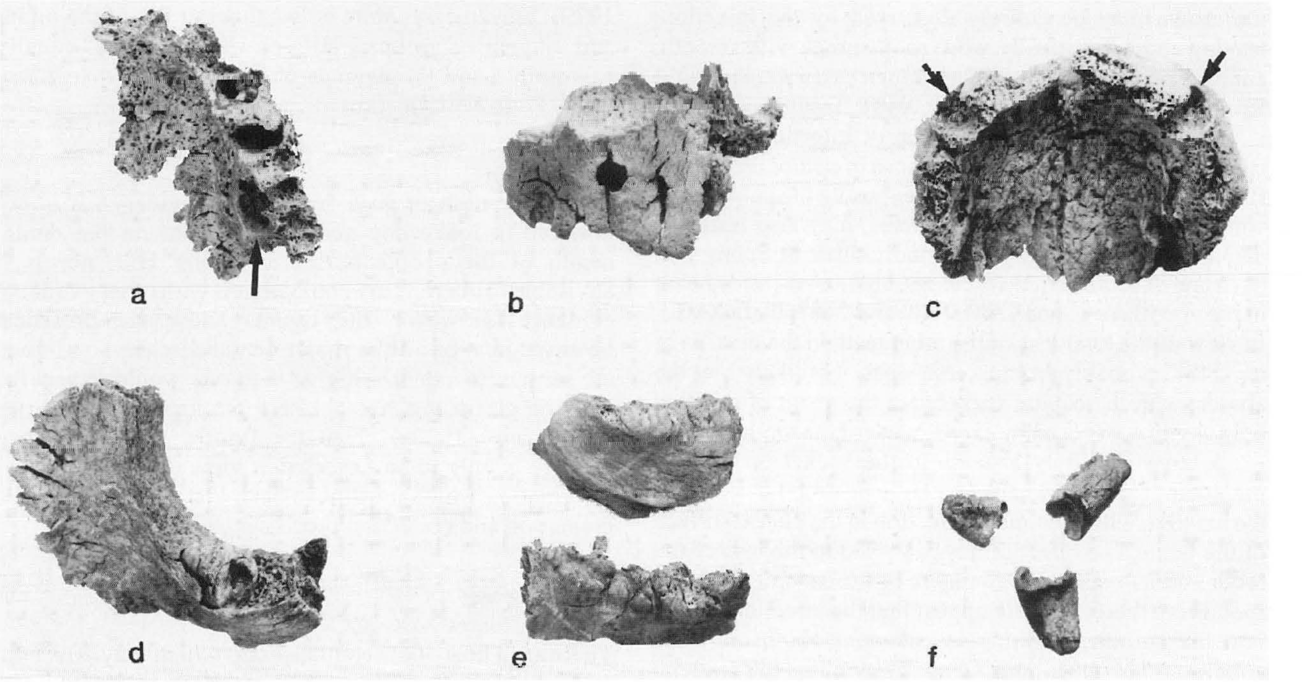


Plate XVII Dental disease: a) no.1380, maxillary abscess in left palate, first molar palatal socket. b) No.1930, maxillary abscess at apex of tooth root. c) No.2487, maxilla with loss of all except canine teeth and resorption of sockets. Dental abscesses at apices of both canines. d) No.1815, impaction of left mandibular third molar; root at right angles to normal. e) No.2452, periodontal disease around mandibular molar sockets. f) No.2916 remains of maxillary molar tooth root branches following destruction of crown, probably due to caries. Reproduced at 86% actual size.

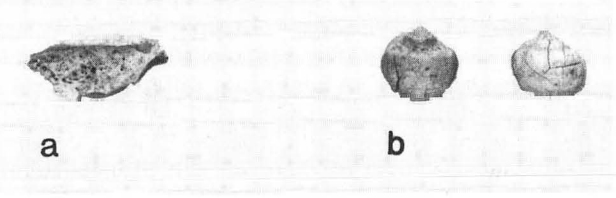


Plate XVIII a) No.1604, Cribra orbitalia in vault of right orbit. b) No.1265, dental hypoplasia in the premolars.

the information in this class of diseases is restricted to those lesions affecting the supportive structures, but it is possible to ascertain a certain amount about the condition of the tooth crowns from the state of the tooth roots and the jaw. Fragments of tooth root, mandible and maxilla are amongst those most commonly recovered in cremations.

Tooth loss may result from one or more factors. The loss of teeth is easily detected within the jaw as, once the tooth has gone, the socket will resorb. By examining the condition of the surrounding alveolus, other sockets and any remaining tooth roots, together with other evidence of the age of the individual, it may be possible to suggest the most likely cause of tooth loss.

a) If there is no sign of infection in the alveolus, more than one socket is resorbed, any remaining sockets are shallow and the tooth roots short, then the most likely cause of tooth loss is excess attrition, due to the advanced age of the individual. This is probably the case with no. 2487 (Plate XVII), even though there are dental abscesses at the apices of both canine sockets, which are the only sockets not resorbed.

b) Should one or several anterior tooth sockets be resorbed while all the other sockets appear healthy and deep, then the most likely cause of tooth loss is trauma. The anterior teeth are prone to damage in the event of a blow to the face, whether it be accidental or deliberate. Trauma of this type may result in the breakage of the tooth crown, followed by infection of the pulp cavity, with eventual loss of the tooth. Infection of the socket apex may also occur, producing a dental abscess.

c) Tooth loss may also be the product of a gross dental abscess destroying the tooth root.

d) Progressive resorption of the alveolus due to periodontal disease leads to the eventual loosening of the tooth, and its subsequent loss.

At Spong Hill, eighty-two individuals (3.6% of the total identified) had lost one or more teeth. Of these, one shows indications that loss was the result of excess wear (no. 2487). Twelve others were thought to be probably of traumatic origin; only anterior teeth were lost, the rest appear to have been strong and intact. Of the twelve, six were female, three male and the other three unsexed. Twelve other cases were recorded from individuals showing dental abscesses, and the loss of the tooth may have been related to these destructive lesions.

Carious lesions are largely a function of diet and reflect the dental hygiene of the individual. Lesions may commence either in the occlusal or the cervical region of the tooth crown. At Spong Hill, few of these lesions were found because all the erupted tooth crowns were badly shattered in the process of cremation and/or not collected from the pyre. However, in cases of gross dental caries, the crown may be entirely destroyed by the infection, leaving characteristically worn root stumps with smooth, concave occlusal surfaces. Three such cases were noted at Spong Hill (*e.g.* no. 2916, Plate XVII).

Dental caries, by transmission of infection from the crown to the roots, is the major cause of *dental abscesses.* Excessive wear of a tooth crown, exposing the pulp cavity, which may thereby become infected, may also lead to a dental abscess. Twenty (0.9%) individuals at Spong Hill have one or more dental abscesses, about two-thirds being in the maxilla (*e.g.* nos 1380, 1930 and 2487, Plate XVII). In view of the total loss of the other teeth in the maxilla of no. 2487, probably from excess wear, it is likely that the abscesses in the canine sockets are the result of infected pulp cavities, exposed by excess wear of the tooth crowns.

A large maxillary abscess in the socket of the first premolar of no. 2964 caused a large destructive lesion in the maxilla, with secondary infection in the buccal surface of the bone. The infection probably led to the loss of the tooth and had spread to the apex of the second premolar root. From there, it would appear that the infection passed into the antrum, resulting in *secondary sinusitis.* This condition has been described by Wells (1977), who reported 6.8% sinusitis (combined primary and secondary) in a sample of 204 Anglo-Saxon inhumations.

Periodontal disease is an infection of the gums (pyorrhoea), which may affect the supportive structure and result in resorption of the alveolar bone and thereby the loss of teeth. There may be various causes of the disease, most commonly ageing, poor dental hygiene, or some deficiency in the diet (Hillson 1986). Thirty-six (1.6%) of the Spong Hill individuals have some periodontal disease. In about three-quarters of these, the individual had also suffered some *ante mortem* tooth loss, possibly an effect of the disease.

Calculus deposits (calcified plaque) are commonly noted in some degree on teeth from inhumations. These deposits are linked directly to diet and a low level of oral hygiene, encouraging the bacteria which cause carious decay. At Spong Hill, only three instances of calculus deposits were detected, only where the deposits had spread to the neck of the tooth root, the roots probably being exposed by periodontal disease.

Hypercementosis, is a harmless condition, involving the excessive formation of secondary cementation, usually in the lower two-thirds of the tooth root. It may relate to a number of conditions, such as ageing, periapical inflammation, mechanical stimulation or tooth trauma. Eleven (0.5% of individuals) cases were noted at Spong Hill, all in molar teeth and most commonly in the third molar.

There is one clear case of tooth *impaction.* The left mandibular third molar of no. 1815 was found to have erupted at right-angles to the usual plane (Plate XVII). The occlusal surface would have rested against the distal side of the second molar.

Cases of *dental hypoplasia* were found amongst the unerupted teeth of immature individuals (infant and juvenile categories). Generally seen as horizontal bands in the tooth enamel, the defects occur during the development of the tooth crown. Unlike bone, enamel cannot remodel, so the lines remain clear. Hypoplasia illustrates periods of arrested growth in the developing tooth crown, and may form because of disease, nutritional problems, localised trauma or congenital defects (Hillson 1979). Eleven cases were noted, that is 1.2% of the infant and juvenile groups. All crowns seemed equally susceptible and the degrees of severity varied (*e.g.* no. 1265, Plate XVIII).

Conclusion

On the strength of such fragmentary evidence it is not possible to make any general statement on the dental health of the people buried at Spong Hill, nor is it advisable to attempt any comparisons with other available evidence. However, the figures show the presence, however low, of all the major dental diseases, and none are present to a degree higher than one would expect for a Saxon group, *e.g.* about 14% tooth loss and 6% caries (Brothwell 1972a). That the figures are lower than average is only to be expected in view of the amount of information which must have been lost as a result of the cremation and collection processes.

Joint disease

(Table 6, Plates XIX–XXX)

There are a host of different diseases which may affect the *c.*200 joints in the skeleton. Many of these diseases are degenerative in nature, the likelihood of occurrence increasing with age, as part of a natural process of degeneration. The speed of that degeneration varies however, with some groups of individuals predisposed to degenerate faster than others, as was found during the examination of the remains from documented families at Spitalfields. Here, some family groups were seen to have degenerative changes much earlier and others much later than expected (Margaret Cox 1989, pers. comm.). Trauma, with associated activity, or previous disease involving the joints, may also be predisposing factors to joint disease.

Joint disease is one area of palaeopathology in which the terminology may be confusing: different reference books and different specialists tend to use slightly different terms to describe a disease. This is because though common, joint diseases are still ill-understood, research is ongoing and new 'diseases' of this class are still being found. It should be remembered that, even in modern clinical work, diagnosis is often correct in less than 25% of living patients and there is much disagreement on aetiology (Stirland 1990, pers. comm.).

Osteophytes are irregular growths of new bone around a joint. Osteophyte formation may be found alone, or together with other lesions in a joint where it may indicate the presence of a disease. Osteophytes alone may be seen as a natural reaction to wearing of the joint; in order to spread the weight-load within the joint, new bone develops around the margins to increase the surface area and stability, leading to stiffness and decreased mobility. Any joint in the body may have these lesions, though the weight-bearing and most frequently stressed joints are the ones which tend to be most commonly affected. The development of wear related osteophytes is known to increase with age (Nathan 1962), and is often mechanically induced; this means that the development of the lesions is more common in the heavy and obese individual (increased weight-bearing stress), onset being no earlier than in other individuals, but the extent greater and progress more rapid (Willis 1924). In the spine, osteophytes may also develop in response to disc destruction and pressure from the disc contents causing

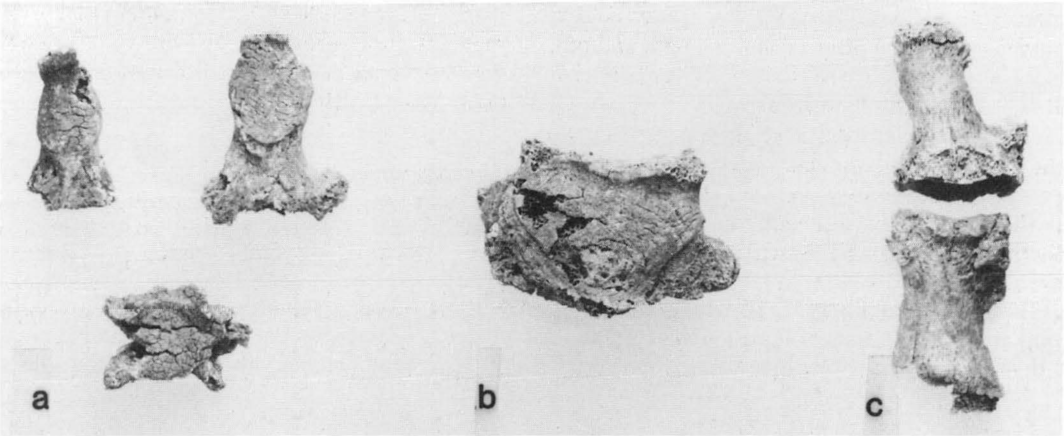


Plate XIX Osteophytes; a) On the apex of the odontoid process (above) nos 2445 and 2898, and the margins of the anterior facet of the atlas (below) no.3066. b) Extensive flanges of new bone on the anterior sides of a thoracic vertebral body surfaces, no.2452. c) On the anterior margins of the first phalanges of the left foot, no.2452.

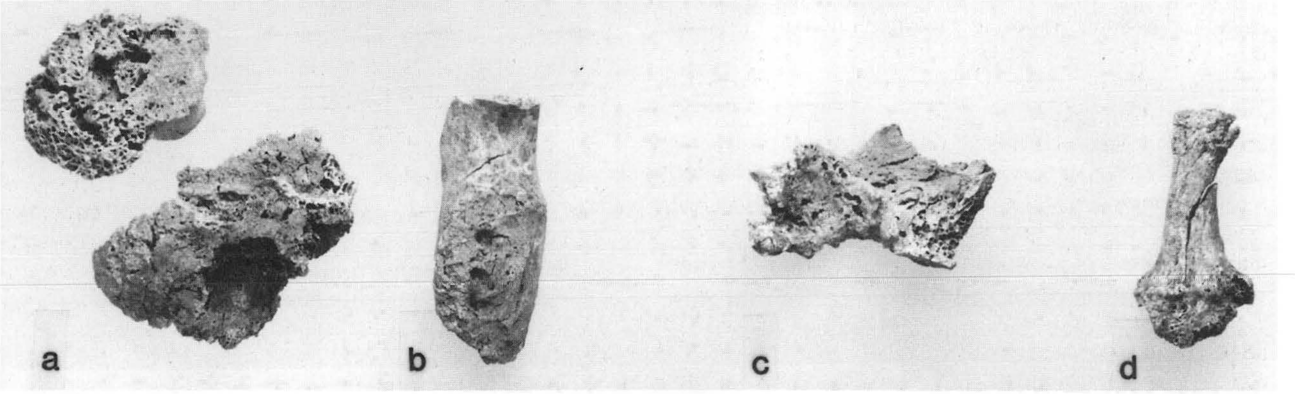


Plate XX Osteoarthritis: a) no.2673, the contours of the humeral head have been altered and there is eburnation and pitting in the surface. The same individual has pitting and proliferative new bone in and around the margins of the radial tuberosity. b) No.3129, atlas anterior facet and part of the right articular surfaces. Gross pitting and some eburnation in the surface of the anterior facet with ostephytes on the margins. c) No.2911, middle finger phalanx. Gross osteophytes on the dorsal margins of the proximal articular surface.

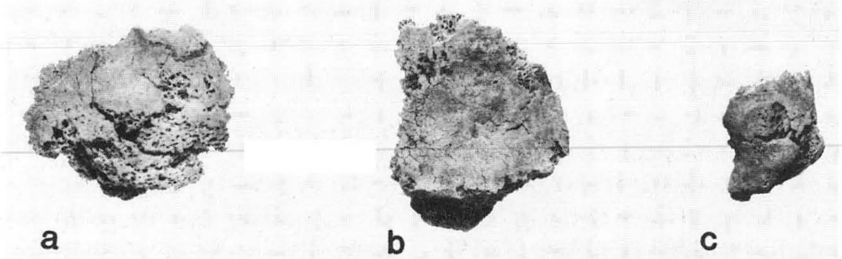


Plate XXI Osteoarthritis: a) no.1547, gross eburnation and pitting in the femur head with some distortion of the surface contours. b) No.3145, the dorsal surface of the patella with eburnation and pitting in the superior centre of the surface. c) No.2987, distal head of the fibula with an area of eburnation and pitting in the articular surface.

atlas/axis	169	(46.8%)	other cervical	48	(13.3%)
thoracic	36	(10.0%)	costo-vertebral	27	(7.5%)
sterno-clavicular	17	(4.7%)	finger phalanx/ges	11	(3.0%)
tempero-mandibular	11	(3.0%)	lumbar	9	(2.5%)
shoulder	8	(2.2%)	hip	7	(1.9%)
knee	6	(1.7%)	elbow	5	(1.4%)
wrist	3	(0.8%)	ankle	2	(0.6%)
sacro-iliac	1	(0.3%)	metatarsal	1	(0.3%)

Table 6 Distribution of osteoarthritic lesions in the joints, showing number of lesions per group and percentage frequency.

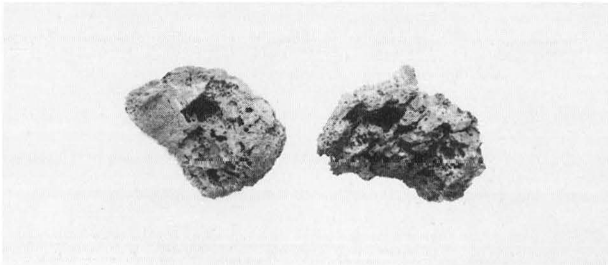


Plate XXII Osteoarthritis: no.2917. Bi-lateral lesions in the medial articular surfaces of the clavicles. Gross pitting in the surfaces and osteophytes on the margins.

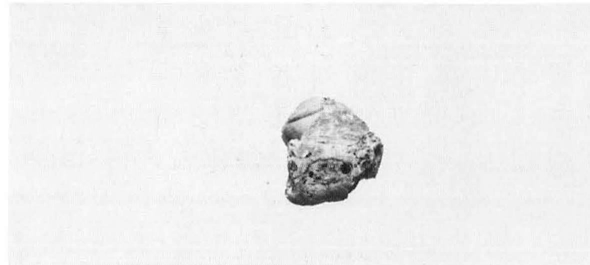


Plate XXIII Osteoarthritis: no.2917, middle finger phalanx. Distal articular surface with oval area of pitting and osteophytes on surface margins.

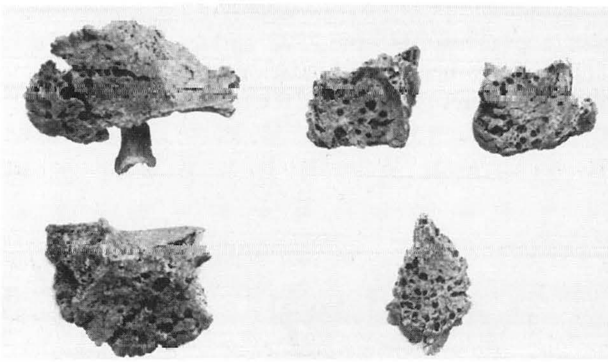


Plate XXIV Osteoarthritis: nos 2820 (left) and 2236 (right), cervical vertebrae articular processes with gross pitting, some eburnation and osteophytes.

