8. **SELECTED STUDIES: Animal Bone**

8.1 Prehistoric

8.1.1 Identification of prehistoric animal bone from Int 41 by Julie Bond

8.2 Early Medieval

8.2.1 The horse from Mound 17 by T O'Connor (Int 48)

A horse skeleton from Sutton Hoo (SH91 Int48 F355)

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During the excavation on Intervention 48 in 1991, the articulated skeleton of an equid was encountered in F355. The bones were lifted, and submitted to the author in 1993 for examination and report. Individual bones and groups of bones were given finds numbers on site, and these are used as the basis of the catalogue appended here. Drawings D453 and D457 were consulted during recording of the bones. Some minor anomalies were noted in the labelling of specimens as received. These are mentioned in the catalogue.

The report which follows is an archive report describing the skeleton and making some comparisons with contemporary material. Further work on parallels will be undertaken prior to publication.

I am grateful to Wietske Prummel, Rijksuniversiteit Groningen, for access to unpublished data.

Condition.
The bone tissue was mainly very degraded and friable. Although records show the skeleton to have been largely intact and complete as excavated, the bones of the thorax and skull were extensively fragmented, and the more distal elements of the limbs were markedly eroded. Only elements with a high proportion of dense cortical bone were at all robust, and even these showed some fine longitudinal cracking. The bone tissue was obviously in an advanced state of decay, and the skeleton presents a substantial curation problem, as it is already crumbling seriously and cannot be handled without further damage occurring. In addition, at least some of the bones were slightly damp when packed, and have developed minor surface mould growths. Accelerated drying to a low RH might further compromise the condition of the bones, and the best that can be suggested is slow drying to 40-50% RH with storage which allows bones to be examined with the absolute minimum of unpacking or handling.

Identification.
The limb proportions and the morphology of the molars and premolars are consistent with horse, rather than any other equid, presumably the domesticated ecotype generally attributable to *Equus caballus* L.

Age and sex.
The horse appears to have been male. Substantial lower canine teeth were present in both mandibles. No trace of upper canines could be located, though given the highly fragmented state of the maxillae and premaxillae, this is not categorical evidence of absence.

Age is less straightforward. All of the epiphyses of the appendicular skeleton were found to be fully fused, as were most of the vertebral centra save the caudal aspects of the lumbar and posterior thoracic vertebrae. Full fusion of the vertebrae might be expected by five years old (Silver 1969), though the supporting modern evidence is insubstantial. All of the permanent dentition was in wear, with some attrition on lower I3, and very slight attrition on the lower canines. This would imply an age at death in excess of five years, though the infundibulum on LI3 was still confluent with the lingual margin of the crown of the tooth, indicating an age not greatly in excess of that figure. The condition of the jaws and teeth made crown height measurements problematical, but the right UP3 gave a fairly secure measurement of 75mm. Using Levine's (1982) data for comparison, this would be consistent with an age of around five years. Taking all of the data together, an age at death of five to six years is proposed, thus suggesting the vertebral epiphyses to be fusing a little late, and placing greater confidence in the eruption times of the lower incisors and canines.

We thus have a male horse, though whether stallion or gelding is not clear, of five to six years old.

Stature.
The shoulder height of the horse has been estimated using the conversion factors of Kiesewalter, as recommended by von den Driesch and Boessneck (1974). Table 01 gives the data used in these estimates and the results obtained.

	Left	Right	Estimates
Radius	331	332	1443, 1448
Metacarpal	225	223	1442, 1429
Femur	384	379	1348, 1330
Tibia	339	339	1478, 1478
Metatarsal	264	262	1407, 1396

Table 01. Shoulder height estimates, following von den Driesch and Boessneck (1974). Humerus measurements were not available. All measurements and estimates are in millimetres.

The estimates obtained from the femora fall rather below those from the rest of the bones, suggesting that the abrasion to the greater trochanters was more significant than had been appreciated. It is proposed that these two estimates are anomalous and should be disregarded. The remaining figures give a mean shoulder height estimate of 1440mm (sd 29.55; n = 8), or about fourteen hands. The breadth measurements and degree of development of muscle insertions indicate a fairly heavy, muscular build, completing the picture of a rather thick set male horse, around the size of a very large pony, aged about five to six years old at death.

Pathology.
No indication of the cause of death could be found, though given the state of preservation not much can be read into such an absence of evidence. The horse was at least skeletally healthy at time of death. There are minor degenerative changes to the caudal aspect of the last lumbar vertebra, indicating the initial stages of an arthritic development. There is an obvious temptation to link this with the use of the horse for riding, but minor arthropathic change in one joint in the lower back is not conclusive evidence, and the teeth showed no wear patterns which could be associated with the use of a bit. The skeletal evidence is thus neither consistent nor wholly inconsistent with the use of this horse for riding.

Comparanda.
Horses seldom comprise more than a small part of any archaeological bone assemblage from north-west Europe, so the range of published comparanda is rather small, though sufficient to place the Sutton Hoo horse in some sort of roughly contemporary context. The closest group of material comes from the Anglo-Saxon settlement at West Stow (Crabtree 1990), whence measurements of 5th and 6th century horses gave shoulder height estimates in the range 1.18 to 1.39 metres, with a mean of 1.38m. Slightly later material comes from the industrial site at Ramsbury, Wiltshire (Coy 1980), where estimates ranged between 1.21 and 1.40 m. As a rough comparison of robusticity, Crabtree gives metacarpus SD measurements ranging between 28.3 and 33.6mm for West Stow: compare 35.6mm for Sutton Hoo.

A similar horse burial is reported from a broadly 7th century context at Oosterbeintum, Frisia (Prummel 1989; also pers comm). The burial, which also included six dogs, was located within a cemetery. The horse was a male aged six to seven years old, and was buried in much the same position as the Sutton Hoo horse; on the right flank, with legs flexed. The Oosterbeintum horse is estimated to have stood between 1.35 and 1.39m at the shoulder, similar to the West Stow series. Prummel (1989) observes that larger horses, up to 1.50m, came into Europe at an earlier date but were quite rare, a point clearly shown by data given in an earlier paper (Prummel 1979). It is notable that the Oosterbeintum horse is described as a stallion (hengst), not a gelding (castreren).

A second example from the same region and similar date comes from the cemetery at Ezinge-de Bouwerd, where two horses and a dog were recovered from a single grave (Prummel pers comm.) The horses are both described as males. Measurements of the Ezinge horses are approximate, as they have had to be measured whilst in situ in a display at the Groninger Museum, but give a range of estimates between 1.43 and 1.50m for 'stallion I' and 1.44 and 1.48m for 'stallion II'. In a wider discussion of early medieval horses from the

Netherlands, Prummel (1979) compares samples from the Roman Iron Age through to Carolingian deposits. The data show the Roman Iron Age specimens to be generally smaller in stature than military Roman or later samples, with the Sutton Hoo horse falling within the range, though above the mean, of samples from Carolingian sites in the terpen area of Groningen and Friesland and at Rijnsburg and Dorestad.

A further brief survey of horses from northern European sites is given by Benecke (1986), in the course of an examination of the size of domestic livestock across northern Europe from the Iron Age to medieval periods. Benecke suggests that horses from grave contexts from 5th to 10th century sites are in general somewhat larger than those from contemporary settlement site contexts, though the supporting data (ibid., 265) show substantial overlap. Horses from graves are typically of shoulder height between 1.34 and 1.40m, whilst those from settlement sites are typically 1.27 to 1.36m. The Sutton Hoo horse thus stands at the upper end of Benecke's grave-context range, though as Benecke points out, environmental effects on phenotype have to be taken into account when making comparisons across such a relatively large area (from the North Sea to the Baltic).

The Sutton Hoo horse thus fits into the wider northern European picture of horses from grave and settlement contexts, being of the same sex and similar age to individually buried horses from the Netherlands, and towards the upper end of the general size range. This report is deliberately limited to discussion of the skeleton as a zoological study. The burial context, and the wider issues raised by the apparent 'offering' of horses, will be the subject of further research to follow this report.

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SH91 Int48 F355.
Catalogue of bones and data in Finds Number order.

Note the following: L, R = left, right. Teeth are coded e.g. LP4 = lower premolar 4. Measurements follow von den Driesch (1976); measurements in parentheses are approximate because of minor surface erosion to bone. All measurements are in mm, given to nearest 1mm where taken with an osteometric board or where surfaces showed minor erosion; otherwise given to 0.1mm.

8121 - Skull plus L and R mandibles. The neurocranium vault is largely complete, but the rest of the neurocranium and much of the viscerocranium is represented by small fragments. The L maxilla is largely intact; R maxilla in three large pieces plus small fragments. Corpus of L mandible is intact from LP3 to LM3; corpus of R mandible intact from LP4 to LM3. Neither ascending ramus is intact, though both mandibular condyles could be identified. Substantial lower canines were noted, both showing slight attrition. A clear infundibulum is present on all lower incisors, those on both LI3 being confluent with the lingual margin of the tooth; i.e. there is no clear line of dentine between the enamel of the crown and that of the infundibulum. The following measurements were obtained:

7 - 85.1
22 - (171)
23 - (78)
24 - (95)
UP2 L 36.7 x 26.2
UP2 R 37.2 x 27.2
UP3 R 29.5 x 29.4
LP2 L 31.5 x 18.9
LP2 R 31.8 x 19.0
Crown height
UP2 L (45)
UP3 R (75)
LP3 L (51)

8122 - Approximately 30 fragments representing L occipital condyle, l petrous bone, atlas, axis, cervical vertebrae 3 and 4 (both centra fused). All highly friable and fragmented.