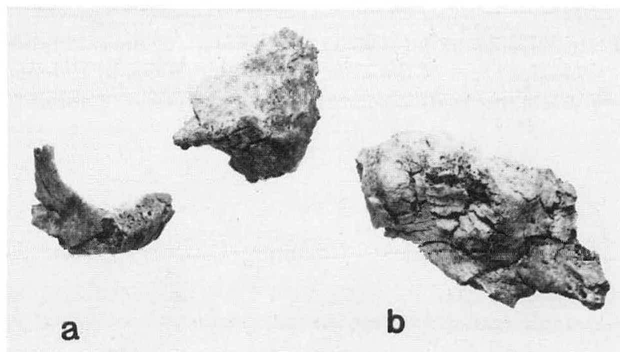


Plate XXV Tempero-mandibular osteoarthritis: a) no.3086, left mandibular condyle and temporal mandibular fossa. Corresponding areas of pitting and slight eburnation in condyle and fossa. b) No.1346, right temporal with articular tubercle, mandibular fossa and postglenoid tubercle. Usual convex surface of articular tubercle is concave with pitting.

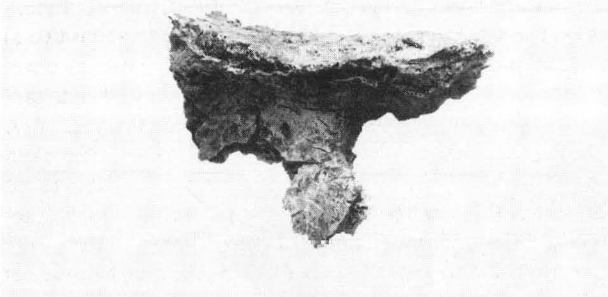


Plate XXVI Osteoarthritis: no.2403 (see Plates XXVII and XXVIII). Glenoid fossa of left scapula, dorsal view showing remodelled surface contours and osteophytes on margins.

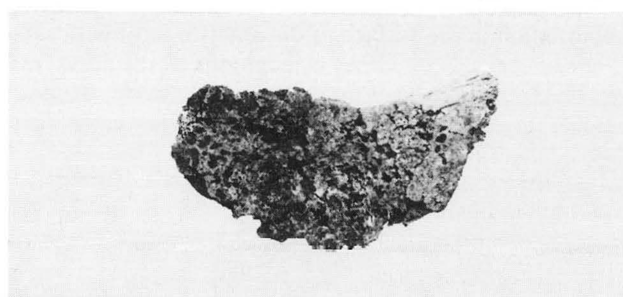


Plate XXVII Osteoarthritis: no.2403 (see Plates XXVI and XXVIII). Glenoid fossa of left scapula, lateral view, showing remodelled surface contours, gross pitting and eburnation in surface and slight marginal osteophytes.

inflammation of the periosteum, or in connection with such diseases as ankylosing spondylitis or diffuse idiopathic skeletal hyperostosis (DISH).

Osteophytes on their own were recorded in 289 joints at Spong Hill. Lesions in more than one thoracic vertebrae, or finger phalanx *etc.* of the same individual, have been counted as one in these figures, that is, the bones are counted in groups. 55.8% of these lesions are in the vertebral bodies of the spine:

Cervical 45 (15.6%)
Thoracic 78 (27.0%)
Lumbar 30 (10.4%)
Sacral (Ist) 8 (2.8%)

The weight-bearing function of the spine, together with its natural curvature, ensures that this area of the skeleton is the one most commonly subject to osteophyte development. The areas of maximum mechanical stress on the vertebral bodies occur at the fifth cervical, eigth thoracic and the third and fourth lumbar (Manchester 1983). In the typically affected spine, the burden is on the lower thoracic and the lumbar vertebrae (Manchester 1983, fig. 30). No. 2452 at Spong Hill, (Plate XIXb) shows the typical 'flange' osteophyte development in a thoracic vertebral body. At Spong Hill the pattern of involvement within the spine is much as expected, except for the

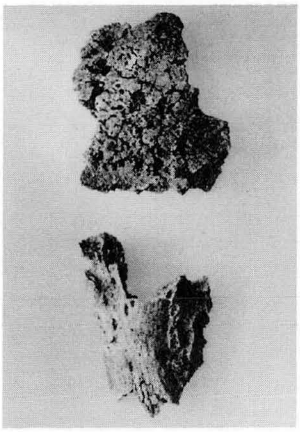


Plate XXVIII Osteoarthritis: no.2403 (see Plates XXVI and XXVII). ?Left humerus head and neck fragments. Gross pitting and eburnation in the anterior surface and exostoses at the attachments in the neck.

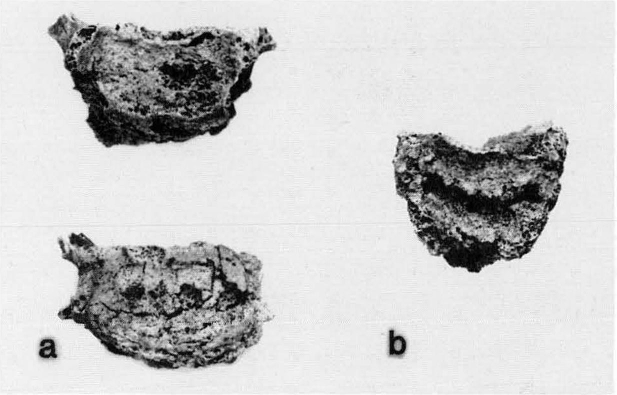


Plate XXIX No.2666. a) Degenerative disc disease in cervical vertebrae body surfaces, pitting in surfaces and osteophytes on margins. b) Schmorl's nodes in cervical vertebra. Kidney-shaped depression with deeper lesions at each end.

number of cervical lesions being greater than the lumbar. This may be an indication of inequality in recovery (though recovery of all areas of the spine appeared to be equally good), or it may be a genuine indication of differing susceptibility resulting from a number of factors.

The joints of the finger phalanges are the next most commonly affected. Here, size of the individual would not be a predisposing factor to development of osteophytes, but activity related stress could be, especially in combination with age. 25.3% of the individuals where osteophytes were recorded show lesions in the finger phalanges. Other joints showed the presence of the lesion only occasionally:

elbow 16 (5.5%)
foot phalanx/ges 13 (4.5%)
metatarsals 6 (2.1%)
ribs 5 (1.7%)
femur 3 (1.0%)
scaphoid 3 (1.0%)
patella 2 (0.7%)
lunate 2 (0.7%)
mandible 1 (0.3%)
innominate 1 (0.3%)
scapula 1 (0.3%)
fibula 1(0.3%)
metacarpal 1 (0.3%)

Plate XIXc, shows the Ist phalanges of the left foot (no. 2452), with osteophytes at the joint.

Osteoarthritis is a condition affecting the synovial joints; in the spine these joints are the dorsal articular surfaces of the vertebrae. Osteoarthritis is basically a degenerative wear-and-tear process, affected by a number of factors including age, weight, trauma, congenital defect, previous disease or vascular insufficiency (Adams 1986). Certain joints are more prone to development of the disease because of the amount of stress they take. The joints of the upper limb are less prone to primary osteoarthritis as they are lightly stressed. The frequency of the disease increases with age, particularly after fifty (Grennan 1984), when there is also a likelihood of more than one group of joints being affected. In Britain today, 52% of the adult population have osteoarthritis, and although prevalence in the two sexes is about equal, females tend to have more joints affected.

The disease is manifested in the bone by a number of related lesions. These are degrees of eburnation (polishing), pitting in the joint surface and subarticular cyst formation, together with osteophytes on the margins of the joint. The disease leads to pain, stiffness and immobility within the affected joint.

At Spong Hill, there are 361 affected joint groups. That is, 16.6% of the adult population had osteoarthritis in one group of joints, and 3.6% of adults had osteoarthritis in two or more groups of joints; forty-two in two joint groups, five in three joint groups, four in four joint groups and one in five joint groups (Plates XX–XXVIII).

The high percentage of spinal joints affected (72.6% of the lesions) may be biased as a consequence of the loss of other osteoarthritic joints during the cremation process as outlined above. The structure of the dorsal vertebral processes does not include as much spongy bone as other synovial joints, which would render them more resistant to destruction under the pressures of cremation than other joints chronically affected by the disease. However, higher spinal involvement is usually noted in palaeopathological studies. The prevalence of all joint change (predominantly osteophytes) in the Saxon-Medieval period has been assessed as two-thirds spinal and one-third peripheral involvement in adults (Juliet Rogers 1988, pers.comm.). Wells (Wells and Cayton 1980) calculated a 60% occurrence of spinal osteoarthritis in his report on North Elmham Park, with about 50% of individuals showing costo-vertebral involvement, 14.0% foot, closely followed by the hip, shoulder, knee and elbow.

The frequency of lesions within the vertebrae at Spong Hill is very similar to that noted by Wells at North Elmham Park where the cervical vertebrae were most affected and the lumbar least affected. Cervical osteoarthritis is very common today, with most individuals over fifty years showing some lesions (Adams 1986). The thoracic and lumbar vertebrae are commonly affected in those used to heavy work.

Degenerative disc disease develops under the same influences of stress, ageing, chemical change, *etc.*, as with osteoarthritis. The intervertebral disc will wear and lose its elasticity (hence the apparent loss of height with age) and there may be eventual rupture with leakage of the fluid, resulting in the formation of small pits in the surface

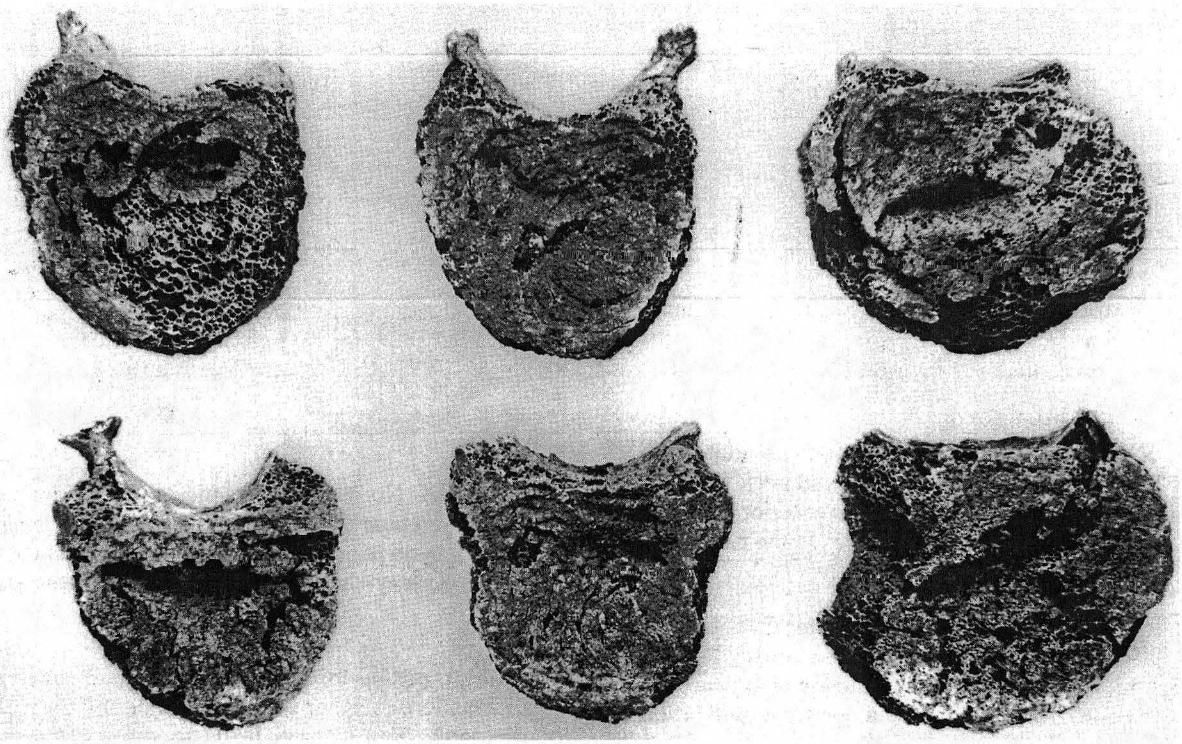


Plate XXX Schmorl's nodes: no.2666, group of six thoracic vertebrae with Schmorl's nodes of various sizes in either the superior or inferior body surfaces.

of the vertebrae. The position and amount of pitting will depend on the position and extent of the stress within the disc. The greatest mechanical stress in the vertebrae tends to be on the anterior portion, hence pitting and osteophyte formation will usually commence here.

15.2% of the adults at Spong Hill had some degree of disc degeneration:

cervical 98 lesions (44.3%)
thoracic 81 lesions (36.7%)
lumbar 31 lesions (14.0%)
sacral 11 lesions (5.0%)

In contrast with the occurrence of osteophytes in the spine, the cervical region, not the thoracic, shows the greatest number of lesions, which corresponds with the percentage distribution of osteoarthritis in the spine (Plate XXIXa).

Schmorl's nodes result from herniation of the intervertebral disc, allowing the nucleus pulposus to protrude into the body of the adjacent vertebra. The effect on the bone is to produce a cavity, groove or impression in the surface of the vertebra.

Thirty-nine (2.7%) adults at Spong Hill have Schmorl's nodes in one or more vertebrae. The thoracic and lumbar/1st sacral vertebra have equal numbers of lesions, with only one node noted in the cervical region (Plate XXIXb). Often there is multiple involvement of the vertebrae in one group, as with the younger mature male no. 2666 (Plate XXX), and occasionally, both lumbar and thoracic groups are affected.

cervical 1 lesion (2.6%)
thoracic 19 lesions (48.7%)
lumbar 14 lesions (35.9%)
1st sacral 5 lesions (12.8%)

Slight to moderate ossification of the anterior longitudinal ligament in the spine was noted in seven individuals at Spong Hill. The thoracic vertebrae were affected in six individuals. Such *hyperostosis* may occur in response to a number of diseases, notably ankylosing spondylitis and diffuse idiopathic skeletal hyperostosis (Resnick *et al* 1975, Resnick and Niwayama 1976, Rogers *et al* 1985). Incomplete skeletal recovery makes diagnosis impossible in these cases, as it cannot be ascertained either how far the hyperostosis in the spine extended or if other skeletal areas were affected. No hyperostosis was noted in other areas of the skeleton which were present and where recorded in the spine the ossification was not severe.

Infectious diseases
(Plates XXXI–XXXIII)

There are two types of *tuberculosis* which may affect humans, human and bovine. The differences are largely environmental and have been well outlined by Manchester (1983, 1984). Bovine T.B. may have been the predominant form until the onset of mass urbanisation in Britain.

Bovine T.B. may enter the system via ingestion of either infected milk or meat. The stomach and bones are the sites commonly affected, though the incubation period may be years. Primary foci develop in the intestinal wall and mesenteric lymph nodes, (for details of development and spread, see Ortner and Putschar 1985). The disease spreads via the blood stream creating secondary lesions elsewhere. Only in about 5–10% of T.B. cases are the bones affected, and the spine is the major site of infection (25–50% of cases). The infection affects the vertebral body either directly, through the adjacent disc or by tracking along the anterior ligaments (Adams 1986). The lesion created is characteristically destructive and infective, and may eventually lead to the anterior collapse of the vertebra. There may be ossification of the posterior

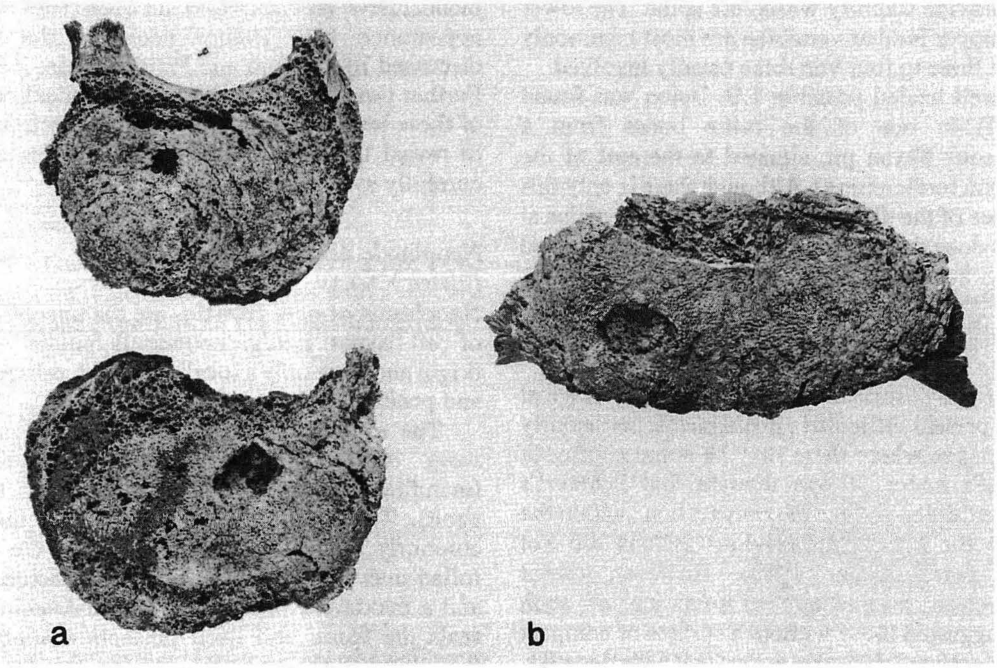


Plate XXXII Schmorl's nodes? and possible tuberculous lesion. a) Two lumbar vertebrae, no. 2709, interior (top) and superior surfaces with corresponding destructive lesions, no sclerosis, spongiosa exposed within the lesions. Schmorl's nodes? or possible tuberculosis lesions? b) First sacral vertebra, superior surface, no. 1825. Destructive lesion with new bone over surrounding surface, possible tuberculosis.

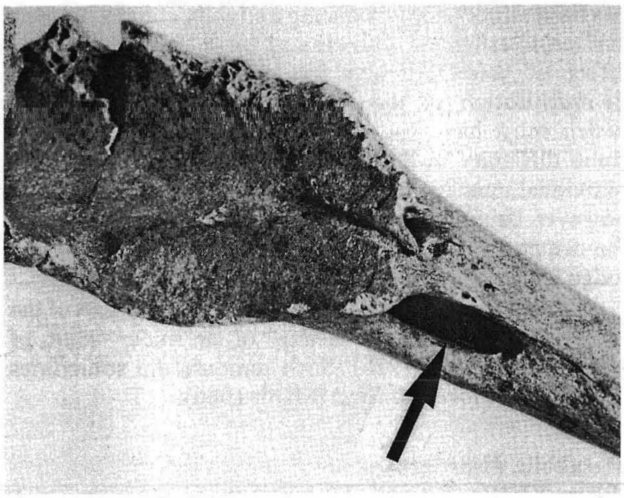


Plate XXXI Cattle vertebra (unburnt) from a contemporaneous Saxon pit to the east of the cemetery. Showing a large, well healed lytic lesion in the spinal process, suggestive of tuberculosis.

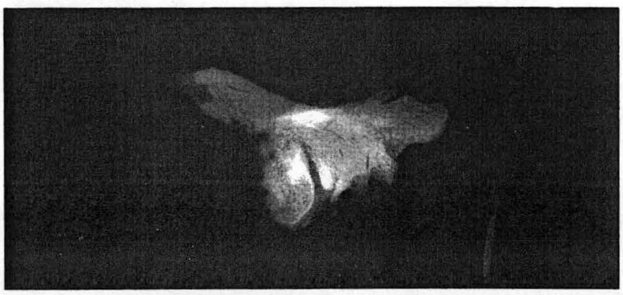


Plate XXXIV X-ray of ivory osteoma (benign neoplasm) in the mandibular fossa of the left temporal, no. 2376 (see Plate XXXV). The osteoma is unattached in the dorsal (right) portion, being joined to the temporal bone in the anterior superior position.

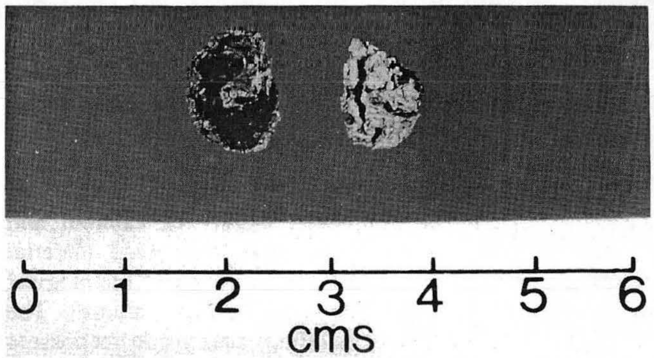


Plate XXXIII Probable calcified lymph nodes from cremations 1419 and 1420.

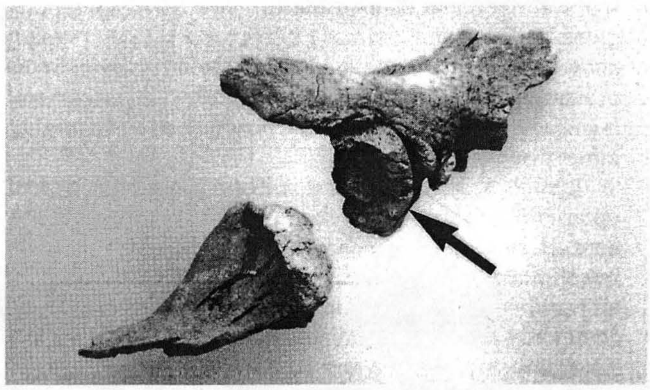


Plate XXXV No.2376, left mandibular condyle and temporal bone. There is an osteoma (arrowed) across the mandibular fossa with the postglenoid tubercle and external auditory meatus visible to the rear (right).

ligament to provide stability within the spine. The lower thoracic and upper lumbar vertebrae are most commonly affected, with three to four vertebrae usually involved.

A large, well healed possible T.B. lesion was found (Plate XXXI) in one of the cattle bones from a contemporaneous Saxon pit, situated to the east of the cemetery (Bond forthcoming). Although there is only this one appearance of the disease within the cattle remains at Spong Hill, it does show that there were possibly infected animals in the herds being kept by the population using the cemetery. Possible T.B. lesions within the human bone were limited to the spine and presented in the form of what are believed to be calcified lymph nodes.

Vertebral body surface lesions in archaeological material may present difficulties in diagnosis, particularly in the early stages where there may be some confusion with Schmorl's nodes. It was thought that Schmorl's nodes would exhibit a surface of compact bone within the lesion, while the similar tuberculous lesions did not (Manchester pers. comm. 1989). However, recent scanning electron microscopy examination of such lesions has suggested those without a surface of compact bone may be active Schmorl's nodes (Manchester pers. comm. 1990). There is only one lesion in the Spong Hill material which may be diagnosed as possibly tuberculosis (Manchester pers. comm. 1990). Plate XXXIIb shows a first sacral vertebra from an older mature male (no. 1825). There is a destructive lesion, 10.0×7.0mm, 3mm deep, with exposed trabeculae, and a thin covering of surface new bone across the adjacent surface.

Three calcined masses were recovered from three separate cremations: nos. 1419, 1420 and 2401, all mature/older males. Each mass was roughly the same size, about 12×10×7mm, and had the appearance of compact, osseous material which had been cremated (Plate XXXIII). The outer surface was white and deeply fissured, the internal portion of the mass was blue/grey as from incomplete combustion. Initial x-ray fluorescence showed the masses to be composed largely of calcium and phosphate oxides, that is, cremated osseous material (apatite) These objects have no organised histological structure (Garland, Appendix III, this volume). The masses are some form of calcified tissue yet do not possess the layered structure usually presented by renal, bladder (Streitz *et al* 1981, El-Najjar *et al* 1985 and Steinbock 1989a) or gall stones (see below). The description of size, shape and mineral content corresponds closely with that given by Baud and Kramar (1991) for a calcified lymph node found in a collective burial at Dolmen des Peireres in France: 'a reniform mass (12×8mm) with a peripheral lamellar capsule enclosing two rounded nodules ... highly mineralised.'

Lymph nodes calcify as a uniform process dependent upon blood supply and hence present no organised internal structure (Manchester 1989, pers.comm.). The lymph nodes are one of the primary areas of infection in tuberculosis (see above) and their calcification is most commonly as a result of this disease. They may also have a parasitic origin (Baud and Kramar 1991).

Thirty-six individuals were recorded as having destructive lesions in vertebral body surfaces. These lesions are most likely to be Schmorl's nodes. There was no sign of any associated surface new bone as with no. 1825, but there were some aspects of the size, shape and structure of the lesions which made this diagnosis inconclusive (see above). One bore close similarities in appearance with lesions noted in the second case discussed by Stirland and Waldron from Ashton (1990). Further time and resources could be spent on assessment of these lesions, including scanning electron microscopy to reveal their true significance, but this option is not currently available.

Neoplastic disease
(Plates XXXIV, XXXV)

Neoplasms or new growths, are the uncontrolled growth of cell tissues. Benign neoplasms remain at their site of origin and have only a localised effect, related to their size and position.

The elderly female, no. 2376, has a long-standing *ivory osteoma*, across the left mandibular fossa (mandibular condyle articular surface in the temporal vault). The growth is attached to the temporal bone anteriorly (see X-ray, Plate XXXIV), the edges being rolled-over and free posteriorly. 15mm across, 8mm deep, and a maximum of 3mm thick, the osteoma effectively seals the fossa, and itself presents a slightly concave, though uneven, articular surface for the mandibular condyle (Plate XXXV). The long-term presence of the osteoma is demonstrated by the changes which have occurred to the mandibular condyle. There is flattening of the head, forming a 9mm anterio-posterior surface, with 2.5mm of osteophytes along the anterior margin. The head has been remodelled, producing a slightly convex, uneven surface, to articulate with the surface of the osteoma. The effect of this particular lesion would have been a de-stabilisation of the left tempero-mandibular joint, which must have caused considerable discomfort and some difficulty in the mastication of tough foods. The individual must have adjusted to her situation fairly well, however, being one of the oldest individuals identified in the cemetery and, incidentally, one of the wealthiest to judge from her grave-goods.

The only other osteoma noted is in the outer part of the right external auditory meatus of an older adult of unknown sex (no. 1975). Such tumours are sometimes referred to as *tori auditivus* (Mann 1986).

Metabolic disorders
(Plates XVIIIa, XXXVI, XXXVII)

Cribra orbitalia or orbital osteoporosity, produces 'sieve-like' pitting in the roof of one or both orbits. There is ongoing discussion as to the cause of this defect, but it has been thought by some workers to be the result of anaemia (Manchester 1983). The condition was found in only three individuals in the Spong Hill group, two infants (*e.g.* Plate XVIIIa) and one adult female. In none of these cases was the condition severe.

Gall stones or calculi may develop in the gall-bladder or bile ducts. There are four major types, which vary in constituents and form (Steinbock 1989b). Precisely why they develop is not fully understood, but three major factors are 'abnormality in composition of bile, biliary stasis and gallbladder infection' (Steinbock 1989b), which are affected by 'dietary, genetic and hormonal factors'. There is an increasing prevalence with age. The stone develops from a nucleus, and builds up in layers in a similar way to a pearl in an oyster. It may be a few millimetres to 5cm in diameter, round in shape or 'faceted' as a result of stones clustering (Steinbock 1989).

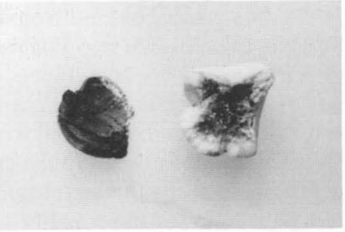


Plate XXXVI Gall stones: exterior view of a gall stone fragment from no. 1259 (left) compared with a modern unburnt gall stone (right). Note the lobulated surfaces.

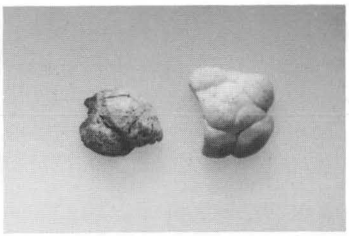


Plate XXXVII Gall stones; interior view of a gall stone fragment from no. 1259 (left) compared with a modern unburnt gall stone (right).

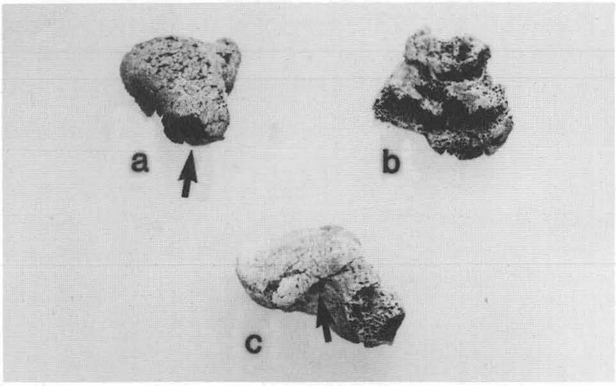


Plate XXXIX Cysts: a) no. 2016 and b) No.1116 show a single and gross destructive lesions respectively in the distal heads of the ulnae. c) No. 2453, shows a solitary bone cyst in the scaphoid carpal bone.

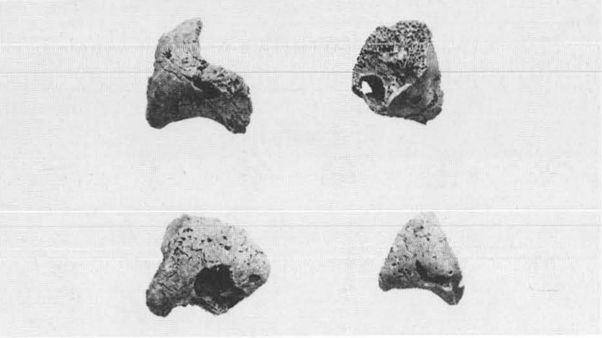


Plate XXXVIII Solitary bone cysts: nos 2805 (top left), 2345 (top right), 1801 (bottom left) and 2999. All lunate carpal bones.

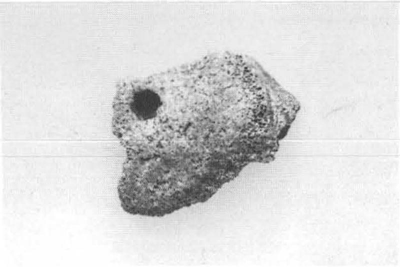


Plate XL No. 2551, humeral head of an immature individual with a deep central cyst

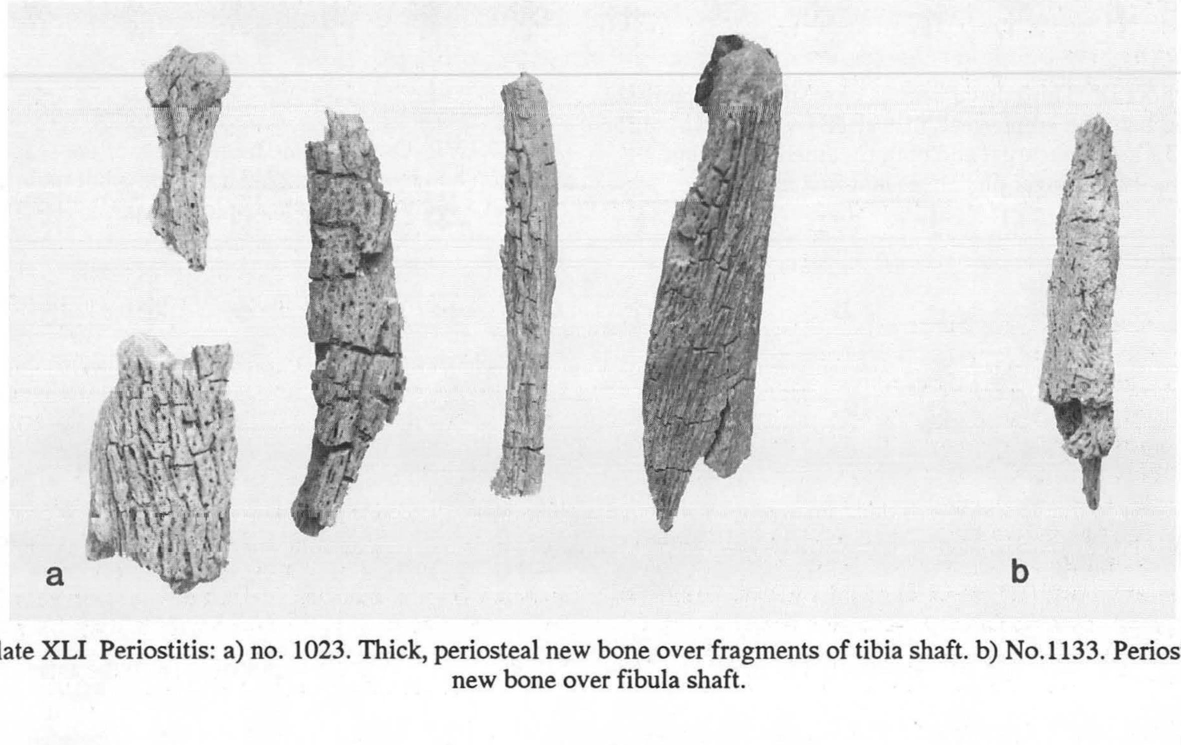


Plate XLI Periostitis: a) no. 1023. Thick, periosteal new bone over fragments of tibia shaft. b) No.1133. Periosteal new bone over fibula shaft.

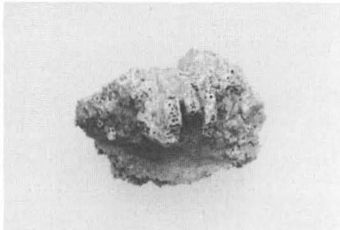


Plate XLII No. 2930, fragment of the anterior superior portion of the patella showing bony 'spurs' (exostoses) at the enthesis.

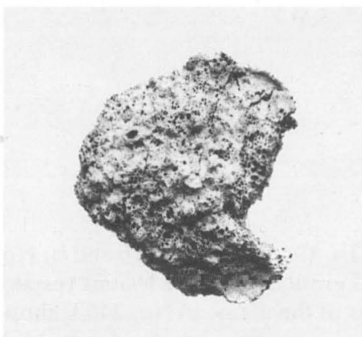


Plate XLIII No. 2563. A thoracic vertebral body with gross proliferative and destructive changes to the surface suggestive of infection.

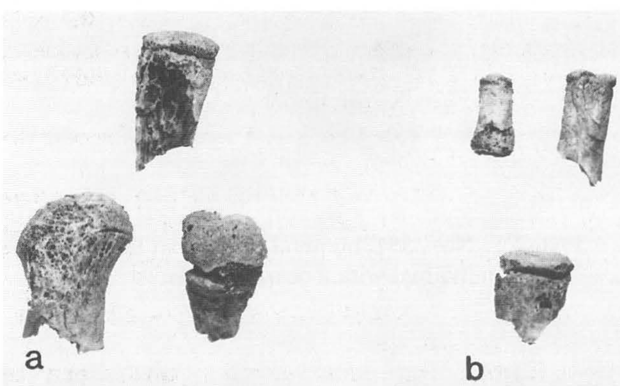


Plate XLIV Third distal centres of ossification, partly fused but with epiphyseal lines clearly visible in a) no. 2973, first metacarpal and both first metatarsals and b) no. 1409, finger phalanges and first metacarpal.

Part of a gall stone was recovered from cremation no. 1259, an older adult, of unknown sex. The fragment shows a white outer surface, with a blue/black, incompletely oxidized, inner one. The lobulated structure of the outer surface is clear, as is the layered internal structure (Plates XXXVI and XXXVII). Unfortunately the stone was seen too late in the project to allow the histological analysis to be included in this volume. It probably represents the remains of a mixed stone (the most common type), though it may possibly be a combination or pigmented stone (Steinbock 1989).

Miscellaneous lesions
(Plates XXXVIII–XLIII)
Solitary bone cysts are miscellaneous lesions which occur mostly in the long bones of immature individuals, and occasionally in adult carpal bones, especially the scaphoid

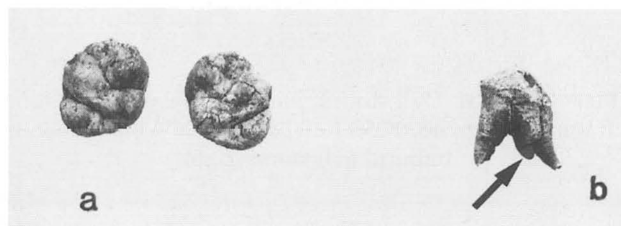


Plate XLVI No. 2396 (left), a pair of unerupted, maxillary first molar crowns with two accessory cusps. No. 3309 (right), maxillary third molar tooth roots with four branches.

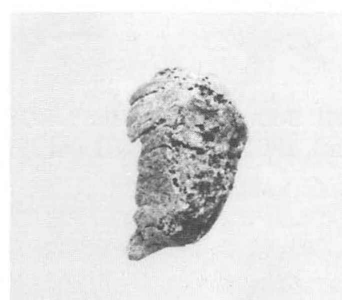


Plate XLVII Os acromiale (non-fusion of the scapula acromion epiphysis). No. 2743 a mature adult male with meso-acromion.

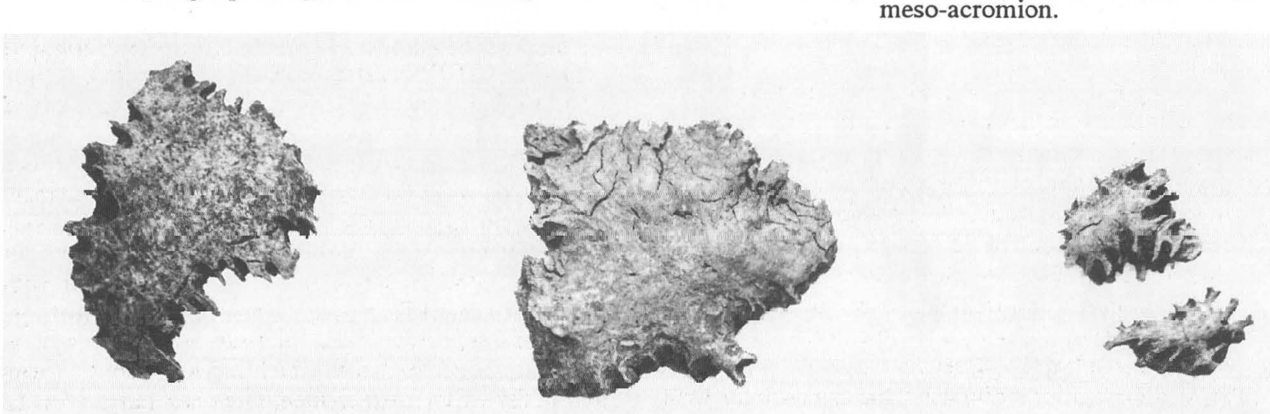


Plate XLV Wormian bones from (left to right) nos 2684, 2201 and 3241. No. 2201 is probably from the asterion.

and lunate (Adams 1986). A single cyst will often cause no symptoms, but may weaken the bone and lead to pathological fracture.

There are fifteen diagnosed solitary bone cysts in the carpal bones of adults at Spong Hill, ten of which are in the lunate and three in the scaphoid; the only other carpals affected are one capitate and one trapezoid (Plates XXXVIII and XXXIX).