8123 - L scapula, collum and articulation. Blade fragmented. Serious surface erosion, hence no measurements, and the interior of the bone is heavily penetrated by rootlets.

8124 - L humerus, with minor damage to proximal end and posterolaterally, but otherwise intact. Both epiphyses fully fused.
GLC 270
SD 36.7
BT 75.4

8125 - L radius plus ulna, abraded around olecranon process otherwise intact, radius fully fused, olecranon process apparently fully fused.
Radius
GL 331
BP 81.1
SD 39.0
BD 75.9
BFd 63.2
Ulna
BPC 47.4
Also 2 L carpals.

8126 - L carpal sesamoid.

8127 - L metacarpals II, III, IV, plus distal series left carpals and sesamoid. All essentially complete. Metacarpal III has both epiphyses fully fused, and shows localised white/grey surface flecks which are believed to be mould spots consequent upon incomplete drying.
Metacarpal III.
GL 225
BP 50.6
SD 35.6
BD 50.6

8128 - L Phalanx I manus, complete, fully fused. Distal epiphysis somewhat eroded.
GL 83
BP 55.6
SD 33.5

8129 - L Phalanx II manus, fused proximally, distal part very eroded so not measured.
Also one small and very corroded fragment believed to be part of the corresponding phalanx III.

8130 - Approximately 100 fragments representing those parts of the vertebral column not represented in 8122

or 8141. Very highly fragmented, so recognition of individual vertebrae was compromised. Centra attributable to cervical 5 through thoracic 10 appeared to be fully fused: centra attributable to thoracic 11 and 12 and to lumbar vertebrae were fused cranially, but unfused caudally.

8131 - 8 capita plus c. 30 fragments ribs, plus 4 fragments thoracic vertebra neural spines.

8132 - L phalanx II pes, fused proximally but very eroded. Also two phalangeal sesamoids.

8133 - L phalanx I pes, complete, fully fused.
GL 79
BP 55.5
SD 34.4
BD 43.1

8134 - L metatarsals II, III, IV, complete. Metatarsal III fully fused proximally and distally.
Metatarsal III.
GL 264
BP 50.7
SD 31.8
BD 50.0

8135 - L navicular bone, cuboid, os tarsi III.

8136 - L astragalus, showing minor abrasion to distal articulation.
GH 58.3
GB 62.5
BFd (52.9)
LmT 59.7

8137 - L calcaneus, complete, with tuber calcis fully fused.
GL 109
GB (52)

8138 - L navicular bone, os tarsi centrale.

8139 - L tibia and patella. Tibia is complete and fully fused. A recent transverse break at midshaft was temporarily reconstructed to allow measurement.
GL (339)
BP 91.6
SD 41.7
BD 78.7

8140 - L femur, complete and fully fused. Minor crushing damage to the anterior aspect of the greater trochanter.
GL 384
GLC 352
BP 116.7
SD 43.0
BD 91.2

8141 - L os innominatum, parts of ilium, acetabulum, pubis. Very friable.
LAR 63.9
SH 43.3
R os innominatum, parts of ilium acetabulum, ischium. Very friable.
LAR 64.1
SH 42.6
Sacrum in two major pieces, separated between second and third segments, plus many small fragments.
Last lumbar vertebra. This centrum exhibits some apparently ante mortem surface irregularity on the caudal

aspect, with minor osteophyte development around the margins of the caudal part of the centrum. The corresponding aspect of the sacrum appears normal.
Also approximately 30 small fragments of ilium and ischium.

8142 [SH92 Int42 8142 - note that drawing D457 appears to show 8142 as part of the pelvis]
R humerus, complete but for minor damage to lateral tuberosity, and fully fused.
GLC 270
BP 89.2
SD 38.0
BD 84.4
BT 74.2

8143 - R femur, complete though abraded around greater trochanter, fully fused.
GL 379
GLC 348
BP 116.4
DC 56.9
SD 42.4
BD 91.6

8144 - R tibia, complete save minor abrasion around proximal end, fully fused.
GL 339
SD 42.3
BD 78.6

8145 - R calcaneum, complete, fully fused.
GL 109.1
GB (53)

8146 - R astragalus, complete.
GH 58.5
GB 64.5
BFd 49.4
LmT 62.4

8147 - R os tarsale III plus os tarsi centrale plus cuboid plus sesamoid. All complete.

8148 - R metatarsal III, complete, fully fused.
GL 262
BP 56.9
SD 34.5
BD 44.4
Also R metatarsals II, IV.

8149 - R pahalanx III pes, extensively broken other than around articular facet.
LF 24.4
BF 44.6

8150 - R phalanx II pes, complete, fully fused. [Note that drawing D457 appears to label phalanx II as 8151].

8151 - R phalanx I pes, complete, fully fused [Note that drawing D457 appears to label phalanx I as 8150].
GL 79.3
BP 56.9
SD 34.5
BD 44.4

8152 - R metacarpal II, fragmented.

8153 - R phalanx II manus, complete, fully fused.

8154 - R phalanx I manus, complete, fully fused.
GL 83.0
BP 58.0
SD 36.8
BD 46.8

8155 - R metacarpal, complete, fully fused.
GL 223
BP 51.2
SD 35.6
BD 51.2

8156 - R radius plus ulna, complete but with recent break in ulna diaphysis, radius fully fused, ulna olecranon process fused.
Radius
GL 332
BP 86.1
BFp 78.5
SD 39.6
BD 67.7
BFd 64.7
Ulna
LO 82.5
DPA 64.5
SDO 48.7
BPc 47.5
8157 - 2 R manus sesamoids.

8158 - 2 capita plus c. 30 fragments ribs, very highly fragmented. [Note that drawing D457 appears to show 8158 as R humerus].

8159 - R scapula, collum plus articulation, blade fragmented.
SLC 66.9
GLP 93.7
LG 56.4
BG 46.8

8160 - 4 R carpals plus sesamoid, all complete.

8161 - L pes sesamoid.

8162 - L manus sesamoid.

Catalogue ends.
TPOC June 93

8.2.2 The bull from Int 50 [Research files]

8.2.3 Fragments from Mound 5 grave pit (Int 41)

Transcript of letter from University of York, Department of Biology

8.2.90

Dear Madeleine

Re: Bones (sensu lato) from Sutton Hoo 88, Int. 41

I've been through the material twice, and can offer the following identifications:

Fragments of molar unidentified large herbivore ▵ 41385, 41386, 41387, 41389, 41393, 41646, 41656.

Probably cattle upper molar :- ▵ 41391

Probably horse upper pre/molar [ie P3 → M2] - 41388, 41390, 41392

Horse upper 3rd premolar - ▵ 41394

I frankly doubt that any further examination would yield further information, as the material's so friable that any handling will just destroy it. As to the significance of these teeth, cattle and horse teeth are particularly large, dense and robust and thus durable in an aggressive environment. It's not out of the question that these are the last relic of a formerly substantial assemblage of bones which included horse and cattle skulls.

The degraded brown squidge labelled ?wood has been passed on to Allan Hall in the faint hope that he might squeeze something out of it. At first glance, it appears to be ginger cake.

Best wishes

Terry

8.2.4 Report on cremated animal bone by Julie Bond

Sutton Hoo Animal Bone Report;

Material from Int 44 (Mounds 6 & 7) and Int 41 (cremation in Mound 5)

J M Bond

Introduction.
This report concerns bone, mostly cremated, from three mounds investigated by the Sutton Hoo Research Committee (Mounds 5, 6, 7). Human bone from these excavations was identified by Frances Lee (SEE REPORT) but there still remained a substantial majority of material which could not be identified as human; some of this material is of animal origin, and forms the basis of this report.

Animals have long been known as grave offerings in both inhumation and cremation rituals of the early Medieval period, and their presence at Sutton Hoo had already been noted by Gejvall in his examination of material from mounds 3 and 4 (Gejvall 1975). However since Gejvall's work, the completion of studies on large early 'folk cemeteries' (Filmer-Sankey 1992, 50) such as Spong Hill and Sancton (McKinley 1993 & 1994, Bond 1993 & 1994) gives a new perspective on the context of these depositions. The presence of animal bone in the recent excavations at Sutton Hoo offers an opportunity to extend our knowledge of animal offerings in the burial rite at this higher-status site.

As in all studies of cremated bone, only a small proportion of the bone recovered can be positively identified; at Sutton Hoo this proportion was even lower than usual, due to the small size of the recovered fragments. McKinley has observed (*pers. comm.*) that disturbance of the cremated bone, once deposited, leads to the breakup of fragments into even smaller (and therefore less identifiable) pieces, and the history of disturbance and grave-robbing at Sutton Hoo is well known; mounds 5, 6 and 7 all suffered in this way. Since the unidentified fragments have all been listed and described by Lee, repetition is unnecessary; this report lists only those fragments which could be identified as animal. The reader is referred to Lee's report for listings of the unidentifed fragments, as well as size and weights of bone present.