Thirty-four other miscellaneous cysts/destructive lesions were recorded within various bones. Lesions were noted predominatly in the distal ulna (20.6% of lesions). In all these cases, no other associated lesions were present to aid diagnosis. A cyst may occur in a number of diseases, and in these circumstances, it was considered inappropriate to offer any diagnosis (Plates XXXIX and XL).

Seven individuals at Spong Hill show exuberant *periosteal reaction* in one or more bones. Infection of the periosteum (the membrane surrounding living bone) may occur in reaction to a number of diseases or events such as osteomyelitis, where pathogenic infection may be carried through the blood stream from elsewhere in the body, or be introduced directly to the bone as a result of trauma. Superficial soft tissue trauma with subsequent long-term infection may also eventually lead to infection of the bone periosteum. None of the individuals with periostitis at Spong Hill had any other associated lesions to support a diagnosis.

All except two of the individuals were adult, four males and two females, with one subadult and one juvenile. Two of the males have lesions in both upper and lower limb bones, one male has lesions in both the tibia and the fibula shaft. The two females have lesions in the ulna and the metacarpal. The tibia is particularly vulnerable to periosteal reaction from trauma as there is little surrounding protective tissue, especially in the shin area, and it is also particularly prone to infection via the blood stream (Steinbock 1976). Plate XLI shows thick, periosteal new bone (giving the appearance of an almond-nut shell as a result of cremation), over fragments of tibia (no. 1023) and fibula (no. 1133) shafts. In both these cases, the new bone was several millimetres thick and covered extensive areas of the shafts.

Exostoses are new bone growths, often 'spurs' of bone, which may form at entheses and syndesmoses (tendon and ligament insertions). They may develop in response to age related stress (long-term persistent use of various muscle groups), trauma, or in association with a disease such as diffuse idiopathic skeletal hyperostosis (Resnick *et al* 1975).

At Spong Hill the rectus femoris attachment for the quadriceps tendon in the patella and the mass of dorsal attachments, particularly the glutimus maximus, of the femur, most commonly show exostoses, each apparent in eleven individuals (Plate XLII). Other lesions were noted in: the flexor digitorum muscles in the finger phalanges, six individuals; the stomach and spinal muscle attachments in the innominates, five individuals; the dorsal interosseous ligaments of the metatarsals, four individuals; the anterior ligament in the lower thoracic and lumbar vertebrae, four individuals; the soleus in the tibia, three individuals; also two each in the radius, humerus and the axis (odontoid), and single occurrences in the ulna, rib and foot phalanx.

No. 1804, an older female, has an odontoid process with a malformed apex presenting a 'squashed-in' appearance and an uneven, remodelled surface. The apex of the odontoid is the point of attachment for the apical ligament, a rudimentary disc, and damage to the ligament could cause resorption of the process (Anderson 1986). It may be that some trauma has occurred in this case, resulting in partial resorption. The destructive lesion at the site of attachment in the odontoid of no. 2495 may also be a consequence of trauma in the ligament, leading to gross, secondary osteoarthritis in the joint, or a direct result of osteoarthritis.

Trauma

Trauma may be of a most minor type, leaving only a bruise, or it may be fatal. It is one of the few *acute* changes which occur to human bodies which leaves a mark on the skeleton, and it is therefore one of the few instances where a palaeopathologist may be able to diagnose cause of death. However, the majority of every day injuries affect only the soft tissue and therefore pass undetected.

Any fatal or gross traumatic changes which may have been present in the cremated skeletal remains from Spong Hill have passed unnoticed. The total absence of any signs of fracture in any of the bones is somewhat suspicious. In an agricultural community there are bound to be accidents. Fractures of the radius and ulna, clavicle, and the tibia and fibula, are amongst the common fractures recorded in skeletal collections from this period (Manchester 1983). The absence of any fractured bones at Spong Hill is probably because of the cremation process (see above). Direct evidence of fracture is not, however, the only manifestation of trauma one might expect to see. Indeed, several of the after-effects of trauma have already been outlined in preceding sections of this chapter:

a) Anterior tooth loss in consequence of a blow to the face (see dental disease).

b) Osteoarthritis may occur secondary to trauma especially where it is present in the joints of the upper limbs *e.g.* the possible dislocated shoulder of no. 2403 (Plates XXVI–XXVIII).

c) Some of the periostitis noted in the long bones may have resulted from trauma.

d) Trauma in the muscles and ligaments may be expressed as exostoses at the entheses and syndesmoses.

II. Morphological variations

(Plates XLIV–XLVII)

Non-metric traits are not pathological, they are variations in the form of the skeleton. However, the lack of any causative factors other than hereditary ones for some of these traits has been questioned in recent years.

The most common variation noted at Spong Hill is a *third centre of ossification* in the distal first metatarsal, first metacarpal and, less frequently, finger phalanges. These bones usually develop from two centres of ossification, the proximal epiphysis and the shaft with head, these centres fusing together around 18 years of age. In some cases, however, a third centre will be present, at the distal end of the bone, which fuses at about 5 years (but, in the writer's experience, there is a range of 4–12 years). The variation may only be seen, therefore, in the bones of infants and juveniles, which probably explains the paucity of recorded occurrences in the archaeological record (Warwick 1986). The small bones of the hands and feet in this age group are frequently subject to poor recovery on archaeological sites.

It is perhaps inaccurate to say two centres of ossification are 'normal' for the development of the first metacarpals and metatarsals, since a third centre of ossification is reported to occur in a high percentage of individuals. A study reported in 1939 (Weddell) of 200 sets of metacarpals and metatarsals of children aged 4–8 years, found 'definite double epiphyses and well-marked pseudo-epiphyses' in 80% of first metacarpals and 67% first metatarsals. Third centres were also noted in the second (50%), third and fourth (6%) and fifth (50%) metacarpals, but no other metatarsals. At Spong Hill, 70% of the immature individuals, where the relevant bones were present, show the presence of a third centre of ossification (Plate XLIV). This figure would fit the 'normal' occurrence of the 'variation' in a modern population. (A distinction was not made at the time of analysis between 'epiphyses' and 'pseudo-epiphyses').

A third distal centre of ossification in the finger phalanges is even less well-documented and unfortunately was not included in Dr Weddell's study. Four of the immature individuals at Spong Hill had a third distal centre of ossification in one or more finger phalanges (Plate XLIVb). Three of these individuals also show a third centre in the first metacarpal/tarsal.

Wormian bones are extra sutural bones within the vault. In cremated material it is not always possible to locate the exact position the bone originally held. These extra bones have always been considered morphological variations but recently environmental pressures such as possible parturition trauma have been suggested as well (Stirland 1990, pers. comm.) (Plate XLV).

Variations in the forms of *tooth crowns and roots* are generally accepted as the most firmly based genetic variations. The maxillary third molar is subject to more variation than any other tooth. Apart from variation in shape (usually 'squashed') and one case of an accessory cusp, most variations in this tooth in the Spong Hill collection are in the roots. There are five instances of maxillary third molars with accessory roots. The mandibular third molar shows greater variation in the crown than the maxillary, there being five crowns with either three, five, six or more cusps (Plate XLVIa). Other molar teeth show rarer variations in numbers of cusps and the presence of enamel pearls. One maxillary first molar has the now rare variation of a small extra root (Plate XLVIb), the 'radix paramolaris' (Van Beek 1983). There are four cases of congenital absence of the third molar and one of absence of the second maxillary molar. There is also the rare molarisation of a maxillary second premolar, with a distopalatal accessory cusp.

Mandibular tori are small, bony protuberances, found on the inner surface of the mandibular body, usually in the premolar/molar area. Only nine of these were noted in the Spong Hill material, all fairly small.

Metopism is retention of the frontal suture, which usually fuses within the first two years of life. Nine Spong Hill individuals show the presence of this suture.

An *accessory mastoid process* may develop behind the main process. This is usually much smaller and less prominent than the mastoid process proper. Three were noted in the Spong Hill material.

Os acromiale is the non-fusion of one or more of the several centres of ossification, at the free end of the acromion of the scapula. This is generally regarded as a developmental defect, although recent work on material from the Mary Rose suggests environmental factors may be involved (Stirland 1984). There are three instances of os acromiale in the Spong Hill material, two pre- or meso-acromion, and one pre-acromion. All are mature/older adults, one female, one male (Plate XLVII) and one unsexed.

Anterior calcaneal double facet is when the mid- and anterior talar surfaces of the calcaneum present as a double facet. This is seen only once in the Spong Hill material (no. 3024), bi-laterally.

Allen's fossa is a depression with exposed trabeculae located near the anterior superior margin of the femoral neck, close to the border of the head (Finnegan 1978). This occurs only once in the Spong Hill material, no. 2796. There is, again, some doubt whether this really is a developmental defect, or an acquired one.

III. Comment

The pathology of the Spong Hill cremated bone appears normal for a cemetery belonging to an agricultural community. The apparent gaps in the record are only those to be expected when dealing with cremated material.

The rare recovery of the three probable calcified lymph nodes and cremated gall stone fragment serves to illustrate the need for careful examination of cremated remains, and for the careful excavation and recovery of skeletal remains generally, by the archaeologist.

Chapter 8. Conclusions

I. Spong Hill

A total of 2284 individuals have been identified from the cremated remains at Spong Hill, but the actual number originally deposited within the cemetery is likely to have been near to, and possibly in excess of, 3000. The cemetery seems likely to have served a fairly large area, probably taking in small villages and isolated farmsteads. It has been calculated (in the absence of phasing) that the population using the cemetery is likely to have been in the region of 446–768 individuals at any one time in the 150–200 years the cemetery was in use.

Individuals of all ages and both sexes qualified for the same rite of cremation. Cremation of the deceased seems to have taken place near the home rather than at the cemetery, where they were likely to have been conducted by the 'family'. There are indications that the same pyre sites were at least sometimes used more than once, but they were usually well cleared of previous pyre debris beforehand. Evidence suggests that the deceased was placed supine and extended on top of a carefully constructed pyre of logs with brushwood infill.

Grave-goods, some of which were indicative of the deceased person's sex, were frequently attached to the body, indicating that they were dressed. Other grave-goods or offerings included food or drink, the latter probably contained within pottery vessels, though containers of organic material were no doubt also used. Food offerings of meat usually included the whole dismembered carcass of the animal, though some, like 'suckling pig,' were whole, and others were just joints of meat (sheep only). An individual may also have had their horse or dog killed and placed on the pyre with them. The grave-goods of all types probably indicate status, which may be in terms of age, sex, wealth, social position or the esteem in which they were held by relatives and friends.

There appears to have been little, if any, tending of the pyres after lighting, and it is probable that, apart from a vigil being kept, the pyre was not touched until it had burnt out or cooled down, possibly being left overnight. Very variable quantities of the bones were collected, a sample from each skeletal area, but never all the human remains. This may have been dictated by the inclination of the collector, by the 'status' of the deceased, or by incomplete combustion of the organic tissues of the body. As well as the human remains, animal bone and other grave-goods were also collected, and occasionally fragments of other pyre debris. The remains were placed in a pottery vessel or urn either directly, or perhaps after a lapse of time. Certainly other receptacles must have been used in some instances. The urns were more or less uniform in size except for those used for infants and juveniles, which are noticeably smaller than the rest.

The urns were taken to the cemetery at Spong Hill where they were buried upright in a pit, sometimes alone, sometimes in pairs or small groups. The close deposition of urns in the same pit, some of which were contemporaneous, others made at different times, implies a family relationship between those contained within the urns. The cemetery shows no organisation on the basis of age and sex as noted in some European cremation cemeteries of this period, and in the absence of any phasing appears most likely to have been arranged on a family basis.

The majority of cremations were of single individuals, but various admixtures of two individuals may occur, most frequently that of an adult with an immature individual. These dual cremations are most likely to have taken place on the same pyre, but it is possible that the cremations took place separately, the bones being mixed just prior to burial.

There are a number of pairs of urns, one each of which have been designated an 'animal accessory'. One vessel contains mostly human bone with a small quantity of animal bone, the other mostly animal bone with a small amount of human; the human and animal individuals being identical in both urns (sometimes the animal accessory vessel itself will contain no human bone). Horse is most frequently included. These deposits are the product of a single cremation, but one where it was felt appropriate to include much more of the animal remains than may have been put into a single vessel. No doubt this indicates the importance of the animal to the deceased.

It should be realised that there is a considerable amount of unseen and unrecognised wealth in cremations, and to consider them the 'poor man's' alternative to inhumation is to misunderstand them.

The pathology noted in the individuals at Spong Hill was far more than expected both in terms of quantity and diversity of lesions. Diagnosis was limited however, and much evidence must have been lost as a consequence of the cremation process and as a result of the incomplete collection of the remains. Two archaeologically rare lesions were recovered: a probable calcified lymph node was found in three cremations and a fragment of gall stone in one.

The ideology behind cremation as a rite may only be guessed at, but anthropological evidence suggests that fire was seen as a purifying element and possibly as a mode of freeing the spirit from earthly bonds. Ibn Fadlan (Foote and Wilson 1979) reported in 922AD, one of the Rus saying to him at a cremation 'You Arabs are stupid... because you take those you love and honour most and put them in the earth and the worms and earth devour them. We burn them in the blinking of an eyelid so that he goes to paradise at that very moment.' An after-life must have been believed in by the people using the Spong Hill cemetery, as is testified by the provision of clothing, personal ornaments, food, drink and even personal 'status' animals for the deceased. Although burial of the remains following cremation was often in elaborate vessels, care being taken to include fragments of all skeletal areas in the urns and at least parts of the various grave-goods, the prime importance appears to have been attached to the ritual of cremation.

Why the cemetery should have fallen out of use remains unknown, though many other Anglo-Saxon cemeteries end at a similar time and further phasing may help to clarify the situation. At present there is no indication of the size of the cemetery at the outset of its use, or when it was at the height of its use, or what size the population was at that time. It is not known whether it was just slowly phased out as appears to have happened at Süderbrarup (Wahl 1988) or abruptly went out of use.

II. Cremation studies

The very size of the cemetery at Spong Hill has led to it being given more comprehensive treatment than is perhaps feasible in smaller, less complete cemeteries. Although not technically a research project the potential has been exploited to a certain extent and the possibilities for profitable future work outlined. In the field of palaeopathology the old adage of cremations being a waste of time will hopefully have been revised. It is hoped that the information it has been possible to extract from the Spong Hill cremations may serve to encourage all areas of archaeology to approach cremations generally with a less dismissive attitude.

III. Future work

The full potential of the cemetery at Spong Hill is far from being realised. Excavation of the adjacent settlement would answer questions and link the cemetery to the surrounding area rather than leaving it in such unexplained isolation. Equally, further investigation of the known nearby contemporaneous cemeteries might help to put Spong Hill in its proper local context. The excavation/examination of another large Saxon cremation cemetery (the cremated bones included), though a daunting prospect, would help clarify whether the apparent divergences noted at Spong Hill are real or not.

The cremated bone from Spong Hill presents several further possibilities. Some of the pathological lesions noted would benefit from further attention. The more detailed analysis of degree of burning, quantity of bone (volume of the urn used) and possibly the inclusion of the bones of large animals are aspects the writer hopes to research profitably in the future.

Appendix I: The cremated animal bone
by Julie M. Bond

I. Introduction
(Table 2, Appendix V, microfiche)

As work began on the re-examination of the cremations from Spong Hill, it became obvious that in many cases a proportion of the cremated bone had animal, not human origins. It is to the credit of J.I. McKinley and the other workers on this project that this material was not only recognised, but that the decision was made to commission a full and systematic examination of the animal bone component of the cremations by an archaeozoologist, a step which to the best of the author's knowledge has not been undertaken on such a large amount of Anglo-Saxon material from this country. Although other workers have noted the presence of animal bone in Anglo-Saxon cremations, and in some cases attempted a level of interpretation (*e.g.* Wells 1960, Wilkinson 1980) the large amount of bone from the Spong Hill cremations and the regularity of its occurrence (734 cremations produced material identifiable to species or species-size and 46.4% of the cremations contained fragments which, although not always definitely attributable, were probably of animal origin) makes Spong Hill unique in the corpus of Anglo-Saxon cremation cemeteries so far examined.

II. Conditions of preservation

The material in general was extremely fragmentary, the bones of larger animals suffering more noticeably than those of smaller animals such as sheep and dog. In the case of these larger animals, the articular surfaces of long bones were in most instances badly fragmented and consequently much more difficult to identify; a proximal humerus might, for example, be broken into twenty or more fragments, not all of which were present; a situation paralleled of course in the human bone, and discussed in Chapter 5, above. Since several species were frequently represented in one cremation, great care was taken over identification; it was felt that no assumptions whatsoever could safely be made about either the species or the bone elements present in these samples. This means that the proportion of unidentified versus identified fragments in this collection is thus even higher than is usual in archaeological material.

This also led to the use of two further categories: 'large ungulate' is used for those fragments of cattle or horse-sized bone which could not be further identified (this category mostly consists of long bone shaft and rib fragments, mandible fragments where there are no clues to be gained to identification from things such as tooth root impressions, and pieces of vertebral bodies too small for further identification). 'Sheep-size' is a similar category for the smaller animals, which might also include some goat, pig or dog material, for example rib or vertebral fragments. Even where only one animal such as horse was positively identified from a context, fragments of long bone, vertebra and rib which could not be securely identified as horse were placed in the 'large ungulate' category, since there are several cases where cattle and horse were represented in the same urn. It should also be noted that some urns contained only fragments identified as 'large ungulate', so that the number of horses and cattle represented in these urns must be even higher than that stated here.

III. Species represented

The range of species identified included horse, cattle, sheep/goat, pig, dog, fox, roe deer, red deer, bear, beaver, hare, domestic fowl, domestic goose and fish. There were also the bones of several other birds, including the terminal phalanges or 'claws' of a raptor which had been pierced for suspension, but which unfortunately cannot be further identified (D. Serjeantson pers. comm.). The distribution of species throughout the cremations is summarised in Chapter 3, Table 2.

Horse was by far the most common animal represented, occurring in 36.5% of the 622 contexts where animal bones could be identified to species (227 individuals). Sheep or goat were the next most common, represented in 27.3% of the contexts (170 individuals) although in three of these cases the bone was unburnt (see below). Cattle bones were definitely identified in just 12.9% of the contexts (80 instances) again by unburnt material in 11 of these cases. Pig was present in 84 instances (13.5%), twice as unburnt material. Dogs occurred in 24 contexts, 3.9% of the identified material, but representing at least 25 individuals. Bear third phalanges were recovered from 6 cremations and may well represent the remains of furs (see below). The two species of deer were identified only by the presence of unworked antler fragments.

No attempt is made here to allow for the effect on numbers of those cremations which may be represented by 'pairs' of urns and where an individual animal might be present in more than one urn (see Chapter 2 above, and the section on dogs, below).

Whatever else may be argued about the meaning and importance of the Spong Hill animal bone, it is not simply a reflection of the economic reality of Anglo-Saxon settlement in East Anglia; the report on the animal bone from the site of West Stow, for example, lists sheep as the most numerous animal in the record, followed by cattle and then pig (Crabtree 1985, 1989a and b). Compare this with the order of horse-sheep-pig-cattle from the cremations, showing, if proof were needed, that this material has a significance other than simply reflecting an animal's frequency in the economy. In this situation we are truly justified in bringing the probability of ritual significance into the argument.

IV. The relative survival of elements

There is a patterning in the cremated animal bone which seems to reflect the mechanical properties of the different bones under thermal stress, paralleling that noted by Calvin Wells in human bone (Wells 1960) and discussed in greater detail by McKinley in Chapter 5, above. Discussion of this patterning may save much time in identification for future workers on similar material, and also serve to explain many of the difficulties in separating natural from man-made patterns.