Method of identification

Bone fragments were compared directly with material in the reference collection of the University of Bradford Department of Archaeological Sciences and with the author's own reference material. Because of the fragmentary nature of cremated bone, and the fact that studies such as Spong Hill (Bond 1994) have shown that several animals (and sometimes more than one individual of the same species) may be present in a cremation, no assumptions can be made in identification of this material. Therefore, as well as bone identified to species, the lists contain two other categories. 'Large ungulate' is used to describe cattle and horse-sized bone fragments which could not be positively identified to either species (this category could also include red deer). 'Sheep/goat size' is a similar category for smaller animals, a size range which might also include some pig, large dog or small deer. Even where only one species in a size category was identified from a deposit, no assumptions were made about bone fragments which could possibly be from that species but which not be precisely identified, and these fragments were listed in the broader categories of 'large ungulate' or 'sheep/goat sized'. This system was used at both Spong Hill and Sancton I, and a fuller explanation can be found in the Spong Hill report (Bond 1994).

Range of Species

Very little of the material from Mound 5 (Int 41) could be identified, although some material fell into the 'large ungulate' and 'sheep/goat' categories. One of these fragments may possibly be from a horse Megapodius, although the identification is uncertain; the smaller material consists of three rib fragments which are probably, though not definitely, from a sheep or goat. Mound 6 yielded material which could be identified as sheep/goat, pig, an unidentified large ungulate, and 'modern' (uncreased) rabbit bone, presumably the result of earlier disturbance. Mound 7 contained evidence for horse (cremated and uncreased bone) cattle, sheep/goat, pig, a fragment of unworked red deer antler, and again, modern rabbit. In addition, the examination of this material also yielded a few fragments of worked bone and antler from mounds 5 and 7; these are listed separately at the end of the report.

Mound 5 (Int 41)

As mentioned above, none of the cremated bone from this early mound could be positively identified to animal species, and very little to the two size categories. The bone fragments in the 'large ungulate' category did suggest, however, that a large animal was present in the cremated bone. The large mammal bone included a small piece which could be part of the shaft of a horse Megapodius, but the identification is not definite. The other bone in the 'large ungulate' category consists of two other shaft fragments, an area of articular surface, possibly from a distal femur, and part of a vertebra. The three fragments in the 'sheep/goat size' category are all from ribs.

Mound 6

The bone identified from Mound 6 included large ungulate, sheep, pig, and modern (uncreased) rabbit.

The relatively large amount of bone in the 'large ungulate' category (42 fragments) suggests the presence of at least one large mammal, although this animal (or animals) cannot be positively identified. The bone includes cranial elements, mandible, long bones, vertebra and rib. One fragment is tentatively identified as possible horse metapodial and one as a probable fragment of cattle humerus shaft (right side).

The sheep/goat bone from mound 6 includes cranial elements (horn core, skull) foreleg (left and right humeri, scapula) hind leg (right half of pelvis, left and right femur, left and right tibia), vertebrae and rib fragments. The pattern of the skull fragments strongly suggests that this animal is a sheep rather than a goat, and the presence of so many elements from both sides of the body makes it probable that a whole animal, rather than selected joints, is represented. No butchery was visible on any of the bones. Assuming that these fragments do represent a single individual, an age at death of less than 2 ½ - 3 years can be suggested. This is based on the fact that both proximal and distal femur were unfused; the former fuses at 2 ½ to 3 years, and the latter at 3 to 3 ½ years (data from Silver 1969). This would suggest a valuable meat-age animal, rather than an old worn-out specimen.

The pig bone in mound 6 consists of fragments from a right scapula, right pelvis, right tibia and right astragalus, as well as some metapodial and phalangeal fragments. Some of the rib and vertebral fragments in the large 'sheep/goat size' category may also be from pig. In view of the lack of cranial elements and the fact that all the other pieces are from the right side of the carcase it is tempting to argue that the pig was deposited either as the right half of a butchered carcase, or as joints from the right side of the body. However, no butchery marks were found on any of the bones, and where so few bone elements are

identifiable, it is probably unwise to speculate beyond the strictest interpretation of the evidence.

On balance, the epiphyseal fusion data from the identified pig bones would suggest an animal of approximately 2 years old; the exception is one fragment of first phalanx, which appears to be unfused, and would suggest an age of less than 1 year old. The other pig bones are too large and robust to be from an individual this young, so it seems likely that this one bone either represents a second pig or is residual, perhaps from an earlier cremation at the pyre site.

There were a number of unburnt rabbit bones from Mound 6; they are in good condition, appear relatively modern and are presumed to be the remains of the animals responsible for much of the disturbance at Sutton Hoo.

Mound 7

The animals identified from Mound 7 were horse (cremated and unburnt), cattle, sheep or goat, pig, red deer and (modern, unburnt) rabbit.

The horse was represented by fragments of head (orbit, sphenoid) and axis vertebra, foreleg (right radius, right ulna, right metacarpal), pelvis, hind leg (femur, right astragalus) and first phalanx. All these fragments were of cremated bone. There was also an uncreased left metacarpal, left lateral metacarpal (m/c ?IV, fused to the m/c III) and a front first phalanx. There is no evidence for the age of the cremated horse, although the bone is obviously too robust to be a neonate or very young juvenile. All the uncreased bones are fully fused, giving a minimum age of eighteen months or so, though the animal may well have been much older. There is no evidence of butchery on any of the bone, cremated or unburnt. On the basis of the very few available measurements (see below), the uncreased bone would seem to be from an individual much the same build as the animal from the 1991 horse burial at Sutton Hoo (O'Connor 1994).

There is no evidence of butchery on either the cremated or uncreased horse bone. There are two pathological features; in the cremated bone, there appears to be some reactive bone formation at the distal end of the ulna, perhaps indicative of some trauma. The uncreased metacarpus has a swelling on the lateral (outer) side of the distal shaft, with a corresponding slight difference in the bone surface texture; the sort of feature which could be associated with sub-periosteal reaction to trauma, for example. The metapodia have little soft tissue covering to cushion against blows, and the outer face of the metacarpal would be a likely place for such damage. The possibility that both these bones (both from the right side of the animal) could be from the same animal and the pathologies the result of the same incident, is intriguing but unprovable. Skeletally, it is possible that these bones are from the same horse; both ulna and metacarpus appear to be from animals of roughly the same build and neither is obviously very old nor very young. It is possible to find unburnt or lightly burnt bones in a cremation deposit; McKinley (1994, 83) notes that poor burning of human skeletal areas, particularly the extremities, is not uncommon, and can happen for a number of reasons, including a small pyre or poor positioning. Some of the horse bones from single cremations at Spong Hill also showed variable degrees of charring (Bond 1994, 123). The metapodia and phalanges, endowed with little natural ‘fuel’ in the form of fat and muscle, situated at the extremity of the limbs and most likely to be on the cooler edges or even protruding from the pyre, are among the elements which are most likely to burn unevenly.

The cattle skeletal elements from Mound 7 consist of head (right occipital bone and mandible) and hind leg (astragalus, sesamoid) bone fragments. There are also possible humerus and metacarpal fragments in the 'large ungulate' category. There is no evidence for the age of this animal, and no pathological features or butchery marks.

The sheep/goat bones positively identified in Mound 7 are all from the hindquarters; left side of the pelvis, left and right astragali. There is a possible fragment of scapula in the 'sheep/goat size' category, although this could also be from the pig. There are many fragments of longbone and rib in the ‘sheep/goat size’ category which could also be from this individual. There is no evidence for the age of the animal, or for butchery of the carcase.

Positively identified pig bone from Mound 7 consist only of rib and right humerus. The animal was over 1 year old, since the distal humerus is fused. There are possible knife marks on the proximal end of one rib fragments, suggesting that these remains might represent a joint of meat, or a jointed carcase, rather than

the whole animal.

Red deer is represented in Mound 7 by a single fragment of unworked antler. Although it is possible that some of the many fragments identified only as 'large ungulate' may belong to a red deer, unworked antler has been found in other Anglo-Saxon cremations and inhumations where no other deer bone is present (Bond 1995). The issue is discussed more fully below.

Some fragments of modern, unburnt rabbit bone were found in the Mound 7 assemblage, again signifying disturbance by these animals.

Discussion

Recent work on the cremated animal bone from other lower-status cemeteries of the 5th to 7th centuries AD in England (Bond 1993, 1994 & in press; Harman 1989) means that there is now a considerable body of data to call on for comparison with the Sutton Hoo material. Although the Sutton Hoo animal bone was in even smaller pieces than is usual, due perhaps to disturbance by the nineteenth century robber activity, it was still possible to identify a number of bone elements and animals. The fact that large mammals such as horses and cattle might be represented by only a few small identifiable fragments, representing a small percentage of a bone, is usual in cremations; both the author's experience and experimental studies have shown that bones of large mammals survive less well under cremation than those of smaller ones - large bones break up into more pieces than small bones (Buikstra & Swegle 1988).

The small and rather unimpressive appearance of these fragments of animal bone do not in any way mirror the importance or material investment the animals would have represented in the burial ritual. The cremation of horses and cattle would have required a significantly bigger funeral pyre or multiple pyres, consuming a much greater quantity of fuel and creating a far more impressive spectacle. The evidence, both from these mounds at Sutton Hoo and from studies of the Spong Hill and Sancton I cemeteries, seems to indicate that whole animals were involved, rather than the head and hoof offerings suggested by earlier writers (e.g. Vierck 1971). At neither Sancton I, Spong Hill, or Sutton Hoo, is there any butchery evidence to suggest that these animals had been jointed as meat, although there is evidence for the dismemberment of sheep and pig at the first two cemeteries (Bond 1993, 1994) and possibly of pig at Sutton Hoo (above).