There is, as noted above, a marked difference in preservation between the bones of the larger and smaller animals, again presumably due to the different mechanical properties of the bone and differences in the distribution of the covering flesh and fat. From the skulls of the larger mammals, the most common identifiable elements are fragments of occipital condyle, mastoid and basion, as well as small areas of orbital margin (often distorted and unattributable to species). Of the teeth, only fragments of root are usually present, almost never whole or nearly whole teeth. Fragments of enamel were rarely recovered attached to teeth. The mandible rarely survives in identifiable fragments, unless pieces of the ramus or condyle or perhaps areas of mandible showing tooth impressions, are present.

Of the axis, pieces of the proximal articular margin and the central portion were the most frequent survivors.The scapula was occasionally represented by areas of the glenoid fossa and occasionally by fragments of blade identifiable to species. The proximal humerus tended to break up very badly and be virtually unidentifiable to species, although areas of humerus shaft could be identified to species. Of the ulna, the area of the proximal articulation was the most frequently identifiable. Fragments of the margin of the acetabulum of the pelvis survived and were identifiable to species, and the proximal articulation of the femur (the *caput*) tends to survive as several fragments.The proximal articulation of the tibia also tends to reduce to several pieces, one or two of which may be identifiable, as may some areas of shaft. Metapodia are similar, in that the denser areas of articulation may survive in a fragmentary state, whilst the shaft area is identifiable in a few cases.

The smaller carpal and tarsal bones seem to have a much better rate of survival than the larger ones which, although present, may be so fragmentary that they are difficult if not impossible to identify, whilst the sesamoids (especially the proximal sesamoids of horse) may survive whole, or nearly so. In first and second phalanges of both cattle and horse, proximal and distal articular fragments and some areas of shaft may be identifiable. The third phalanges of both cattle and horse may typically be identified by marginal areas of the articulation, by tiny fragments of bone margin and by areas of the plantar face. Vertebrae survive as articular areas and fragments of neural spine and centrum. Caudal vertebrae may survive virtually intact. Ribs are normally present as pieces of proximal articulation and comminuted areas of shaft. Ribs may also split in half and roll or fold along their length, appearing as half their original width.

Amongst the smaller mammals the pattern differs, as might be expected from the different mechanical properties of smaller bones and the differences in distribution of fat and flesh. The skull and tooth fragments which are identifiable are much the same, whilst the mandible itself seems to survive better. Some long bone areas, such as the distal tibia of sheep, survive almost intact. Phalanges may survive whole as may carpals and tarsals but presumably their small size when shrunken by heat means that many have been missed when the bones were collected from the pyre. For the most part, the bones of smaller mammals seem to be more heavily burnt than the larger mammals, with less variation in colour (see Chapter 6).

It is worth noting that these differential modes of preservation may well introduce bias into the range of species recorded from a site; the relatively well-preserved bones of sheep, for example, may be readily noted by an excavator or by other specialists whereas the more fragmentary bones of large mammals may not be so obvious. Indeed as Wilkinson (1980) observes, it may not be possible to completely separate human and animal long bone fragments. This must be borne in mind when attempting comparison with some of the earliest reports of animal bone in cremations, where the material may never have been seen by an archaeozoologist.

V. Taphonomy

It is assumed, given the relative consistency of the species and animals represented, that for the most part the animal remains found in these cremations are largely the result of intentional deposition and firmly associated with the urn. There are a few instances where this can be shown not to be the case, and most of these involve unburnt bone. For example, it is noticeable that where unburnt teeth are found (*e.g.* 1986, 2032/2140, all cattle, and 2058 sheep/goat) there is rarely any other animal bone present from the same species. Tooth is in most conditions the toughest skeletal material, and it is possible that these fragments are residual or intrusive. Similarly, a few unburnt fragments of rodent bone have been identified (*e.g.* 2283, 2335) which are considered to be intrusive. It is not possible to say, of course, if some of the cremated fragments could not be residual from other cremations carried out at the same pyre site (see Chapter 6.I above).

VI. Whole animals or joints?

Whilst it may be taken for granted that the human remains in the urns usually represent whole bodies, the question of whether the animal remains in the cremations represent whole or half carcasses, joints or parts of joints, must be considered. This is no easy task, since the number of bone fragments identified per species may in some cases be in single figures, whilst the deposit may contain much more bone of animal origin identified only to large ungulate or sheep/pig size. Even when this material is taken into account it is clear that rarely, if ever, does the remaining bone amount to the total to be expected from the animal. It would appear that this is as much to do with cremation and post-cremation bone-gathering activities as with the parts of the animal present originally, as scrutiny of the body-parts representation tables makes clear (Appendix V). This aspect of the study will be discussed further under the separate species headings, but it is worth noting that in this, as in evidence for butchery practices, there are clear differences between species.

VII. Number of animals per cremation

Elucidation of the minimum number of bone elements present, and thus the minimum number of animals present from each species, is made very difficult indeed where the material is so fragmentary, collection before burial apparently not thorough, and identification based on such small areas. It seems, however, that in only one case, cremation 1725, is more than one animal of the same species (dog) definitely represented. Cremation 1725 is discussed at greater length below. In all other cases there is no evidence that more than one animal of each species is represented. Full records of the minimum numbers of bone elements per species in each cremation can be found in Appendix V (microfiche).

VIII. The animal remains

Horse

As mentioned above, horse is by far the most common animal found in the cremations (at least 227 individuals), an anomalous position in comparison with the identified material from other similar sites such as Elsham, Illington, Newark, Loveden and Millgate (Richards 1987, 125; Wilkinson 1980; Harman 1989). In considering this material, among the questions which may be asked are:

Are these whole animals or joints?
What evidence for dismemberment or butchery is present?
What is the evidence for ritual deposition?

There is good evidence within the West European tradition, for both the burial of whole horses with humans and for 'head and hoof' burials; for example, the later 9th-century graves from Birka (Gräslund 1980) and the head and hoof pits illustrated in Müller-Wille (1971). In the first instance, because of the fact that the more dense head and hoof bones survive and can be identified in cremated material, it might be thought that the Spong Hill horses are a variant of 'head and hoof' depositions, but as we have seen, this is a taphonomic rather than a human action. Although the fragmentary nature of the material means that it cannot be proved in all instances, the general trend of evidence at Spong Hill suggests that we are dealing with whole animals which have not been dismembered.

Close studies of the material and several significant pieces of evidence suggest that of the four main possibilities:

1. The presence of whole animals
2. The deposition of single joints
3. 'Head and hoof' burials
4. 'Token' bones

the horse bones from Spong Hill probably represent whole animals.

As mentioned above, in many cases there may be only one bone or a small number of bones identified from each context, and often these are cranial bones or fragments of lower leg. For example, 1024 and 1290 contain only sesamoids identifiable to horse and 1059 contains as identifiable only bones assignable to a single back leg. This might suggest the possibility of either 2 or 3 above, but these are the areas of the body which, in their human counterparts, are amongst those which Wells cites as being most frequently recognisable in cremations (Wells 1960 and see Chapter 5 above). Looking at some of the other contexts, bones are identified which would suggest that in these cases at least, more of the animal is present. If we consider not the tiny fragments of bone identified, but the areas of the body which they represent, we find that for instance, 1281 contains fragments of a horse cranium, pelvis and three legs, 1742 contains at least right and left front legs and the lower part of a back leg, 1421 has cranial (tooth) fragments and three lower legs, 1199 has cranial, mandible, pelvis, left back leg and one other lower leg present, and 2044 has cranial, mandible, left scapula, left front leg and part of a back leg.

When it is remembered that much of the long bone, rib and vertebral fragments which cannot be identified more closely than 'large ungulate' may also belong to these horses, it is much more likely that these are whole animals. The lack of butchery or skinning marks (see below) also suggests not offerings of heads and joints, but entire carcasses. It must be said, however, that study of the body-parts representation tables (Appendix V) shows that proportionately many more horse than cattle lower leg bones have been identified in the cremations. This may be a true reflection of the situation, or a result of the efficiency of identification of cremated fragments of horse phalange relative to cattle. Future studies will hopefully clarify this point.

It was considered that in cases where only proximal sesamoids of horse were found it was possible that these small compact bones might represent not parts of a missing carcass, but gaming pieces similar to those made from sheep astragali (see below). Unlike the sheep astragali known to be gaming pieces, none show knife marks associated with boning-out and the surfaces are uniformly fresh and unworn, unlike many of the astragali which show evidence of handling before cremation.

Butchery

There is only one possible example of butchery on the identified horse bone from Spong Hill: cremation 2778 contains a fragment of proximal femur (the *caput femoris*) showing a fracture which may possibly be a chop mark. If this is so, it could be due to dismemberment.The incidence is rather higher in other species (see below).

The lack of butchery marks on such a relatively large number of animals seems to preclude the idea that the horse bones are the remains of a 'ritual feast' or indeed any sort of preparation for consumption. This is a situation rather different from that found in the few horse bones recovered from the settlement area at Spong Hill, which show evidence of dismemberment for consumption (Bond forthcoming).

The bones show a wide range of burning but only one is mostly unburnt; 2822 (a distal sesamoid) is only charred at the tip and the rest of the bones from this context show very variable degrees of cremation. When one considers the practicalities of arranging large animals on or around a pyre, this variability is perhaps not very surprising. Indeed, it might perhaps have been expected that more evidence of dismemberment would have been found because of these problems, a collection of joints being rather easier to arrange on a pyre without smothering it. It is interesting to note that in his description of a cremation among the Rus in the tenth century, the Arab writer Ibn Fadlan records that 'they took two horses, ran them until they sweated, then cut them to pieces with a sword and put them into the ship' (Brøndsted 1965, 301–5). Cattle and dogs, he records, were similarly treated, perhaps to avoid this problem.

Age at death

In theory, it ought to be possible to tie down the ages of individual animals from the urns quite precisely, since all fusion points should be present, and the bones are probably all from the same animal. As we have seen, this is not so simple. The teeth do not survive in any state which would allow ageing by eruption or tooth wear; selective gathering of bone means that in practice, only one or two fusion points may reasonably be expected to occur per cremation, whilst many have none. It is even more unfortunate that as we have seen, the bones which tend to survive are the bones of the lower leg, which fuse at a relatively early age (Silver 1969). This means that for the bulk of the population, even when fusion points are present, we can only say that the animals are over 9 or 13 months old. Figure 29 therefore consists of 'open ended' spreads of individual animals' ages, while Table 8 shows the number of fused and unfused bones from the population as a whole.

Taking the population as a whole, it can be seen that none of these animals are neonates or very immature, and only in three cases (1414, 2062, 2678) do we have evidence of death before the age of three to three and a half years, whilst in fourteen cases we know that the animals were definitely over the age of three years (Fig. 29). For the bulk of the population, we can only say that the animals are juveniles or adults, since the size and general lack of porosity of the bones indicates animals of young-adult or adult age. This would seem to suggest that their role in the cremations is very different from that of the cattle, sheep or pig, in all of which, even with far smaller numbers of individuals present, there are examples of neonates and young animals. Gräslund (1980) records a similar situation in the Viking period inhumation cemetery at Birka, Sweden, where no very young or very old horses were recovered (although this is based on the original notes and is partly anecdotal).

Sex and Stature

The very fragmentary nature of the material and the shrinkage due to cremation (Coy 1975) meant that it was not possible to assess either sex or stature for these animals.

Pathology

There are four mild examples of pathological lesions in the horse assemblage; interestingly, they are all of the same nature. 1332 contains a metatarsal and a fragment of another metapodial which both show exostoses around the proximal area of the shaft, but no involvement of the articular surfaces so far as can be determined from the surviving fragments. This is probably a condition known in modern horses as 'spavin'; the result of heavy strain on the joint capsule, and particularly common in draught animals (Baker and Brothwell 1980). Similar exostoses are also seen on fragments of metapodia from 2353 and 2928; 2353 in particular shows heavy exostoses and apparently some pitting on the articular surface. The horse in cremation 2767 shows evidence of mild exostosis around the proximal epiphysis, probably a related condition known as 'high ring bone'. It cannot be said, on this limited evidence and without evidence for older horses, whether this means that at least some of the animals at Spong Hill were work rather than riding beasts, as was claimed for some of the Birka horses (Gräslund 1980) but it does suggest the possibility.

		F	NF
9–12 months	Phal II Prox.	115	
13–15 months	Phal I Prox.	38	
15–18 months	Humerus Dist.	3	
15–18 months	Radius Prox.	2	
15–18 months	Metacarp. Dist.		
15–18 months	Metatars. Dist.		
15–18 months	Metapod. Dist.	29	
18–24 months	Scapula Dist.	1	
18–24 months	Pelvis (acetab.)	2	
18–24 months	Tibia Dist.	13	
36–42 months	Ulna Prox.		
36–42 months	Femur Prox.	3	2
36–42 months	Radius Dist.	5	
36–42 months	Humerus Prox.	3	1
36–42 months	Femur Dist.	3	
36–42 months	Tibia Prox.	2	

Table 8 Horse: fusion of elements (After Silver 1969).

Parallels

Horse has been identified in animal bone remains from cremation cemeteries at Elsham, Illington, Newark, Loveden and Millgate, although at none of these sites do they appear, as at Spong Hill, to be the most frequent animal. Indeed, Spong Hill seems so far to be unique in this respect in cremation cemeteries from Britain. Rather out of this general trend, but perhaps more interesting in terms of the assessment of status, is the report on cremated animal remains from the Sutton Hoo mounds. What the bone remains on the Anastasius dish in Mound 1 represented has never been satisfactorily determined, but Gejvall's report on the cremated bone from Mounds 3 and 4 records that both tumuli contained the remains of (male) human and horse, and that possibly a young female was also represented in Mound 4. Gejvall also considered that Mound 4 might contain the mandible of a dog, but was uncertain of the identification. (Gejvall 1975).

In Swedish cremation burials of the Vendel and Viking periods, horse bones are very common; mainly from men's graves, but also from women's (Gräslund 1980, 43). Five male graves of the seventh and eighth centuries at Helgö also contained the remains of horse (Gejvall and Persson 1970, Persson 1970). Gräslund considers the inhumations from 9th-century Birka, and the common finds of whole horses in the twenty chamber graves; sixteen were men's, three contained a man and a woman, and one a woman. Interestingly, she suggests that some of the animals were draught horses, because whilst some of the graves contained spurs or stirrups, others contained draught chains and horse collars. In two cases, these 'draught' animals came from the double graves, and Gräslund suggests that this may be because women of status at the time would ride in carriages rather than on horseback. This raises an intriguing question of a parallel with the possible presence of draught animals in the Spong Hill material.

Ritual significance?

Many authors have considered the possible ritual nature of deposits of horse bones, taking into account the cultic significance of 'head and hoof' deposits in bogs, where it seems the butchered remains of a ritual feast may have been thrown into a votive site (Todd 1975, 198). Other examples of heads and lower legs form part of Müller-Wille's study of horse burials, where he showed that one of the main concentrations was the area of NW Germany and the Netherlands settled by Frisians and Saxons (Müller-Wille 1971,181).

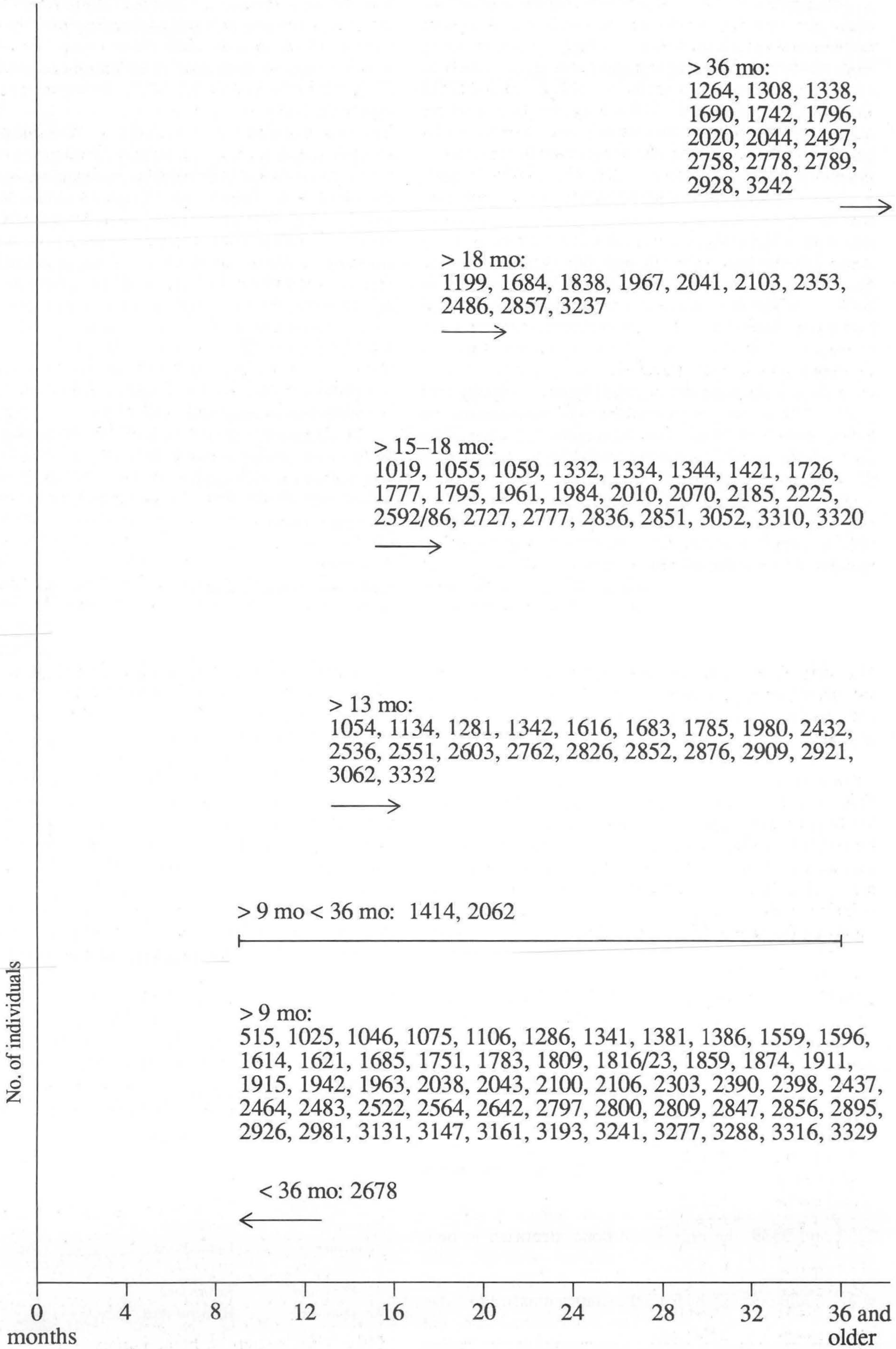


Figure 29 Horse: range of age at death (ageing as individuals). (Fusion ages after Silver 1969).

On the other hand, it would seem that some, if not all, of the Spong Hill horses represent whole carcasses with no evidence of dismemberment, which takes them away from ideas of the remains of ritual feasting, and closer to other grave deposits such as the Vendel, Helgö and Birka finds of a later age. Gräslund has suggested that the Birka horses may have been used to carry the corpses to the grave and then slaughtered, comparing this to Saami practice where a reindeer which has drawn a body becomes taboo (Gräslund 1980, 43). She also points to 8th-century Gotland picture stones showing the dead man riding into Valhalla. Müller (1984, 191) studying forty horse graves from the 5th and 6th centuries in the Elbe-Saale region, and finding that 80% of them were between 3–15 years of age at death and presumably still useful, concluded that both dogs and horses were probably personal property which had to be buried with the deceased.

The general impression gained from the Spong Hill material, then, might be that for whatever reason the horses were killed they were then cremated whole with their owners as symbols of his or her status, rather than sacrificed and ritually eaten or placed on the pyre as 'meat joints'. For purely practical reasons, it might not have been surprising to find that, as with Ibn Fadlan's account of the Rus cremation practices, the animals including the horses had been dismembered. This would not only make them easier to fit on or around the pyre, but would probably make cremation more efficient.