The investment represented by the loss of a fully-grown cow or ox is itself substantial, but the loss of a horse is on a different scale. If these were fully-broken riding horses, as the parallel horse burials would suggest (O'Connor 1994) then the investment includes the time and effort required in breaking and training the animal, as well as the secondary products (hide, bone, meat) which might normally be expected at the end of its working life. The relative abundance of horses in some lower ranking cemeteries such as Spong Hill and Sancton (23% and 22% respectively of the cremations, had material identified as horse) thus seems even more remarkable than the presence of horse at Sutton Hoo in the burial of a male human (O'Connor 1994), in the cremations examined here, and in Mounds 3 and 4, which contained a male human and a horse each (Gejvall 1975). In contrast to the apparent association with male humans in these examples at Sutton Hoo, at Sancton and Spong Hill there appeared to be little sex bias in the deposition of horses in cremations; at Spong Hill for example, 13% of the definitely male and 11% of the definitely female cremations were associated with horse bone (McKinley 1994, 99), implying that the relationship being expressed is less obvious and more intriguing than simply a male warrior going to the grave with his favourite horse.

In 1971, Müller-Wille argued in his study of Continental horse-burials that there was a concentration of the custom in the areas of North-West Germany and the Netherlands settled by the Anglo-Saxons, whilst Vierck suggested that there was a connection between the horse burials and cremations found in England and West Scandinavian customs. 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, Gejvall and Persson 1970, Persson 1970). More recently however, O'Connor has pointed out that horse burials can be found across Europe, from England to Hungary (O'Connor 1994), so perhaps it is unwise to attribute too great a cultural significance to the simple presence of horse in the burial rite.

Compared to the range and variety of animal remains found at other Anglo-Saxon cemeteries, it may be thought surprising that these investigations identified only horse, cattle, red deer, sheep and pig, plus the possible dog identified from Mound 4 (Gejvall 1975). In contrast, Spong Hill contained all of these plus

bear (terminal phalanges, possibly from skins) roe deer, beaver, fox, hare, domestic fowl, goose and fish (unidentifed to species). Other smaller cemeteries, whilst not producing such a wide range, have also included some of these species. Sets of bear terminal phalanges were found in six cremations at Spong Hill, two at Sancton I and two at Elsham Wold (Bond 1994, 1996, Harman 1989). Whilst it is undoubtedly true that the sheer size of the Spong Hill cemetery means that the excavated sample is very large and that this might influence the greater range of species seen there, it might have been expected that the high status of the Sutton Hoo mounds would mean that more 'exotic' items such as bearskins could be expected. It has been suggested that these skins may have been imported, from Scandinavia for example, since the available evidence implies that bear was rare in Britain by this time (O'Connor 1989, 187). It could be argued that the small sample of cremations at Sutton Hoo, poor preservation and the effects of nineteenth century disturbance are sufficient explanation for the absence of this wider range of material, but there is also the possibility that the rarer deposits such as bearskins, fox carcasses and pieces of hare and beaver indicated something other than social rank.

The single piece of unworked red deer antler from Mound 7 is interesting because a number of cremations have contained similar material, without evidence for any other parts of a red deer carcase. Unworked red deer antler was found in three cremations at Sancton I and five at Spong Hill (two were female humans, one with a child), as well as in cremations at Millgate, Nottinghamshire and Lackford, Suffolk (Bond 1993, 1994, Harman 1989, Lethbridge 1951, 17-18). At Spong Hill, there was no other possible red deer bone from the contexts, though at Sancton I two of the burials had 'large ungulate' bone which could just possibly have come from a deer. Unworked roe deer antler was also found in two cremations at Spong Hill, with no definite evidence for the presence of other roe deer bone. At Millgate, 300g of unworked antler was found with a male cremation. There is no material from Mound 7 at Sutton Hoo which is definitely or probably red deer bone, though since there is material identified only as 'large ungulate' there is a slight possibility that more of the animal was present. It has been suggested that antlers found without other red deer bone may have been used in shamanistic practices, although it is difficult to see how this could be demonstrated (Wilson 1992, 136; Lethbridge 1951, 17-18).

The material from Mounds 5, 6 and 7 has added a new piece to the pattern already seen in mounds 3 and 4, with another horse cremation in Mound 7. However, the presence of cattle, sheep, pig and the fragment of red deer antler in this cremation reveals a much larger collection of animal offerings than has previously been identified from a Sutton Hoo mound. The unidentified large ungulate (horse, cow or perhaps both), sheep and pig in Mound 6 and the presence of large ungulate-size and sheep/goat size material from Mound 5 suggests that the deposition of multiple animal offerings is not a feature unique to Mound 7. These offerings show many similarities with those seen in studies of the humbler cemeteries of Spong Hill and Sancton I. It is now necessary to re-evaluate the function and purpose of these offerings, and their relationship to the status of the humans with whom they were buried.

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Sutton Hoo Animal Bone; Identifications of Material from Int 41 and 44

Intervention 41 (Mound 5 cremation);

1. Large ungulate-size (cremated bone)

F. No.			Box No.
38909	longbone	1 shaft frag	0-18
38961	longbone	shaft frag; possibly horse Megapodius (central foramen & rough-textured area to side)	0-18
38994	longbone	articular frag; possibly distal femur	0-18
40878	longbone	1 shaft frag	0-18
40982	vertebra	frag of articular surface	0-18

2. Sheep/goat size (cremated bone)

39206	rib	shaft frag	0-18
40878	rib	1 shaft frag	0-18
40981	rib	1 shaft frag	0-18

Int 44
Mound 6

1. Sheep/goat (cremated bone)

F.No.			Box No.
6060	?horn core?	2 frags	0-7
6057	cranium	2 frags, fit, occipital; shape suggests sheep not goat	0-7
6230	scapula	blade & part of *spina scapulae*	0-8
4582	humerus	distal shaft frag	0-5
4585	humerus	?sh/g, distal shaft frag, R, could be part of 4582	0-5
6009	humerus	3 frags shaft; probably sheep/goat L humerus	0-7
6042	humerus	6 shaft frags, L	0-8
6062	humerus	proximal articular surface fragment; ?F/NF, possibly L	0-8
4598	pelvis	?ischium frag, ?R	0-5
5885	pelvis	?sh/g, ilium shaft frag	0-6
5872	femur	?sh/g, distal epiphysis, NF, ?R	0-6
6030	femur	proximal frag (trochanter), L, prox NF	0-7
6037	femur	prox articulation, ?F/NF, ?L	0-7
4599	tibia	?sh/g, shaft frag, R	0-5
4621	tibia	?sh/g, longbone shaft frag	0-5
5828	tibia	?sh/g, distal shaft frag., ?R	0-6
5896	tibia	shaft frag, ?L	0-7
5916	tibia	?sh/g, shaft frag, R	0-7
6020	tibia	proximal shaft frag, ?L	0-7
6026	tibia	3 shaft frags	0-7
6175	tibia	shaft frag, R	0-8
5869	vertebra	cervical vertebra frag, epiphysis fused	0-6
6095	rib	shaft frag	0-8
6208	rib	3 shaft frags	0-8

2. Pig (cremated bone)

6183	scapula	3 frags, fit, distal F, R	0-9
4633	pelvis	?L ilium frag	0-5
5853	pelvis	R ilium (ala) frag, NF	0-6
6149	pelvis	ilium (ala) frag	0-8
6094	tibia	shaft frag, R	0-8
6097	tibia	prox frag, NF	0-8
6357	tibia	distal F, R, quite large (see note)	0-9
6031	astragalus	3 frags, fit. R. Quite large (see note)	0-7
6167	Megapodius	distal epiphysis, NF	0-8
5838	phal II	proximal epiphysis, NF	0-6

Notes;
The distal tibia and astragalus fragments noted above as ‘quite large’ are not measurable.

3. Large Ungulate-size (cremated bone)

5888	cranial	supramaxillary (?) frag	0-7
6028	cranial	?frontal fragment, very thick	0-7

4591	?mandible	?large ungulate mandible fragment	0-5
6007	?ulna	2 possible ulna shaft frags, fit	0-7
4611	longbone?	?large ung., shaft frags (5)	0-5
4626	longbone	possible horse metapodial shaft fragment	0-5
4628	longbone	shaft fragment	0-5
4629	longbone	2 shaft frags	0-5
4637	longbone	shaft frag	0-5
5915	longbone	2 frags	0-7
5922	longbone	?large ung size shaft frag	0-7
6027	longbone	shaft fragment	0-7
6039	longbone	shaft frag	0-7
6047	longbone	probably ?cattle humerus shaft fragment, R	0-7
4593	?metapodial	possible fragments of distal articulation, ?large ung.	0-5
5905	vertebra	4 frags of caudal vertebrae; epiphyses NF	0-7
5863	rib	2 frags, fit	0-6
5908	rib	3 shaft frags	0-7
6102	rib	c.10 frags	0-9

4. Sheep/goat sized (cremated bone)

5862	?scapula	blade frag	0-6
6202	scapula	frag of blade with part of spine; not pig	0-9
4600	longbone	possibly femur shaft frag	0-5
4609	longbone	shaft frag	0-5
4625	longbone	shaft frag	0-5
4650	longbone	tiny frag; may be part of humerus shaft	0-5
4655	longbone	frag of articular surface, ?tibia	0-5
5851	longbone	5 shaft frags	0-6
5882	longbone	shaft frag	0-6
5900	longbone	?metacarpal shaft frag	0-7
5907	longbone	shaft frag	0-7
5910	longbone	3 shaft frags; possibly tibia	0-7
6005	longbone	shaft frag	0-7
6013	longbone	4 frags shaft	0-8
6170	longbone	could be sheep/goat metacarpal? shaft frag	0-8
6186	longbone	shaft frag	0-9
6203	longbone	probably metacarpal shaft	0-9
4659	vertebra	fragment of articulation, epiphysis NF	0-5
5884	?vertebra	body frag	0-6
5921	vertebra	epiphysial plate, NF	0-7
6046	vertebra	3 frags epiphysial plates, NF	0-7
6063	vertebra	fragment of thoracic or possibly lumbar vert. body, NF	0-8
6092	vertebra	2 frags thoracic vertebra; spinous processes & part neural arch (possibly pig)	0-8
6155	vertebrae	1 lumbar vertebra, NF, 2 frags vertebral body, NF	0-8
6159	vertebra	body frag, NF	0-8
6172	?vertebra	possibly a lateral process from a cervical vertebra	0-8
6173	vertebra	possibly another lateral process articulation	0-8
6204	vertebra	cervical vertebra, body frag, both ends NF	0-9
6205	vertebra	NF	0-9
6232	vertebra	fragment	0-9

4586	rib	fragment	0-5
5860	?rib	shaft frag	0-6
5914	rib	4 shaft frags	0-7
6012	rib	fragment	0-8
6015	rib	frgament; probably juvenile pig?	0-8
6024	rib	12 shaft frags	0-7
6066	rib	frag	0-8
6034	rib	1 shaft frag	0-7
6038	rib	1 shaft frag	0-7
6093	rib	2 shaft frags	0-8
6174	rib	6 tiny fragments	0-8
6233	rib	2 frags	0-9
4632	rib	4 frags, tiny	0-5
4639	rib	shaft frag	0-5
4642	rib	2 shaft frags	0-5
6236	phal I	frag of sheep/goat or pig phalange; proximal ?NF	0-9

5. Rabbit (Modern, uncreased)

5635	tibia, radius & vertebra	unburnt	0-5
5490	vertebra	unburnt	0-5

Int 44
Mound 7

1.1 Horse (cremated bone)

11311	cranium	?sphenoid? quite a good match with horse		0-14
15691	cranium	?horse, frag of orbit		0-17
11305	axis	frag of proximal articulation	0-14	
5820	radius	distal articular frag, R	0-12	
13777	?ulna	?horse ulna shaft, R.		
		Pathological feature; new bone growth at distal end. 0-14		
15691	pelvis	?horse, frag of acetabulum margin	0-17	
11259	femur	shaft frag, ?*fossa plantaris* (good match)		0-13
15692	astragalus	2 frags, fit, articular surface, R	0-17	
5783	?metacarpal	proximal, F, ?R		0-12
11291	?metapodial	shaft frag	0-13	
12659	phal I	2 frags of distal articulation, F	0-13	

1.2 Horse (uncreased bone from mound 7)

7615 metacarpus III unburnt, whole, L
7615 & lat. metacarpus ?IV fused to M/c III.
(*No visible butchery or dismemberment marks on either of these bones; the surface is mostly intact. There is a pathological feature on the M/c III; a slight swelling on the outer (lateral) side of the lower shaft with some alteration of the surface texture.*)
7614 phal I whole, F.
(*Slightly worse condition than 7615, with more of the surface missing.*)

Measurements were taken where possible on these bones (see below), for comparison with the horse burial from Sutton Hoo (O'Connor 1994).

Measurements of uncreased horse bones (Find Numbers 7615, 7614);
All measurements after Von den Driesch (1976). Values in millimetres. Values for the Sutton Hoo horse burial (O'Connor 1994) are given in italics. Measurements in brackets indicate a damaged surface, and therefore a value which is possibly too small.

7615 metacarpus III;		***O'Connor 1994***
GL1	(239)	--
Bp	(47.8)	*50.6, 51.62*
Dp	(31.3)	--
SD	35.3	*35.6, 35.6*
Bd	48.3	*50.6, 51.2*
DD	23.2	--

7614 phalanx I;	***O'Connor 1994***
GL (86.2)	*83, 83.0*
Bp (48.7)	*55.5, 56.9*
Dp 34.0	--
SD 36.0	*34.4, 34.5*

2. Cattle (cremated bone)

15486	cranial	3 frags R occipital, fit	0-17	
11288	?mandible	?frag of lower edge of mandible		0-13
15688	astragalus	4 frags, fit	0-17	
15685	sesamoid	1 frag	0-17	

3. Sheep/goat (cremated bone)

5730	pelvis	acetabular fragment, ?L, iliac side	0-10	
15692	astragalus	1 frag, L	0-17	
15485	astragalus	1 frag, ?R	0-17	

4. Pig (cremated bone)

6420	humerus	distal fragment, R, F	0-10	
11304	rib	1 frag ?pig rib, shaft	0-14	
64112	rib	1 frag ?pig rib, proximal shaft. Possible knife marks at proximal end	0-11	

5. Red deer

11270	antler	1 frag antler, unworked	0-13	

6. Large ungulate-size (cremated bone)

15485	cranium	10 frags mastoid		0-17
15692	cranium	1 ?frontal frag		0-17
15486	tooth	2 root frags, fit	0-17	
15679	tooth	root frag	0-15	
13792	?humerus	?distal shaft, R	0-14	
13813	humerus	1 distal shaft frag	0-15	
5749	femur	1 frag distal, F	0-10	
5745	longbone	1 shaft frag	0-10	
5746	longbone	1 shaft frag; internal pattern suggests humerus, possibly cattle	0-10	
5747	longbone	1 shaft frag	0-10	
5773	longbone	1 shaft frag	0-11	
5775	longbone	5 shaft frags	0-11	
5779	long bone	1 shaft frag; possibly palmar face of horse Megapodius	0-12	
5784	longbone	1 shaft frag	0-12	
5785	longbone	1 shaft frag	0-12	
5799	longbone	articular frag, possibly distal femur	0-12	
5810	longbone	1 shaft frag; possibly cattle metacarpal	0-12	
6415	longbone	1 shaft frag	0-10	
11317	longbone	1 shaft frag	0-14	
11330	longbone	1 shaft frag	0-14	
12807	longbone	1 shaft frag	0-13	
14359	longbone	1 shaft frag	0-14	
15485	longbone	4 shaft frags	0-17	

15486	longbone	1 articular frag, 5 shaft frags	0-17
15678	longbone	1 shaft frag	0-15
15679	longbone	1 shaft frag	0-15
15688	longbone	1 shaft frag, large ung size?	0-17
15690	longbone	4 shaft frags	0-17
15691	longbone	1 ?humerus; frag of articular surface; 8 shaft frags	0-17
15692	longbone	4 shaft frags & 3 articular frags	0-17
11331	rib	1 shaft frag	0-14
13915	rib	ossified cartilege frags	0-15
14360	rib	1 shaft frag	0-14
15485	rib	2 shaft frags	0-17
15681	rib	2 shaft frags	0-17
15684	rib	4 shaft frags	0-17
15688	rib	1 prox shaft frag, F	0-17
15690	rib	3 shaft frags	0-17
16545	rib	1 shaft frag	0-17
13800	vertebra	1 frag epiphysis, NF	0-14
15486	vertebra	1 frag caudal vertebra	0-17
15691	vertebra	1 body frag, F	0-17
15692	vertebra	3 frags	0-17
16546	vertebra	1 frag body	0-17

7. Sheep/goat size (cremated bone)

5774	?scapula	2 frags blade	0-11
5735	longbone	shaft frag	0-10
5772	longbone	shaft frags	0-11
5799	longbone	shaft frag	0-12
15691	longbone	4 frags	0-17
11302	rib	shaft frag	0-14
11303	rib	shaft frag	0-14
11315	rib	shaft frag	0-14
11334	rib	shaft frag	0-14
11335	rib	shaft frag	0-14
12807	rib	shaft frag	0-13
13801	rib	shaft frag	0-14
15485	rib	7 shaft frags	0-17
15488	rib	1 shaft frag	0-17
15685	rib	1 shaft frag	0-17
15686	rib	1 shaft frag	0-17
15692	rib	22 shaft frags	0-17

8. Rabbit (unburnt bone, modern)

5159	mandible	L	0-12
10856	femur		0-13
10171	R femur, L femur, pelvis, sacrum, R tibia, vertebra, calcaneum, astragalus, Megapodius & phalanges		0-11
11717	tibia		0-14

Worked bone/antler from Mound 5;

39195	2 frags (fit) of trapezoidal object; max remaining size 14x16x9mm.	0-18
40008	? fragment of handle, curved cross-section.	0-18
40825	2 frags (fit) of plaque, maximum length 20mm. Pierced with 3 holes.	0-18

Worked bone/antler from Mound 7;

15691 1 frag comb plate, 2 frags gaming counters, 2 frags of a bone ?handle (external surface smoothed, revealing structure of bone)

15486 1 tiny fragment of bone/antler pin, cylindrical section.

9. **SELECTED STUDIES: Human Bone**

9.1 Inhumations

9.1.1 Assessment by J Rogers Aug 1985 [RF Z8.5(3)]

9.1.2 Assessment by J Rogers Dec 1987 [RF Z8.5(4)]]

9.1.3 Skull of F 161 [Burial 27] by F Lee [RF Z1.13(5)]

9.1.4 Interim report of skeletal material from INT 20, 32, and 41 by F Lee [RF Z1.13(4)]

9.1.5 Interim report on skeletons recorded from Sutton Hoo during the 1990 season by F Lee [RF Z1.15(4)]

9.1.6 **Final Report on inhumations by F Lee [unedited]**

Methodology

Age and sex

The age and sex of individuals were determined from the widest possible criteria following the recommendations published in Prashma 1980, in conjunction with Krogman (1978) and Phenice (1969).