It is interesting to speculate on the effect at contemporary settlement sites of the removal of so many horses from the archaeological record, and on how this might affect the perceived structure of Anglo-Saxon economies. It is worth noting, in this respect, Crabtree's remark that horses are poorly represented in the Anglo-Saxon features at West Stow in comparison with coastal sites in the Anglo-Saxon homelands, such as Feddersen-Wierde (Crabtree 1989a and b). The practice of cremating horses with their owners would take out of circulation many animals which might otherwise ultimately become meat, hides and discarded or worked bone.

Cattle

As stated above, cattle seem to have been less well-represented in the Spong Hill cremations than horse, sheep or pig, occurring in 80 instances compared to 227 horse. In many of these cases too, the only identifiable fragments are cattle teeth, often unburnt, raising yet again the problem of possible residuality. In cremation 1986 and pits 2032/2140, 2363/2364/2366, 2526, 2607, 2704 and 3191, the only animal bone present at all consists of unburnt cattle tooth or fragments of unburnt enamel. It would therefore seem reasonable to discount these pieces as residual.

Similarly, although other animal bone is present in 2103 and 2339, the only cattle bone identified in both these contexts is unburnt tooth enamel (although 2103 also contains material identified only as large ungulate, which could possibly be from the same animal). 1753 also contains only cattle tooth and no other animal bone but this material is cremated. The situation is further complicated by instances such as the unburnt right humerus from 2325 which again is the only animal bone present but which could be the remains of an unburnt joint, and the single cattle carpal from 2146, which although burnt and showing no signs of working is rather worn, as if used as an amulet. It therefore seems likely that the actual minimum number of cattle present is below sixty.

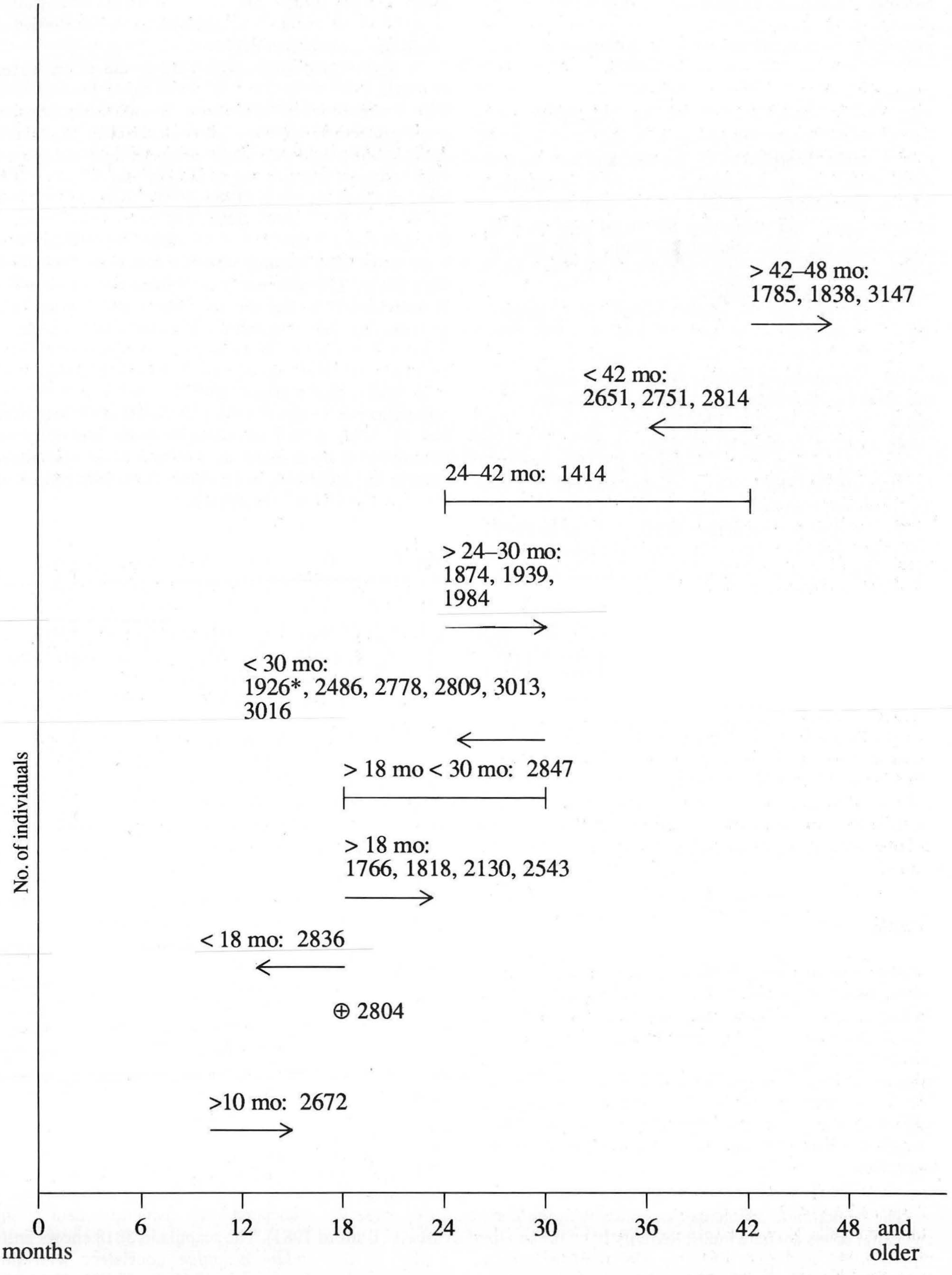
Age at Death
The cattle bone obviously suffers from the same problems outlined above for horse, with the added burden that there are far fewer individuals present. Nevertheless a glance at the illustration of age ranges (Table 9 and Fig. 30) shows that the pattern of deaths (so far as can be judged from this small sample) is very different from that of horse; the majority of cattle represented are young animals under three and a half years of age, perhaps mostly around the age of two and a half to three years. This is much closer to the pattern one would expect if these animals had been killed for meat. This impression is strengthened by the bones from 1963, 2732 and 2751, which although they do not provide fusion evidence, are all small porous bones probably from young juveniles.

There are some contexts which differ from this pattern; 2836 is an animal demonstrably younger than eighteen months, whilst 1926 appears to contain the bones of a very young calf. Three of the animals (1785, 1838, 3147) are over three and a half years of age.

Butchery
Only two definite cases of butchery on identified cattle bones are recorded, although some of the rib fragments merely identified as large ungulate show signs of knife marks or chopping (1825, 1835, 1924, 2299, 2430, 2666) as do two vertebral fragments (2615, 2758) which although recorded as large ungulate are more probably cattle than horse. The two definite examples of butchery on cattle bone are a pelvis fragment from 2672, which shows a knife mark on the edge of the acetabulum consistent with dismemberment of the carcass (see the discussion of butchery marks in Binford 1981, 138, table 4.04) and a lumbar vertebral fragment from 2727 which bears marks which would seem to indicate that it was chopped through longitudinally.

		F	NF
7–10 months	Pelvis (acetab.)	1	
10 months	Scapula Dist.	1	
18 months	Humerus Dist.	1	
18 months	Radius Prox.		
18 months	Phal I Prox.	4	1
18 months	Phal II Prox.	5	1
24–30 months	Metacarp. Dist.		
24–30 months	Tibia Dist.	2	
24–30 months	Metatars. Dist.		
24–30 months	Metapod. Dist.	5	4
36 months	Calcaneum		1
36 months	Femur Prox.		2
42–48 months	Ulna Prox.	1	1
42–48 months	Radius Dist.		
42–48 months	Humerus Prox.	1	
42–48 months	Femur Dist.	3	1
42–48 months	Tibia Prox.	1	

Table 9 Cattle: fusion of elements. (After Silver 1969).



Notes:

* 1926: Neonate/young calf (on bone size) (1963, 2732, 2751 – No fusion points present, but bones are immature).

Figure 30 Cattle: range of age at death (ageing as individuals). (Fusion ages after Silver 1969).

Pathology
None of the animals identified here showed any visible abnormalities, although with so few animals and the majority so young, this is perhaps to be expected.

Joints or animals?
The same problems were encountered in trying to answer this question as with the horse; with only fragments of certain bones identified in the burials, and with so little evidence of butchery, it is difficult to provide a satisfactory answer. The situation is also complicated by the presence of both horse and fragments identified only as large ungulate in the same contexts as cattle bone. As with horse, analysis in terms of body part nevertheless leads to some interesting possibilities.

Cranial fragments are present in many of the samples, either on their own (*e.g.* mandible fragments in 1064, 2563 and 3235) or with other bones; for example, 1421 contains maxilla fragments, mandible, axis and a sesamoid from the lower leg. Some deposits contain single bones which can be identified as cattle; 1344 has just a femur (but other 'large ungulate' fragments) 1630 has a patella only, 2325 an unburnt humerus, 2814 a femur, whilst 1826 and 2677 both contain first phalanges only and no other bone. There are, however, many other deposits which have evidence for the presence of most of the animal; 1777 has fragments from the head, mandible, axis, the left upper front leg, pelvis and metapodia. It could be argued that cases such as 1939, with upper and lower front leg (humerus, ulna, radius, metapodial) or 2130 with only lower back leg bones (left metatarsal, tarsal, first and second phalanges) could be thought of as the remains of meat joints, but 1818, with bones from the lower front leg, pelvis and lower back leg, cannot be so considered. 2651 containing cranium, ulna, tarsals and a third phalange, 2672 scapula, radius, pelvis, femur, tibia and carpals, 2678 cranial, maxilla, mandible, axis, ulna, femur and first phalange, suggest a fair coverage of the body, whilst 3147, for example, contains cranium, axis, a right humerus, ulna, metacarpal, a left femur and a third phalange, showing not only a range of body parts but also the presence of the right and left sides of the carcass. It would seem, then, that even if these animals had been dismembered, virtually all parts of the carcass are present in at least some of these deposits.

Comparison with other sites
Cattle bones are found with cremations at Loveden Hill, Millgate, Elsham Wold, Illington and Newark, but nowhere do they appear to be the most numerous animal.

Sheep/Goat
There are 170 instances of sheep/goat bones in the cremations; none of these have been positively identified as goat, although of course the presence of goat in the Anglo-Saxon economy is well-known and their presence here cannot be discounted.

The taphonomic problems associated with the horse and cattle bones are here multiplied; firstly by the smaller size of the bones, which might have led to fewer of them being collected from the pyre site or at least a more selective collection, and also by the demonstrable presence of sheep/goat astragali as playing-pieces in several of these cremations. As with cattle, there are instances of unburnt tooth fragments, often with no other animal bone present in the assemblage (2092 has an unburnt enamel fragment and 31, an inhumation, has sheep and pig tooth) but also an instance where other sheep bone is present (3113, unburnt tooth and sheep rib) which further confuses the issue.

It is clear that 1803, with a minimum of ten sheep astragali, 1647 with nine well-worn examples and 2575 with a minimum of seventeen, are all collections of playing-pieces and in 1673, although the only identifiable animal bone present is a single sheep astragalus, the worn edges suggest that this too must be a playing-piece. But what of those instances (1286, 1315, 1376, 1674, 1715, 1836, 1929, 2060, 2084, 2295, 2389, 2933, 3045) where a single sheep astragalus is the only identifiable sheep bone, sometimes the only identifiable animal bone, from the context? There are many other instances where sheep is represented in the urn by only a single bone and astragali, by their size and compactness, would be more likely to survive and be recognised in collection from the pyre site. Two other examples of astragali are made more problematic by the presence of other bone; in 1709, the astragalus is accompanied by a sheep-sized rib fragment, and in 2294, a pair of astragali (right and left) are accompanied by a sheep vertebra. For all the above reasons, the exact minimum number of sheep present in the cremations cannot be known.

Ageing
Table 10 and Figure 31 below, give some idea of the age structure of the group of sheep represented here, while sharing the same problems already encountered in ageing the horse and cattle bones. One is struck by the much greater spread of ages here, possibly a result of the better preservation of the long bone articular ends than in the larger mammals, but more likely a reflection of the real situation.

Whilst the majority of these animals probably fall within the one to three and a half year age group, it is interesting to note the exceptions to this; the two lambs (2756, 2884) under ten months old, and the group of animals (1488, 1591, 1633, 1675, 1725, 2573, 3056, 3193, 3253) which, at three and a half years old or older, might be thought to be a little above the optimum age for meat production. Of course, we should not expect these animals, killed as offerings for the dead, to reflect the sort of ideal mortality curve one might expect for meat production; neither the deaths of these people, nor their cremations, are likely to have been timed to coincide with the main culling or lambing seasons, and perhaps what we are seeing are animals selected from a flock for reasons other than their status as prime meat-producers. Perhaps their appearance or health or even expendability were more important.

Butchery
The sheep bones have produced far more butchery marks than any of the other bones from the assemblage. Almost all of these are associated with dismemberment of the carcass (Binford 1981). The scapula in 3018 shows knife marks on the *collum scapulae* consistent with this practice, and the humerus in 1845 has light knife marks on the distal end. Two femora show butchery marks; 1287 has marks on the proximal articulation consistent with dismemberment, whilst 3252 reveals fine knife marks running at right angles to the shaft which have no parallels in Binford, and might possibly be due to meat removal. If

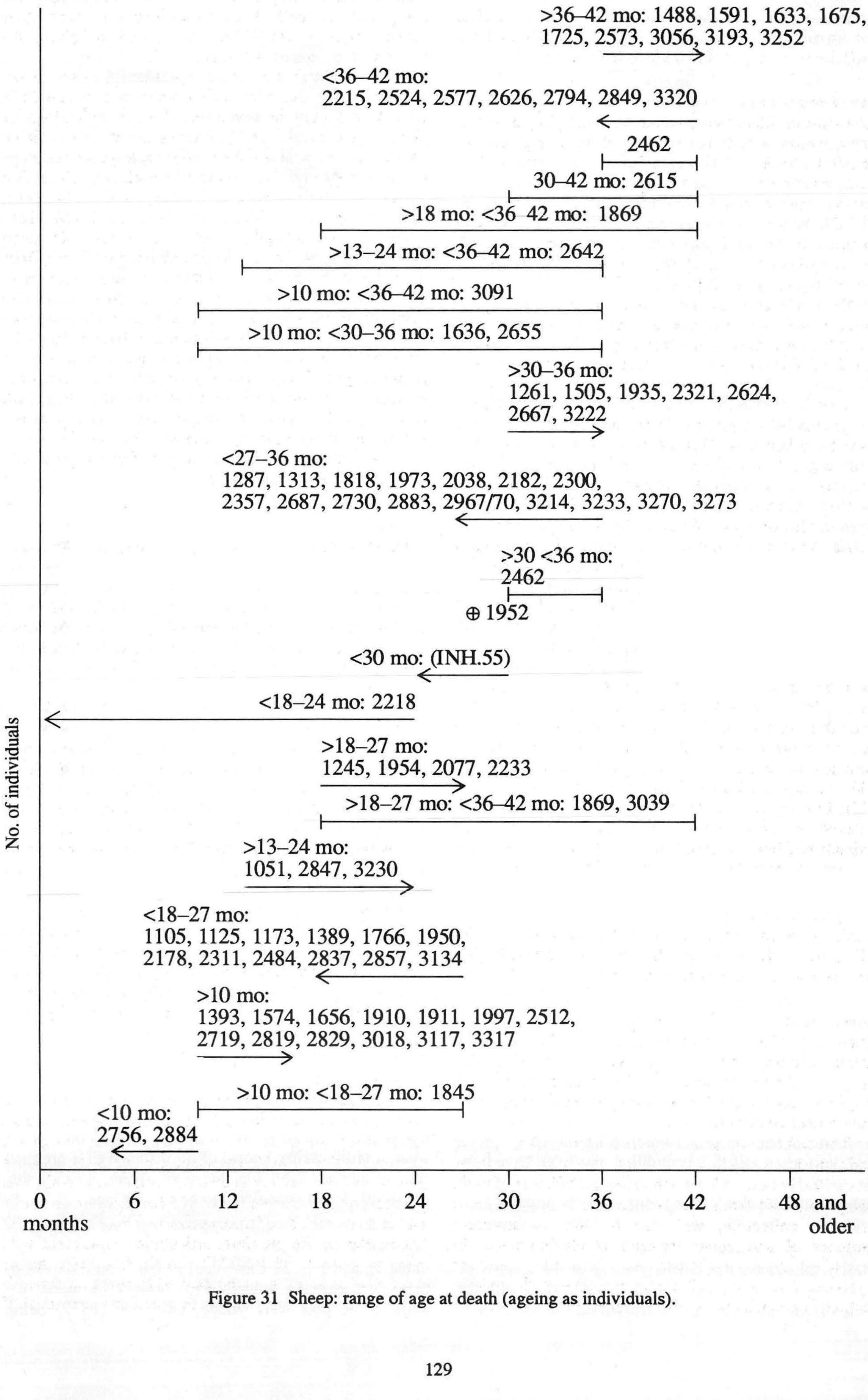


Figure 31 Sheep: range of age at death (ageing as individuals).

		F	NF
6–10 months	Pelvis (acetab.)	8	1
10 months	Scapula Dist.	10	2
10 months	Humerus Dist.	11	2
10 months	Radius Prox.	3	
13–24 months	Phal. I Prox.	4	2
13–24 months	Phal. II Prox.	2	
18–27 months	Metacarp. Dist.		
18–27 months	Tibia Dist.	8	13
18–27 months	Metatars. Dist.		
18–27 months	Metapod. Dist.	2	4
30–36 months	Ulna Prox.	3	2
30–36 months	Calcaneum		6
30–36 months	Femur Prox.	7	9
36–39 months	Tibia Prox.	3	12
36–42 months	Radius Dist.	3	8
36–42 months	Humerus Prox.	5	5
36–42 months	Femur Dist.	3	7

Table 10 Sheep/goat: fusion of elements. (After Silver 1969).

so, this is the only evidence for the possible preparation of meat for consumption.

The sheep vertebra and rib fragments and those more tentatively identified as 'sheep-size' are the major focus for butchery marks; bones from 1776, 1795, 2548, 2651, 2705, 3130, 3140, 3240 and 3331 all show chop marks at the proximal end of the rib, marks where the rib has been chopped through, or knife marks on the ventral surface of the rib, all associated with the dismemberment of the carcass (Plate VIII). A cervical vertebra in 2386 shows a chop mark along the edge of the body, and many of the astragali, including the gaming pieces in 2575, show knife marks due to dismemberment of the limb. The marks on the astragali were obviously created long before the bones reached the pyre site, but it would seem that, at least in the other instances quoted above, the sheep carcasses did not rest on the pyre as whole bodies, but either as joints or as entire but dismembered animals.

Pathology

Four examples of pathological lesions are found amongst the sheep bones: two (2512, 2677) are relatively minor exostoses on rib fragments, in 2512 on the ventral surface of the bone. The other two examples are both vertebrae, and appear more serious: 3072 contains a thoracic vertebral fragment with a sinus pierced through the vertebral body; there is no obvious sign of pitting or exostosis around the hole. Cremation 2234 contains two bodies of thoracic vertebrae, both showing destroyed articular surfaces, chambers within the vertebral bodies from some infection, and much exostosis around the area (Plate XLVIII). We do not as yet have a satisfactory answer as to what may have been the causal agent of these symptoms. The animal cannot have been in prime condition when killed; its condition may even have been the reason for its selection, if sacrifice of the animal, rather than its consumption by the living, was the primary aim.

Joints or whole animals?