Sex
An indication of sex can only be attempted for the adults because the definitive traits used in sexing skeletal remains are not present until the onset of puberty. The determination of sex relies on the differences in robusticity between the sexes and the adaptation of the female skeleton for childbearing. The skull and pelvis are therefore the most reliable indicators.

Age
The characteristics employed in the estimation of age in skeletal remains depends upon the developmental phase of the individual. The age given refers to the biological age, and the chronological (or real age) is assigned to a particular developmental stage from the studies on recent populations. The dental development is the most accurate method for ageing children up to fourteen years. When taken in conjunction with the appearance and ossification of the epiphyseal centres, which appear and fuse at determined developmental ages, the individuals may be aged to within a couple of years.

The problems involved in ageing adult skeletons have been widely discussed in recent literature (Molleson and Cox 1993, Suchey *et al* 1988, Iscan and Loth 1986). The outcome of these studies is that osteologists and physical anthropologists are now more acutely aware of the pitfalls in assigning a finite age for specific skeletons and now employ age categories for adults with caution. Sutton Hoo is no exception, the skeletons which proved possible to age were simply placed in broad groups of young, middle and mature adults. The poor preservation of the body has resulted in many of the criteria routinely employed becoming inapplicable; only the degree of dental attrition (after Brothwell 1981) and cranial suture closure (Meindl and Lovejoy 1985) were used.

The age categories were as follows:

Infant: 0–2 years
Child: *early*—2–5 years; *late*—5–10 years
Subadult: *early* 10–15 years; *late*: 15–18 years
Adult:18+ years: *young; middle; mature*

Dentition

The dentition was recorded according to the FDI system outlined in Hillson (1986) but is given in the following manner in the text:-

PERMANENT DENTITION
Upper Jaw

Right	8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8	Left

8 7 6 5 4 3 2 1 | 1 2 3 4 5 6 7 8

Lower Jaw
DECIDUOUS DENTITION

	Right	Left
Upper Jaw	e d c b a | a b c d e	
Lower Jaw	e d c b a | a b c d e	

*	Loss before death (ante-mortem)	A	Abscess
/	Loss after death (post-mortem)	U	Unerupted
-	Jaw missing	O	Erupting
C	Caries	NP	Not present
Cr	Root caries	R	Root only

PHYSICAL AND GENERAL CHARACTERISTICS

(1) Stature was estimated from the long bone measurements using the formulae employed by Trotter (1970).
(2) Robusticity indices follow Bass (1981) while the cranial and the intracranial indices are after Bass (1981) and Brothwell (1981).
(3) Epigenetic variations in the cranium were recorded according to Berry and Berry (1967) and in the post-cranial skeleton as described by Finnegan (1973).
(4) Individual summaries are listed below for Groups 1 and 2 burials and for the inhumations associated with the mounds see above, Chapter 5.

PRESERVATION

The preservation of the burials at Sutton Hoo is unusual (see above). Although many

bodies were clearly visible during the excavations (see Pls 00–00), very little of this was represented by bone. That which did survive was fragmentary and extremely friable and more often than not crumbled on lifting. Various techniques were employed to maximise the data available, these included the use of PVA, moulds and lifting the bodies en bloc. The burials appeared on excavation quite clearly as a dark stain in the sand. This stain was of a more compact material and on excavation the bodies were three-dimensional. Occasionally within the stain bone had survived, but this was of poor quality. An attempt was made (see catalogues of skeletal material) to compare the state of preservation for the Sutton Hoo burials; this comparison was subjective and not quantifiable. Compared to other cemetery populations the skeletal assemblage rates poor to unidentifiable. the human bone reports record the limited information from the bone which did survive sufficiently well to be looked at in the laboratory in conjunction with field notes. The catalogues summarise the burial information but more detailed listing have been left in the archive.

Report on the skeletal material from Group 1 (Burials 17-39)

Evaluation of material

A total of twenty three graves was excavated from the eastern periphery forming the Group 1 inhumations (Burials 17-39). Eighteen graves were excavated in Int 32 of which three (Burials 28, 31 and 34) were present as a body stain only. The remaining fifteen bodies contained variable amounts of osseous material, these include Burials 23-27, 29, 30, 32, 33. Five graves were excavated from Int 52. Of these Burial 38 was a body stain. In this study nineteen bodies from Group 1 containing osseous material are discussed.

The nineteen graves with bone surviving were all in a poor state of preservation. For the purposes of this study the bone condition was graded comparatively throughout the sample according to good, fair and poor, see Table 6.6.

Table 6.7 shows the proportion of the skeletons represented.

Sex

Three of the burials were male (Burials 23, 30 and 39), and a further four were probable males (Burials 17, 24, 25 and 27). Twelve individuals proved impossible to sex, either because the relevant parts of the body were not present or because they were too fragmentary and weathered.

Age

Six individuals were young adults, one of which, Burial 37, is aged subadult–adult (15-21 years); a further three individuals were in the young to middle age range and only two middle to mature (see Table 6.8). Finally, eight individuals were so poorly preserved that they could only be aged as adult (estimated to be over the age of 18 years) (including 3374).

Stature

Only one individual had any of the long bones sufficiently well preserved for an estimation of stature or height to be made. Burial 30 was a young male measuring 172.3 cm ± 3.27 (5' 7^{k}").

Epigenetic and non-metrical variations

These measure the biological distance of the population by multivariate analyses of the metrical and non-metrical traits or minor variations in the skeleton. They are not so much pathological but anatomical anomalies and result from normal but varied developmental processes. As yet, their exact relevance is incompletely understood, however, the effect of the environment and genetics are considered to be determining factors. The non-metrics for this study were simply recorded where present (Table 6.9). No attempt was made to interpret the results as the incomplete nature and small size of the sample would invalidate the results.

DENTITION

Fourteen individuals had fragments of the upper or lower jaws present, with a total of 217 permanent teeth represented, 111 from the upper jaw and 106 from the lower jaw (TABLE 6.10).

Caries were only present in one individual, Burial 39, with seven of the teeth affected: the maxillary right canine, right 1st molar and left and right 2nd molars; in the mandible the right 2nd and 3rd molars and a root caries to the left lateral incisor. Dental caries result from the progressive and irreversible decay of the dental hard tissues exposed to the oral fluids. It is one of the commonest of all dental pathologies and is also the main route through which bacteria reach the deeper tissues opening the way for infection and inflammation of the dental pulp and periapical tissues. Burial 35 has a large developmental pit to the buccal aspect of the 2nd left mandibular molar, the site for an early carious lesion.

Three individuals (Burial 23, 24 and 39) have evidence for apical abscesses. These are localised areas of infection resulting in a build-up of pus with the formation of an osteolytic, bone destructive, lesion. Abscesses may be secondary to dental caries or result from infection through the pulp cavity as a result of severe attrition. Table 6.11 shows the site of these lesions.

In Burial 23, the abscess occurs to the left mandibular 1st molar and drains buccally, while in Burial 24 there is an apical abscess contained in the socket of the right lateral maxillary incisor. Burial 39 has three such lesions, one to the right maxillary 1st molar, one to the 2nd left maxillary molar and a probable 3rd lesion developing at the right maxillary 2nd premolar.

Calculus, a hard deposit which forms on the teeth by the calcification of bacterial plaque, was noted on the teeth of six to seven individuals. In six cases, the degree was very slight but in Burial 39 there was a moderate deposit. Clinical studies have shown that relatively low deposits of calculus may be the result of dietary factors influenced by the pH or acidity of the mouth, which is in turn dependant upon the amount and type of carbohydrate in the diet. Plaque grows faster in the mouth where sucrose is added to the diet than when other sugars such as fructose or glucose are added (MacPhee and Cowley 1975). An alternative reason for the absence of calculus may be due to post-mortem loss or failure to preserve in the adverse soil conditions.

Alveolar recession was noted in seven individuals, this is associated with periodontal disease, a disease of the supporting tissues of the teeth resulting in their loosening and eventual loss. The most common cause is as a build up of calculus which instigates an inflammatory response, in Burial 39 alveolar recession and periodontal disease were

marked.

Enamel hypoplasia, a defect which occurs during the enamel forming processes of the teeth and is caused by a cessation of enamel production, was recorded in six individuals, and a large developmental pit in a single tooth of Burial 35. Enamel hypoplasia may be due to a variety of causes including nutritional deprivation, disease, and parasitic infection. Defects are visible macroscopically as lines or pits on the surface of the teeth. The most commonly affected tooth was the mandibular canine affecting seven teeth in four individuals, the maxillary canine was the second most commonly affected tooth (See Table 6.12).

Two individuals (Burials 17 and 19) had failure of one or more teeth to develop (hypodontia). In both cases the 3rd molar were absent. In Burial 17, the left mandibular molar was affected and in Burial 19 all three of the 3rd molars available for analysis were absent. There is some indication that the absence of the 3rd molar may be directly related to tooth size and contain an inherited characteristic (Hillson 1986, 256). Brothwell et al (1963) estimated that between 0.2%–36.6% of jaws may have the absence of one or more of the 3rd molars while Banks (1934) suggests that as many as 20% of the population may be affected.

Finally Carabelli's cusps and shovel-shaped incisors, both considered to be epigenetic or non metrical traits, were recorded on single individuals (Burials 24 and 25).