Clearly, the evidence of butchery marks on the sheep bone makes this an even more urgent question than with the cattle. There are many instances within the group (*e.g.*

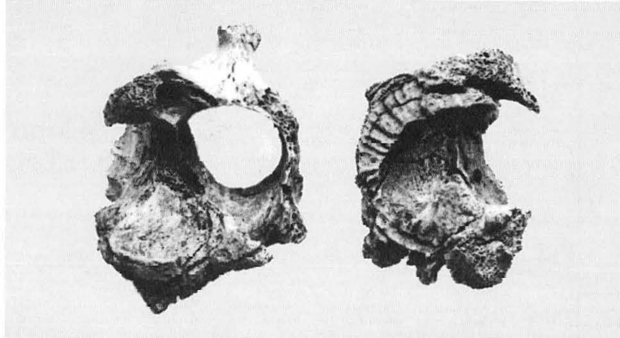


Plate XLVIII Sheep vertebrae from no. 2234 with gross destructive lesions in the bodies.

1183, 1261, 1313, 2819) where the sheep is represented by a single long bone or just a few bones (or even just ribs) which could represent a joint of meat. There are cases (for example, 2546 where only the mandible or cranium is represented, and 1168, containing just a horn core fragment), which also suggest only selected areas of the carcass.

In other instances such as 1488 (L humerus, scapula, tibia, phalange I and R patella) 1725 (L & R femur, pelvis, humerus, L tibia, metatarsal, R astragalus and calcaneum, vertebrae and ribs) 1845 & 1952 (L and R ulnae, radius, femur, R tibia, metacarpal, metatarsal, astragalus, first phalange, vertebrae and ribs) there can be little doubt that virtually a whole animal is represented.

It may be that some cremations contain an entire animal whilst others contain only a half or quarter carcass or a single joint, but given the piecemeal nature of the evidence it is difficult to see how these latter possibilities could be definitely proved. It is worth pointing out that neither the bone representation nor the ageing evidence has indicated that more than one animal is present in any of these cremations.

Sheep are often the most numerous animals on Saxon settlement sites (Crabtree 1989a and b) and this is reflected in many of the other cremation cemeteries also (*e.g.* Millgate, Elsham), where sheep is the most common animal bone found (Harman 1989).

Pigs

Pig bone was present in 84 of the cremations although there were other instances (*e.g.* 1724 and 2439) where pig carpals with drilled holes were present as artefacts. In only two cases was it considered probably intrusive: the unburnt pig tooth from inhumation 31 and the calcaneum in 3285, discussed under 'butchery', below, although a single fragment of unburnt cranium was the only animal bone from 2740. In three instances (2217, 2339, 2837) pig was represented by a single astragalus and the possibility was considered that they, like the sheep astragali, were gaming pieces. However in many other contexts pig was represented by a single bone, none of these bones show wear, and the writer knows of no instance of a grouped find of pig astragali like those of sheep, so that this possibility is not considered to be a likely one.

Ageing

Table 11 and Fig. 32 show that, as one would expect of these fast growing animals kept mainly for meat, the majority of pigs were young, only one (1877) being

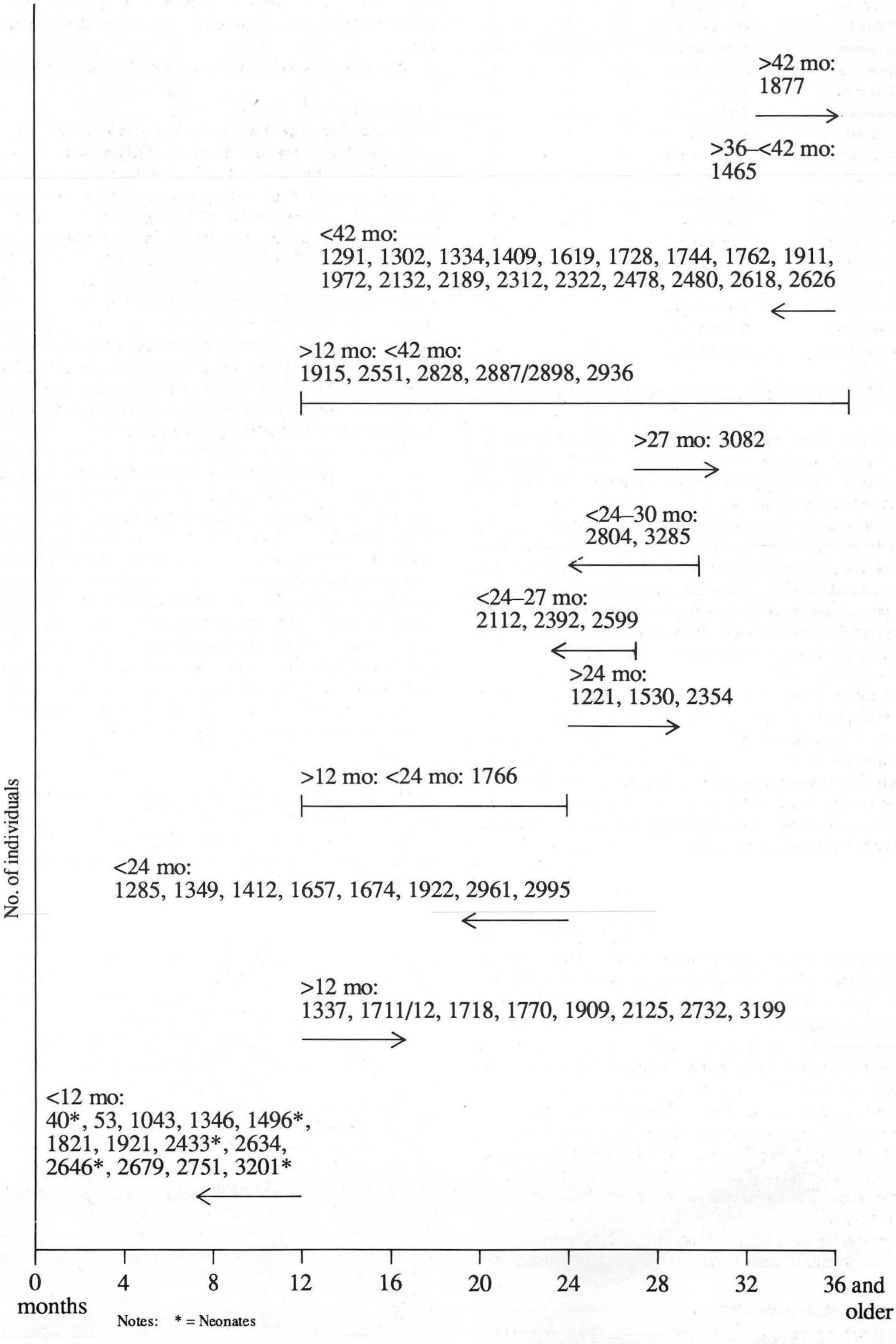


Figure 32 Pig: range of age at death (ageing as individuals). (Fusion ages after Silver 1969).

		F	NF
12 months	Scapula Dist.	3	3
12 months	Pelvis (acet.)	7	1
12 months	Humerus Dist.		4
12 months	Radius Prox.	3	1
12 months	Phal. II	1	1
24 months	Phal. I	1	3
24 months	Tib. Dist.	2	6
24–27 months	Metapod. Dist.		4
27 months	Metatars. Dist.		2
24–30 months	Calcaneum		3
36–42 months	Ulna Prox.	1	1
36–42 months	Ulna Dist.		7
42 months	Femur Prox		8
42 months	Radius Dist.		7
42 months	Humerus Prox.		6
42 months	Femur Dist.		7
42 months	Tibia Prox.		9

Table 11 Pig: fusion of elements. (After Silver 1969).

definitely over three years of age. Indeed there is a substantial number of animals (13, or 16%) which died before the end of their first year, and of these, five were sufficiently undeveloped to be described as neonates, or perhaps 'suckling pigs' (40, 1496, 2433, 2646 and 3201). When such young animals are found on settlement sites there is sometimes debate as to whether they would have found their way into the human food chain, but in the circumstances of a burial offering, they must presumably be regarded in that light. The bones of newborn piglets were also found at Millgate (Harman 1989).

Butchery
There are several instances of butchery on the pig bone, mostly, as with the sheep, evidence of dismembering of the carcass. The scapula in 3027 has been chopped off at the collum scapulae, as if for jointing, and there are knife marks on the spinous process. The radius and ulna in 1619 both show evidence of dismemberment: knife marks on the proximal shaft of the radius below the articulation, and on the olecranon process of the ulna. The pelvis in 2828 shows knife marks on the ilium compatible with dismemberment, and pig and pig-size ribs from 1657, 2007 and 2474 show chops and knife marks from dismemberment. Rather more difficult to explain is the pig calcaneum in 3285, which shows the distinctive puncture marks of canine gnawing, presumably produced before

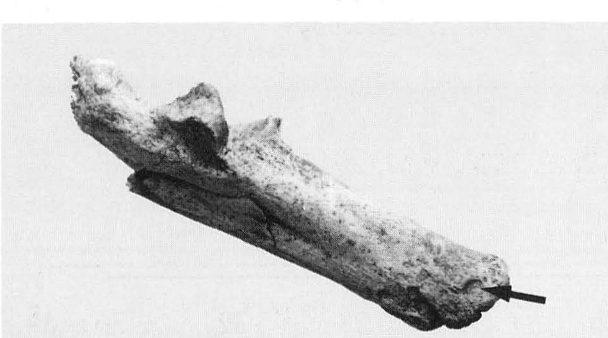


Plate XLIX Fragment of pig calcaneum from no. 3285 with 'punch' mark from gnawing in one end (arrowed).

cremation (Plate XLIX). Either this bone (the only pig bone from the context) is to be considered intrusive, or there must have been canine activity around the cremation site.

No pathological lesions were recorded on the pig bone.

Dog and fox
Dog and dog-size bones occur in twenty-six of the cremations and the distribution of elements, from an animal that was presumably whole on cremation, provides a good indication of the seemingly-random collection process. Dog-size vertebral or rib fragments, with no other accompanying bones, are found in four contexts (40, 1231, 1601, 2358) whereas other contexts such as 1287 have produced virtually all the major bones of both sides of the body (Plate IX). Dog is also the only animal where it can be proved that there are two animals in the same cremation; 1725 contains two dogs, one of which is slightly larger than the other, and which seems to have been placed in a different position on the pyre since its bones are dark grey, not white; a result of the difference in efficiency of cremation (see Chapter 5).

The animals do vary widely in size, and although because of heat shrinkage, metrical comparisons are useless, it can at least be said that some of the animals are only terrier-sized (*e.g.* 1287, 1317, 1318 & 1770), whereas those from 1752, 2667 and 2668 are wolf-sized (it is possible, of course, that wolf is represented amongst these bones but this cannot be proved from the fragmentary material available). 2667 & 2668, which were found in the same pit, may well be the same animal. They are identical in size, and nothing in the element distribution (2667 consists of maxillary, scapular, metapodial, phalangeal and vertebral fragments; 2668 has cranial, maxillary, mandibular, tibia, femur, metapodial, phalangeal and vertebral fragments) suggests that two animals are represented.

It is appropriate to discuss at this point the fox mandible and tooth fragments from 2323, identified as fox both by the size and shape of mandible, the position of the nutrient channels, and the gracile canines. Two other mandibles, in 2890 and 3194, are small enough to be fox,

		F	NF
6 Months	Pelvis	2	
6–7 Months	Scapula Dist.	4	
7 Months	Phal I Prox.	5	
7 Months	Phal II Prox.	3	
8 Months	Metacarp. Dist.	1	
8–9 Months	Humerus Dist.	4	
8–10 Months	Metapod. Dist.	20	
9–10 Months	Ulna Prox.	2	
10 Months	Metatars Dist.	1	
11–12 Months	Radius Prox.	1	
11–12 Months	Radius Dist.	3	
11–12 Months	Ulna Dist.		
13–16 Months	Tibia Dist.	7	
13–16 Months	Calcaneum	7	
15 Months	Humerus Prox.	3	
15–18 Months	Fibula Prox.		
18 Months	Femur Prox	6	1
18 Months	Femur Dist.	2	
18 Months	Tibia Prox.	2	1

Table 12 Dog: fusion of elements. (Silver 1969).

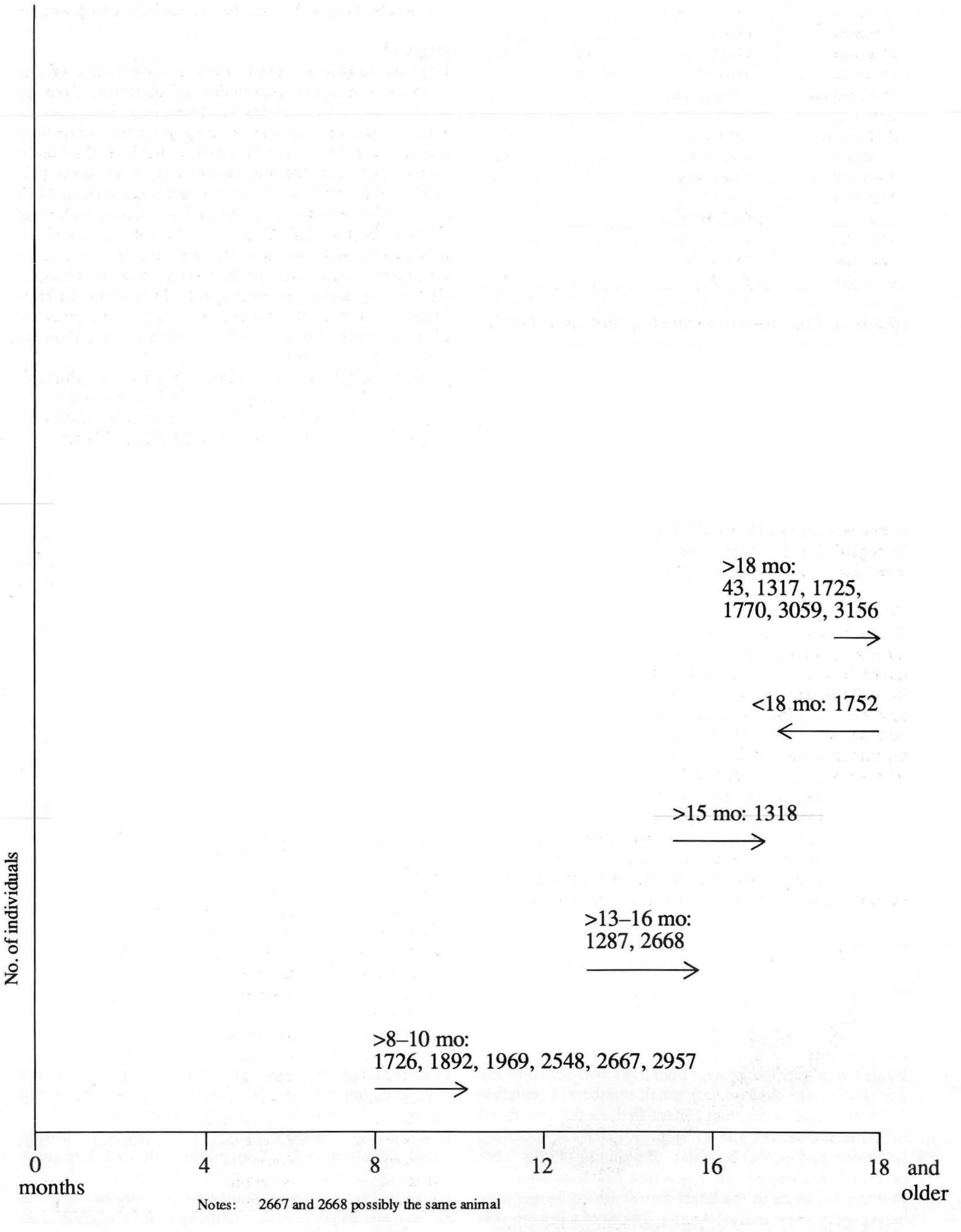


Figure 33 Dog: range of age at death (ageing as individuals). (Fusion ages after Silver 1969).

but too fragmentary for positive identification, as is an atlas fragment from 1281, of small dog or fox size. A mandible from 1475 may also be fox (Plate XI).

Ageing

Table 12 and Fig. 33 show that, as one might expect, almost all these animals are adult; only one animal, that from 1752, has any unfused epiphyses present. Given that this is already the largest dog in the assemblage, one can only assume that this animal was something like a large hunting dog or even a wolf.

Dog seems to be rare in the published animal remains from Anglo-Saxon cremation cemeteries; the only example the author has found is the possible mandible from Sutton Hoo Mound IV (Gejvall 1975), although Wilkinson reports an inhumation at Loveden Hill with man, child and dog (Wilkinson 1980). This is puzzling given that dogs, like horses, have a long association with votive contexts in N.W. Europe (Todd, 1975, 198–9). Horses and dogs are found together in Swedish Viking graves (Gräslund 1980) and at Helgö from the seventh to ninth century, there are fourteen cremations, of both men and women, containing dog (Gejvall and Persson 1970, Persson 1970).

Bear

The third phalanges of brown bear (*Ursus arctos*) were found in six of the cremations (1418, 2390, 2536, 2610, 2890, 3330) (Plates VII and X). Bear phalanges have been found in other cremations; the earliest being from the La Tène period in Germany (Kühl and Remagen 1985, Kühl 1984). Six of the sixth-century cremations at Helgö, male and female, produced terminal phalanges (Gejvall and Persson 1970, 231) whilst the Anglo-Saxon cemetery at Elsham Wold produced two cremations with third phalanges (Harman 1989). More recently, several have been recovered from settlement debris of the Anglo-Scandinavian period at York (O'Connor 1989). No other bear bones have been found with any of these deposits, and it is generally assumed that they represent the remains of bearskins, in which the claws are traditionally left intact. The faunal remains from West Stow have recently been reported as containing a bear metacarpus from deposits of similar date, though here too the author considers that the bone could be from a bearskin (Crabtree 1989b, 25).

There is little evidence about the date at which brown bear disappeared from the British Isles; Dent (1974, 35–37) suggests that the last definite literary evidence of bears is in the Roman period, with some slight evidence for their presence in England as late as the eighth century AD. There is of course no reason why the bearskins could not be trade imports from Europe or Scandinavia.

Other mammals

Evidence of four other wild mammals was found in the cremations, although in very small numbers. Cremation 2350 produced a fragment identified as the left distal humerus of a beaver, and a fragment which may possibly be beaver radius. No butchery or skinning marks were observed on these bones. The writer has been unable to find any evidence of the latest date at which beaver may have been present in East Anglia. Traces of a beaver-skin bag were found with the Sutton Hoo lyre (Bruce-Mitford 1975, 452) and Wilson (1992) notes that beaver teeth have been found in pendant form in a few (<ten) Anglo-Saxon inhumation burials.

Cremation 2805 produced part of the right humerus of a brown hare plus a vertebral fragment of a similar sized animal. Calvin Wells identified a possible fragment of hare bone from the material at Caistor-by-Norwich (Wells, C. in Myres and Green 1973, 120,121).

Fragments of unworked red deer antler were found in five cremations (1334, 1496, 1661, 1985, 2778) but no other bone which could be attributed to red deer was found in these contexts, nor could any other bone from the site be identified as red deer. Red deer antler was found, with red deer bones, in a cremation at Millgate, Notts (Harman 1989). Unworked roe deer antler, with its characteristic surface patterning, was found in cremations 1806 and 2041. 1806 contained no other identifiable animal bone, but 2041, besides producing a horse and large ungulate bones, had a 'sheep-size' fragment of rib; it is possible that this, too, was roe deer.

Bird

Bird bones were found in sixteen of the cremations. Of these, four (1281, 1571, 2028, 2961) could be identified as domestic fowl. 2028 was the most complete, containing ulna, tibia and radius, all from the left side. No other animal bones were identified from this context. Cremation 1302 contained the L & R radius of a domestic goose, plus another long bone fragment. Calvin Wells noted bird bone, unfortunately unidentifiable, at Caistor-by-Norwich (Wells 1973) and bones of domestic fowl, sometimes burnt but sometimes not, have been found with Viking-age cremations in Sweden (Gräslund 1980) recalling Ibn Fadlan's description of the Rus cremation where chickens were decapitated as part of the ceremony (Brøndsted 1965, 303). The settlement at West Stow produced bird bones which were mostly domestic goose and chicken, examples of wild birds being rare (Crabtree 1989a and b).

The other eleven instances of bird bone from Spong Hill cannot yet be assigned to species, *e.g.* 2081 contains a carpometacarpus fragment which appears to be from something rather like a mallard. The long bone shaft fragment of a large bird from 2008 (not further identified) shows knife marks across its surface.

The two raptor terminal phalanges, presumbly originally claws, mentioned in section III above, are not strictly speaking animal offerings since they are pierced for suspension and are presumably a form of bead or talisman (Plate XII). The most complete (2817) is at least 25mm long, the other (2439) more fragmentary, and associated with a pig carpal also pierced for suspension. A closer identification of these bones does not seem to be possible (D. Serjeantson, pers.comm.).

Fish

Cremation 2890, which also contained a small dog and a third phalange of a bear, produced a fragment of fish vertebrae, not further identified (Plate VII). A second example of a fish vertebra, from cremation 3040, was unfortunately crushed in transit, before any identification could be attempted. Many more fish and bird may originally have been present on the pyres than the few bones recovered, but obviously such small and delicate skeletal elements are even less likely to survive cremation and subsequent recovery processes than the bones of larger mammals.

IX. Conclusion

In comparison with other Saxon cemetery sites, the animal bone from Spong Hill shows several highly-distinctive features:

The percentage of burials containing animal bone (46.4%).

The wide range of species present.

Many of the cremations where animal bone is present, contain more than one species.

Horse, rather than sheep, is the most common animal in the cremations.

Butchery marks are visible on some of the bones.

Some of these features may be explained by the more detailed examination to which these bones were subjected, compared to very early studies, where the bones were never seen by an archaeozoologist and the number of identifications were neccessarily lower. This might even favour the identification of species such as sheep, pig and dog, where the size difference with human bone was more noticeable, and the articular areas are more intact after cremation than those of the larger mammals, and therefore easier to identify. It is this writer's experience, echoed by Gejvall and Persson (1970) and McKinley (Chapter 2.II, above) that familiarity with the nature of cremated bone is essential for this work and that the proportion of bone identified undoubtedly increases with practice even for those already familiar with archaeological bone. However, these factors alone cannot account for all the discrepancies between Spong Hill and other cremation cemeteries. Social and other factors must be brought into the argument, an area which it is inappropriate to discuss more fully here.

It is hoped that this study of the animal bone from the Spong Hill cremations shows that, as in more traditional studies of animal bone from settlement sites, there is much more to be gained from the material than just a list of species in each context. For example, the differences in the age structure and treatment of the horse and cattle suggests different roles for the two species in the burial rites. The age structure of the cattle, like that of both sheep and pig, is much closer to what one would expect from a settlement site, whilst the horses are mostly animals which would not normally be killed, and may have been offered for their value as riding or draught horses. The dogs show a range of sizes (and perhaps functions?) and may well have been the personal property of the deceased. The evidence of features such as pathological lesions suggests that selection of animals for cremation was not based on straightforward criteria of greatest suitability. There is undoubtedly much more to be gained from further detailed study of animal bone from cremation cemeteries in the area of man/animal relationships, in a context which for once is unambiguously ritual in nature.

Acknowledgements
Thanks are due to Dale Serjeantson for advice on the bird phalanges, to Charlotte Roberts and Keith Manchester for discussion of pathological features and to Sebastian Payne for his comments on the text.

Appendix II (microfiche)

Appendix III: Histological analysis of the calcined masses
by Neil Garland

Urn 1419
The specimen was of an irregular shape, measuring 12×9×5mm. The predominant colour of the external surface of the specimen was dull yellow orange (10YR6/4) and the internal colour was grey (5Y5/1 and 5Y5/4). The weight of the specimen was 0.73g.

Urn 1420
The specimen was irregularly shaped, measuring 12×10×7mm. The predominant colour of the external surface was pale yellow (2.5Y8/4), the internal colour was black (5YR1.7/1). The weight of the specimen was 0.32gm.

Both specimens showed cracks radiating from the periphery into the core. Plain radiography showed the specimens to be densely mineralised, more so in the core than at the periphery, but without any apparent structure (Plate XXXIII).

Histological processing and sectioning proved difficult. Decalcification of a small fragment resulted in its complete dissolution. Although thick sections were readily cut from the resin embedded blocks, handgrinding was difficult because bits of the section would break off. This was, presumably, because of the inability to fully impregnate the specimens with resin.

Histologically, the specimens had a finely granular and nodular appearance. Examination under polarised light revealed birefringence and inclusions of soil material. Higher power of certain areas showed more finely crystalline or granular material with a pale periphery and a darker core which were in a cobble-stone configuration. In addition to the stains described previously, both these specimens were stained with alizarin red, PAS and Perls in an attempt to identify their components.

The PAS stain showed the peripheries of the specimens to be penetrated by actinomycetes and yeasts. Staining with alizarin red, for calcium, was positive, the stain showing no areas of imperfect penetration. Staining with von Kossa revealed patchy areas of positive staining.

Microradiography showed that the specimen was irregularly mineralized; the mineral being in 'layers'.

Analysis of a small fragment from the periphery of one of the masses by X-ray diffraction revealed the sample to be highly crystalline hydroxyapatite, with formula $Ca_5(PO_4)_3OH$. The mole fraction of calcium in the sample, as estimated by atomic absorption spectroscopy, was found to be 0.30. This value is slightly higher than that calculated from the chemical formula (0.28). However, this slight discrepancy was not surprising, given the variable composition of apatites from biological systems.

Appendix IV: The inhumations

Following the discovery of several errata and addenda to the inhumation report published in 'Spong Hill Part III, Catalogue of inhumations' (Putnam 1984), a full reassessment of the inhumed bone was made. This report presents the results of that reassessment.

Fifty-seven graves were excavated, but adverse soil conditions meant that only 38 (66.7%) still contained bone. Often only the tooth crowns survived, the bone itself and tooth roots having been destroyed leaving the more resistant enamel. The high incidence of bronze grave-goods aided the preservation of adjacent bones, with a bias towards the upper portion of the skeleton, a reflection of the grave-good type.

Only those inhumations from which bone was recovered have been reported here. Details of identification may be found in Appendix VI (microfiche). All plans and associated grave-goods may be found in Hills *et al* (1984).

Methods

Age was assessed from the stage of tooth development (Van Beek 1983) and epiphyseal fusion (McMinn and Hutchings 1985, Gray 1977) in the immature individuals, and from the patterns of tooth wear (Brothwell 1972a) and degenerative changes to the bone (Brooks 1955) in mature individuals. Age categories rather than age in years are used in view of the problems of accurate age assessment for adult individuals. The categories used are the same as those for the cremated bone (see Chapter 2).

Sex was assessed where possible from the sexually dimorphic traits of the skeleton (Brothwell 1972, Bass 1987). Categories are the same as those for the cremated bone (Chapter 2).

Measurements were taken according to Brothwell (1972).

As with the cremations, morphological variations, though not actually pathological lesions, have been included in the 'pathology' section.

Animal bone from the inhumations have been included in the discussion on animal bone in cremations in Appendix I.

Results

Inh.1. Represented by elements of skull and upper/lower limb.
Age: Young adult.
Sex: ?
Pathology:1) Heavy calculus deposits on anterior teeth. 2) Single line of hypoplasia in premolars.
3) Morphological variation: radix entomolaris - accessory rootlet from the distal root of the right mandibular third molar.
Inh.2. Represented by tooth crowns.
Age: Young adult.
Sex: ?
Pathology: Calculus deposits on all teeth.
Comment: Bronze staining on all crowns.
Inh.3. Represented by tooth crowns.
Age: Older juvenile/young subadult.
Sex: ?
Pathology: 1) Hypoplastic line in cervical region of mandibular right second molar.
Inh.4. Represented by elements of skull.
Age: ?
Inh.5. Represented by elements of axial and upper limb.
Age: Older mature/older adult.
Sex: ?
Pathology: 1) Osteoarthritis in cervical and thoracic vertebrae and in costo-vertebral articulation.
Comment: Bronze staining on many of the bones.
Inh.8. Represented by elements of skull and lower limb.
Age: Adult.
Sex: ?
Inh.9. Represented by teeth.
Age: Older subadult/young adult.
Sex: ?
Inh.11. Represented by elements of upper/lower limb.
Age: ?
Comment: Bronze staining on bone.
Inh.13. Represented by elements of skull and upper/lower limb.
Age: Older mature/older adult.
Sex: ?
Pathology: 1) Slight periodontal disease in maxillary alveoli.
Inh.14. Represented by teeth and elements of axial and upper limb.
Age: Young adult.
Sex: ?
Pathology: 1) Slight calculus deposits on all molar teeth.
Inh.16. Represented by teeth.
Age: Subadult.
Sex: ?
Inh.17. Represented by elements of skull.
Age: Older subadult/young adult.
Sex: ?
Inh.18. No inhumed bone survived.
Comment: Three fragments cremated/burnt bone (? from fill) including human mid-shaft ulna (poorly cremated) and ? animal bone.
Inh.19. Represented by elements of skull, upper and lower limb.
Age: Older mature/older adult.
Sex: ?
Comment: Bronze staining in tooth crowns and scapula.
Inh.20. No inhumed bone survived.
Comment: Two fragments cremated long bone including tibia shaft. Cremation disturbance from grave fill.
Inh.22. Represented by teeth.
Age: Young adult.
Sex: ??female
Pathology: 1) Mild calculus deposits on most teeth.
2) Morphological variations in mandibular molar tooth form; Both first have a small mesio-lingual accessory cusp. The right second has a 5-cusp form. The left third has the usual 4-cusp form but with many accessory grooves, while the right third has a 5-cusp form with many accessory grooves.
Comment: Fragment cremated long bone probably from urn 1946 cut into the grave fill.
Inh.23. Represented by elements of skull and lower limb.
No.Individuals: Two.
Age: 1) Older infant/young juvenile 2) Mature/older adult
Sex: ?
Comment: There are a few fragments of cremated long bone including tibia shaft, probably from urn 1912 which cut the grave fill.
The grave plan does in fact illustrate this double, side-by-side burial of an adult individual, with the smaller cut for the immature individual appended to the south side.
Inh.24. Represented by elements of upper/lower limb.
Age: ?
Comment: Bronze stained fragment upper limb.
A cremated metacarpal/tarsal shaft (adult/subadult), probably from a disturbed cremation.
Inh.26. Represented by elements of upper limb.
Age: Subadult/adult.
Sex: ?
Comment: Bronze and iron stains on clavicle.
Stored/recorded with grave-good 5 were fragments of cremated bone, probably from urn 1941 which cut the grave.
Inh.28. Represented by elements of skull and upper/lower limb.
Age: infant.
Inh.29. Represented by elements of skull, axial and upper limb.
Age: Adult.
Sex: ?female
Comment: Bronze stains on axial and upper limb fragments.
Inh.30. Represented by elements of skull, axial and upper limb.
Age: Younger mature adult.
Sex: ?male
Pathology: 1) Small carious lesion in the occlusal surface of the mandibular right second molar.
2) Slight/medium calculus deposits on all teeth.
3) Very slight osteoarthritis in the atlas vertebra.
4) Morphological variations: a) Small wormian bone. b) Form of the third molar crowns; mandibular right is a rather squashed 5-cusp variation with a triangular out-line, pointed distally. The right maxillary has a diminutive disto-buccal cusp, while the left has numerous accessory grooves.

Comment: An urn was cut into the fill of the grave and originally given a grave-good number 30/1. This has subsequently been relocated with the other cremations as urn no. 3333.

Inh.31. Few fragments unidentifiable human bone.
Age: ?
Animal: First maxillary molar of a pig and fragments of long bone.

Inh.36. Represented by teeth and elements of lower limb.
Age: Young adult.
Sex: ??male

Inh.37. Represented by elements of skull.
Age: Young adult.
Pathology: 1) Morphological variation: Maxillary third molar trapezoidal form.

Inh.38. Represented by teeth and elements of axial skeleton.
Age: Young adult.
Sex: ?
Pathology: 1) Medium/heavy calculus deposits on all teeth.
Comment: Tooth wear unusually light on first and second molars considering age indicated by eruption of third molar.

Inh.39. Represented by teeth and elements of upper limb.
Age: Young adult.
Sex: ?

Inh.42. Represented by teeth.
Age: Young/younger mature adult.
Sex: ??female
Comment: Uneven pattern of wear between mandibular and maxillary teeth and between sides - maybe as a result of some undetected dental lesion? Teeth bronze stained.

Inh.44. Represented by elements of skull, axial, upper and lower limb.
Age: Older subadult.
Sex: female.
Cranial Index: 62.96 Dolichocrany.
Pathology: 1) Strong, single lines of hypoplasia in several of the left maxillary teeth.
2) Mild/medium calculus deposits on all teeth.
3) Morphological variations in tooth crown form: Right maxillary second molar has two small disto-palatal accessory cusps. Both maxillary third molars are small, multi-cusped with many accessory grooves.

Inh.45. Represented by teeth and elements of lower limb.
Age: Older subadult/young adult.
Sex: ?

Inh.46. Represented by teeth and elements of upper limb.
Age: Older mature/older adult.
Sex: ?

Inh.47. Represented by elements of skull and upper/lower limb.
Age: Subadult.
Sex: ??female
Pathology: 1) Mandibular canines each have a minimum of two lines of hypoplasia.
2) Morphological variation: Mandibular third molars, usual 4-cusps but of uneven size and with accessory grooves.

Inh.50. Represented by elements of skull, axial, upper and lower limb.
Age: Mature adult.
Sex: Male
Pathology: 1) Osteoarthritis in atlas vertebra.
2) Morphological variations: a) Several small wormian bones in lambdoid suture. b) Slight sagittal cresting.

Inh.51. Represented by elements of skull and upper/lower limb.
Age: Adult.
Sex: ??female
Pathology: 1) Morphological variation: Two small wormian bones in the right lambdoid suture.

Inh.54. Represented by elements of skull and upper/lower limb.
Age: ?
Sex: ?

Inh.55. Represented by elements of skull, axial and lower limb.
Age: Mature adult.
Sex: ?

Inh.56. Represented by elements of skull and upper limb.
Age: Older subadult/young adult.
Sex: ?
Pathology: 1) Hypoplasia in mandibular canine and premolar crowns.
Comment: Mandible bronze stained.

Inh.57. Represented by elements of skull.
Age: Older mature/older adult.
Sex: ?female

Inh.58. Represented by elements of skull and upper/lower limb.
Age: Adult.
Sex: ?

Discussion

Of the 66.7% of inhumations with bone surviving it was only possible to age 84.2% and to sex 26.3%. The limitations on demographic analysis of such a sample are obvious.

The number of infants/juveniles recorded is unusually low even including the two immature graves recorded with no bone (7%). This may just reflect the gross loss of fragile immature bone under adverse soil conditions, but the lack of obvious immature graves may also indicate a bias in the use of this mode of burial at Spong Hill.

Inhumation 23 was the only one to contain the remains of more than one individual: an adult plus an older infant/young juvenile. It would seem likely that the small appendage on the southern edge of the main cut was in fact the grave of the immature individual (See Hills *et al* 1984).

Bronze staining to the bone was noted on areas of the skull, the superior axial skeleton and upper limb bones, reflecting the fact that most of the bronze grave-goods were brooches.

Cremated bone was recovered from six of the graves; in all except one case the quantities were small, generally from the grave fill, and obviously redeposited. One urn, recorded previously as 30/1 was found apparently accidentally dug into the grave fill. This was clearly not a grave-good as at first believed and has since been moved to the cremation collections (see urn no. 3333 this volume).

Animal bone was recovered from one or possibly two of the graves, notably the pig tooth and deer tooth in Inhumation 31. The animal bone elements here are not indicative of joints of meat, although judging by the condition of the human bone in this grave, any other fragments of animal bone may have been lost due to the soil conditions. (See Chapter 6 and Appendix I for animal bones in the cremations).

Pathology

For fuller descriptions of lesions and diseases see Chapter 7.

Dental disease, though not frequent, was the most common category of disease noted. Lesions affecting the supporting structure of the teeth were not as numerous as those affecting the teeth themselves, due to the low survival rate of the bone.

Four individuals had dental hypoplasia. Six individuals had slight–heavy calculus deposits on the tooth crowns; these were mostly young individuals, of both sexes. There was only one noted occurrence of dental caries, a small occlusal lesion in the molar of an adult

Age category	Number	Female	Male
older infant/young juvenile	1		
older juvenile/young subadult	1		
subadult	3	2	
older subadult/young adult	5		
young adult	8	1	1
mature adult	4	1	2
older adult	6	1	
adult	4	2	

Table 14 Number of individuals in each category and sex.

male. Periodontal disease was noted in only one older adult.

Lesions indicative of slight vertebral osteoarthritis were recorded in the cervical and thoracic articular processes of inhumation 5, a mature/older adult and the atlas vertebra of two mature males.

Numerous morphological variations were recorded, mostly in the form of the third molar crowns, where five individuals had variations in the normal cusp forms. Inhumation 22 was unusual in that all three left mandibular molars were of five-cusp form in decreasing size (the same variation was noted in an Anglo-Saxon inhumation from South Acre, Norfolk; McKinley forthcoming (d)). Wormian bones were found in three individuals. In only one, Inhumation 44, did sufficient of the vault survive to enable cranial index to be calculated.

Burial position

The majority of the inhumations appear to have been extended and supine but there are a small percentage (*c.*17%) where the body was flexed (knees bent) to some degree; at least one was crouched (tucked/curled up, knees by chin). This pattern is repeated at Morning Thorpe (Green *et al*, 1987) where in *c.*7% of the graves the body appears to have been flexed and at Bergh Apton (Green and Rogerson, 1978), where the figure is *c.*9.7%. At Spong Hill, the distribution of flexed burials is spread across the site with a significant concentration of the four in the ring-ditch around inhumation 40. One of the four was flexed, one crouched and the other two either crouched or flexed. Of the flexed burials which could be sexed, four were females and one male, three of the four females being in the ring-ditch. This is in contrast with the flexed burials from Bergh Apton where the majority have been sexed (from grave-goods) as male. At Morning Thorpe, there were also more males than females amongst the flexed inhumations which could be sexed. There are no other obvious differences between the flexed and extended burials, for example in grave-good association. As the bone from each of the three sites was all in such poor condition, it was not possible to ascertain if any morphological differences would separate the flexed groups. It is, therefore, not possible to say why some of the inhumations from the site should be flexed and others not, though the group of three females and one unsexed individual, crouched or flexed within the ring-ditch, do appear to be rather more than a coincidence.

Appendices V and VI (microfiche)

Appendix VII: Preliminary investigations on the potential of cremated bone for the recovery of human blood samples

by Christine Catteneo

Samples were taken from eleven of the Spong Hill cremations to be tested for the presence of Human Albumin using ELISA (Enzyme-linked immunosorbentassay) and monoclonal antibodies.

Positive results were obtained from several of the samples, revealing the survival of human blood in the cremated bone. The methods are described in Cattaneo *et al* 1990, and forthcoming. These tests formed only a preliminary part of an ongoing investigation, but do demonstrate the survival of organic components in some cremated bone.

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Figure 3 Complete plan of the cemetery site.

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