DENTAL PATHOLOGY

The dental pathology is shown in Table 6.13.

DENTAL SUMMARY

Although dental pathologies were recorded, they give little insight into the dental and oral hygiene of the population because of the poor degree of preservation. The absence of the dentition from many of the skeletons and the presence of the enamel only (as in the case of Burial 17) provides a very incomplete and subsequently biased picture of the dental pathology for this group.

Skeletal pathology

DEVELOPMENTAL

Burial 19 has a small developmental pit to the centre of the left superior apophyseal joint of the 4th cervical vertebra.

INFECTION

Pitting and erosion were recorded to the left incus of Burial 27, the result of chronic inflammatory disease of the middle ear.

Burial 39 had subperiosteal reactive bone, linear in appearance and merging with the cortical bone, to the medial aspect of the midshaft of the right tibia, suggesting an old inflammatory reaction.

GENERAL HEALTH

Cribra orbitalia was visible as pitting to the roof of the left orbit of Burial 24; this is in the

process of being remodelled, suggesting a healing lesion. Cribra orbitalia is thought to result from iron deficiency and/or intestinal blood loss through chronic intestinal parasitic infection (Stuart MacAdam 1982).

DEGENERATIVE

The degenerative diseases of the body result in part, from continued or successive trauma of a very mild nature sustained over a period of years. They reflect everyday wear and tear on the body, which is inseparable from a normal but vigorous life, and consequently appear to be closely associated with advancing age. Secondly, there is known to be an increased local prevalence in certain occupations where a single joint is exposed to unusual stress (Dick 1972, 12). The only evidence for degenerative change was noted to the left acetabula of Burials 26 and 39, with lipping and early pitting to the joint margins suggestive of incipient degenerative joint disease.

MISCELLANEOUS

Burial 39 has an osteolytic lesion to the left fibula immediately above the attachment of the interosseal ligament. This is most probably the result of a cyst and there is no evidence for any bone reaction.

Catalogue of skeletal material from Group 1 burials

BURIAL 17
Int 20/F9; Int 32/F118. Body: F254 (1049)
AGE: Adult (young 17-25 years)
SEX: Probable male
BONE PRESERVATION: Poor; originally the body was well represented, but only the skull fragments of the right upper body and right lower leg have been recorded. The rest was sent to Harwell for C14 dating during the evaluation programme.
DENTITION:

	R															L
								*	*	*	*	*	*	*	*	
Maxilla	8	7	6	5	4	3		1	2	3	4	5	6	7	8	
Mandible	8	7	6	5	4			1	2	/	/	/	6	7	NP	
								*	*							

* enamel crown only survives

Calculus: slight, much probably lost post-mortem

BURIAL 18
Int 20/F39; Int 32/F101. Body: F246 (1067)
AGE: Adult
SEX: Unknown
BONE PRESERVATION: Very poor; only fragments of the right femur, left temporal bone of the skull, and maxillary premolar survive.

BURIAL 19
Int 20/F40; Int 32/F102. Body: F247 (Int 20 1069/Int 32 1062)
AGE: Adult (young-middle)
SEX: Unknown
BONE PRESERVATION: Good-fair; the right side of the skull in particular the facial region, cervical vertebrae and a single carpal bone.
DENTITION:

	R															L
Maxilla	NP	7	6	5	4	3	2	1	/	/	/	/	5	6	7	-
Mandible	NP	7	6	5	4	3	2	1	1	2	3	4	5	6	7	NP

Calculus: slight-moderate
Slight overcrowding of the anterior mandibular teeth

SKELETAL PATHOLOGY:
Developmental: Developmental pit to the left superior apophyseal joint of the 4th cervical vertebrae.

BURIAL 20
Int 32/F106. Body: F249 (2009, 2091)
AGE: Probably adult
SEX: Unknown
BONE PRESERVATION: Poor-unidentifiable; very badly weathered long bone probably from the upper leg.

List of Bones recovered
2772 L. leg, probably tibia

BURIAL 21
Int 32/F108. Body: F251 (2000). The head of the body (2002) was redeposited on the body above (Burial 22).
AGE: Adult
SEX: Unknown
BONE PRESERVATION: Very poor; weathered fragments of the innominate and legs only present. The underside of the bone survives best, the rest of the body present as a stain.

BURIAL 22
Int 32/F109
AGE: Adult
SEX: Unknown
BONE PRESERVATION: Poor; fragments of the lower body only, in particular long bones of the lower leg.

BURIAL 23
Int 32/F137/1. Body: 2023
AGE: Adult (middle-mature)
SEX: Male
BONE PRESERVATION: Good-fair, for Sutton Hoo the preservation is exceptional. The left side of the skull, right arm, lower trunk and upper legs have a substantial amount of bone. The lower legs and left arm are represented by a stain only.

DENTITION

	R								L
Maxilla						6	7	8	
Mandible				/	/	6	7		

Calculus: lost postmortem, periodontal disease and alveolar recession present

BURIAL 24
Int 32/F137/2. Body: 2059
AGE: Adult (young-middle)
SEX: Probable male
BONE PRESERVATION: Good–fair; the skull only, predominantly the left side.
DENTITION:

	R													L
Maxilla	7		5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible			5	4	3	2	-	1	2	3	4	5	6	7	8

Calculus: slight most lost postmortem. Alveolar recession slight. Enamel hypoplasia present.

SKELETAL PATHOLOGY: Cribra orbitalia—healing lesion to left orbit.

BURIAL 25
Int 32/F146. Body: F258 (2060)
AGE: Adult (young)
SEX: Probable male
BONE PRESERVATION: Very poor; only very small fragments of the body remain, including the skull, right lower leg and unidentifiable long bone fragments. The teeth are represented by fragments of enamel only.
DENTITION: Laterality of teeth unknown.

Maxilla	8	7	6	5			1							
Mandible				5						4	5	6	7	8

BURIAL 26
Int 32/F154. Body : F259 (1080)
AGE: Adult
SEX: Unknown
BONE PRESERVATION: Poor; cranium and fragments of the innominate and upper leg.
DENTITION:

Maxilla	7	or	8

SKELETAL PATHOLOGY: Early osteoarthrosis to the left acetabulum

BURIAL 27
Int 32/F161. Body: F260 (2065)
AGE: Adult (young-middle)
SEX: Probable male
BONE PRESERVATION: Poor; fragments of skull and upper cervical vertebrae and right clavicle only.
DENTITION:

	R															L
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	8	7	6	5	4	3			/	/	/	4	5	6	7	8

Calculus slight most probably lost postmortem. Enamel hypoplasia

SKELETAL PATHOLOGY: Infection Pitting to L. incus

BURIAL 28
Int 32/F163, Body: 1096
AGE: Adult (from FL's examination of the *in situ* body stain)
SEX: Unknown
SKELETAL PATHOLOGY: Disc degeneration to mid lumbar vertebrae noted by FL in field.
PRESERVATION: Stain only. No bone survived into the laboratory; some vertebrae observed in field.

BURIAL 29
Int 32/F166. Body: 1089
AGE : Adult.
SEX: Unknown (robust)
BONE PRESERVATION: Poor; fragments of skull and lower limb.

BURIAL 30
Int 32/F173. Body: F264 (2038)
AGE: Adult (young)
SEX: Male
STATURE: 172.3 cm ± 3.27 (5' $7^{3}/4$")
BONE PRESERVATION: Good-fair; most of the body is represented. The skull and lower body are the best preserved elements. The upper part of the skull (left side) was preserved with PVA and consequently the dentition could not be examined and superficial observations only recorded.
DENTITION:

	R															L
Maxilla	8	7	6	5	4	3	/	-	1	2	3	4	5	6	7	/

Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	?

Calculus: slight to moderate. Alveolar recession slight. Enamel hypoplasia.

BURIAL 31
Int 32/F231. Body: F237 (1107)
Body stain only. No bone was recovered.h

BURIAL 32
Int 32/F227. Body: F238 (1112)
AGE :Adult (young)
SEX :Unknown (robust)
BONE PRESERVATION: Poor; dentition well preserved, left upper arm and upper leg only.
DENTITION:

	R														L
Maxilla	8	7	6	5	4	3	2	1		2	3	4	5	6	7	-
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

Calculus—slight to moderate. Alveolar recession slight, enamel hypoplasia.

BURIAL 33
Int 32/F227. Body: F239 (1113)
AGE : Adult
SEX : Unknown
BONE PRESERVATION: Poor, fragments of the occipital bone, atlas and axis.
DENTITION:

	R														L
Maxilla	8	7	6												
Mandible	8	7	6											6	7	8

BURIAL 34
Int 32/F235. Body: F240 (1114)
Stain only. No bone recovered

BURIAL 35
Int 52/F4. Body: F34 (1039)
AGE : Adult (young 18–21 years)
SEX : Unknown, but general appearance is robust
BONE PRESERVATION : Poor; fragment of left side of skull, and fragments of upper and lower limbs.
DENTITION:

L

Mandible 6 7 8

c?

BURIAL 36
Int 52/F37. Body: F71 (1086)
AGE: Probable adult
SEX : Unknown
BONE PRESERVATION: Very poor; fragments of R. lower arm, pelvis and upper legs only.
COMMENT: Size and robusticity suggests adult

BURIAL 37
Int 52/F25. Body: F72 (1087)
AGE :Subadult-adult (young) (approximately 15-25 years)
SEX : Unknown
BONE PRESERVATION : Very poor; fragments of the skull and R. tibia only.
DENTITION:

L

Maxilla 6 7 8

BURIAL 38
Int 32/F35. Body: F75 (1090)
Stain only. No bone recovered

BURIAL 39
Int 32/F36. Body: F74 (1089)
AGE : Adult ? mature
SEX : Male
BONE PRESERVATION: Fair; skull condition exceptional for Sutton Hoo. R. lower limb posterior aspect only preserved, left lower limb good condition.
DENTITION:

R L

A ?A A

c c c c

Maxilla	-	7	6	R	R	3	2	1	1	2	3	4	5	6	7
Mandible	8	7	X	5	4	3	2	1	1	2	3	4	5	X	X	8
	c	c								cr					

Calculus—moderate, alveolar recession considerable, periodontal disease. Dental health poor, caries, abscess and enamel hypoplasia all present. Anterior teeth marked attrition.
SKELETAL PATHOLOGY: Subperiosteal reactive bone to midshaft of R. tibia, well healed or old inflammatory change. Osteolytic lesion to L. fibula above attachment of interosseal ligaments, result of a bone cyst.
Early degenerative joint disease to L. acetabulum.

Report on the Group 2 skeletons

EVALUATION OF THE MATERIAL.

Sixteen graves were excavated from around Mound 5, arranged radially or tangentially. These Group 2 skeletons were found in Int 41, 44, 48 and 50, with a minimum of seventeen individuals. Burial 47 is described as a body piece but, given the nature of the preservation, it is impossible to positively identify it as human, thus giving a minimum of sixteen individuals and another possible part of a skeleton.

Six of the graves contained stains of bodies (Burials 41, 46, 49, 50, 51, and 53) with no bone preservation whatsoever. In the ten graves with bone surviving, the bone was in variable states of preservation, ranging from relatively good to almost unidentifiable or simple bone splinters (see Table 6.14). The proportion of the skeletons present is shown in Table 6.15.

SEX

An attribution of sex could be suggested for six of the individuals with osseous material surviving. Of these, two were positively sexed as male (Burials 42B and 48), three probable males (Burials 40, 44 and 45), and one probable female (Burial 43). A further eleven proved impossible to sex.

AGE

Seven individuals proved impossible to age at all, as there was little or no bone preservation. Of the other ten, all were adult, with the majority (five) in the young adult age range, one of which was aged between adolescence and young adulthood. A further two were in the young to middle age bracket and two in the middle to mature range (see Table 6.16)

STATURE

An estimation of height was possible for Burial 42B, an adult male who was calculated to be 179.9 cm ± 3.37 (5' 10 ^{3}/4").

NON-METRICS IN GROUP 2

See Table 6.17.

DENTITION

Parts of the dentition from ten individuals were present. A total of 119 permanent teeth was recorded (Table 6.18, 116 fully erupted and three in the process of erupting). Of these, sixty two were recorded from the upper jaw and fifty seven from the lower jaw. A summary of the dental pathology is recorded in Table 6.19. Apical abscesses were evident in Burial 42B at the position of the 1st maxillary molar and the 2nd maxillary molar in Burial 48. A single caries was noted in the 3rd left maxillary molar of Burial 48, and a possible early caries or enamel defect to the occlusal surface of the 3rd mandibular molar in Burial 44. Enamel hypoplasia (Table 6.20) was recorded in five of the dentitions, while Burial 40 had failure of the right maxillary molar to erupt. Burial 42A has no evidence for the mandibular 3rd molars but it is felt, given the age of the individual, that they may not yet have erupted. Five of the dentitions have evidence for slight to moderate degrees of calculus, but the preservation of the bodies may account for much of its absence.

Alveolar recession and periodontal disease were scored, but little emphasis is placed on the results as the condition of the bone was too poor for this to be significant. Four individuals had evidence for alveolar recession and two for periodontal disease.

SKELETAL PATHOLOGY

Two individuals (Burials 42B and 45) have pathological lesions. A developmental pit was recorded in the right acetabulum of Burial 42B. Schmorls nodes, depressions on the surface of the vertebral body, were noted in Burial 42B to the 5th–7th thoracic and 11th thoracic to 1st lumbar vertebrae, and to the 3rd lumbar vertebra of Burial 45. These arise during childhood and adolescence and result from the protrusion of the disc into the adjacent body. Intervertebral osteochondrosis, a condition resulting from pathological changes to the intervertebral disc with age, was recorded in the 3rd and 4th lumbar vertebrae of Burial 45, associated with marginal vertebral osteophytes, and in the 6th thoracic vertebra of Burial 42B.

In Burial 42B osteoarthrosis was present in both the apophyseal joints of the 5th-7th thoracic vertebrae and incipient degenerative change to the right femoral head, distal articular surface of the left humerus, to the tubercle facet of two left ribs and the head of one right rib. Early degenerative change was present as early pitting to the left temporomandibular joint, and osteophytic lipping suggesting incipient change was recorded to the right glenoid cavity and intercondylar fossa of the left femur. Finally, enthesopathies, areas of increased muscle attachment were noted to the left ulna at the insertion of the triceps and to the right ribs at the attachment of the lateral costo-transverse ligaments.

Catalogue of skeletal material from Group 2 burials

BURIAL 40
Int 41/F81. Body: F152 (1426)
AGE: Adult (young)
SEX: ? Male
BONE PRESERVATION: Fair-poor; skull and upper vertebrae only (see comment).
DENTITION:

	R										L
Maxilla	NP	7	6	5	4	3		4	5	6	7	-

Mandible	8	7	6	5	4	3					4	5	6	7	8

Calculus—slight, enamel hypoplasia widespread

COMMENT: P. Bethell's report records more of the body (see Archive).

BURIAL 41
Int 41/F82. Body: F507 (1938), with pieces F509 (1944), F510 (1945).
Body stain only. No bones Recovered.

BURIAL 42A
Int 41/F86. Body: F148a (extra)
AGE : Adult (young)
SEX : Unknown
BONE PRESERVATION : Good; facial region of the skull and lower jaw.
DENTITION :

	R								L							
	O															
Maxilla	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Mandible	NP	7	6	5	4	3	2	1	1	2	3	4	5	6	7	NP
	U	?														U

Calculus—slight, attrition severe to the anterior maxillary teeth. Enamel hypoplasia - widespread.

BURIAL 42B
Int 41/F86. Body: F148b
AGE: Adult (middle-mature)
SEX: Male
STATURE: 179.9cm ± 3.37cm (5' $10^{3}/4$")
BONE PRESERVATION : Fair-poor; the condition is about the best experienced at Sutton Hoo. Most of the body with the exception of the facial region of the skull are represented. Much of the left lower arm is also absent.
DENTITION :

	R								L							
												A				
Maxilla		3									/	7	8			
Mandible												7	8			

Calculus slight; much has probably been lost postmortem. Alveolar recession moderate and periodontal disease surrounding the left maxillary 2nd molar. Enamel hypoplasia.

SKELETAL PATHOLOGY:
Developmental: Shallow pit to R. acetabulum
Schmorls Nodes: 5th-7th thoracic and 11th thoracic; 1st lumbar vertebrae.
Degenerative: SPINAL—Osteoarthrosis to apophyseal joints of 5th-7th thoracic Intervertebral osteochondrosis, 6th thoracic
POSTCRANIAL—Incipient change to R. femoral head, to distal articular surface of L. humerus, 2 x left ribs (tubercle), 1 x right rib, L temporomandibular joint Osteophytic lipping to R. glenoid cavity, and intercondylar fossa to L. femur.
Enthesopathy: L. ulna at attachment of the triceps, and to lateral costotransverse ligament of the right ribs.

BURIAL 43
Int 41/F86. Body : F149 (1529)
AGE : Adult (young)
SEX : ? Female
BONE PRESERVATION : Poor; only fragments of the skull, right femur and right tibial condyle.
DENTITION:

	R														L
Maxilla	8	7	6	5	4	/	2	1			3	4	5	6	7	8
Mandible	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

Calculus: slight. Developmental pits to the enamel.

BURIAL 44
Int 41/F124. Body : F542 (2011)
AGE: Adult (probably mature)
SEX: Probably male
BONE PRESERVATION: Poor; very fragmentary, including fragments of skull, L. maxilla, R. innominate, and L. and R. legs and feet only.
DENTITION:

	R		L
Maxilla		7	
Mandible		8	
		?c	

Developmental defect or early caries to the occlusal surface of the 3rd mandibular molar.

BURIAL 45
Int 41/F154 (Int 12, Grave 3). Body: F55 (1112)

AGE : Adult (young-middle)
SEX : ? Male
BONE PRESERVATION : Poor; very fragmentary, pieces of skull, pelves and lower limb.
DENTITION:

	R								L
Maxilla					5	6	7	8	
Mandible					/	6	7	8	

Calculus: slight to moderate. Alveolar recession slight.
SKELETAL PATHOLOGY
Schmorls Nodes Disc herneation to 3rd lumbar vertebra
Degenerative Intervertebral osteochondrosis, 3rd, 4th lumbar vertebrae. Associated marginal osteophytes.

BURIAL 46
Int 41/F424. Body : F499 (1917, 1928)
Body stain only. No bone recovered

BURIAL 47
Int 41/F435. Body piece: F418 (1827)
Organic stain which may derive from a body, possibly part of a long bone. It may or may not be human. No bone recovered.

BURIAL 48
Int 41/F486. Body: F555(2033)
AGE: Adult (middle-mature)
SEX: Male
BONE PRESERVATION: The left side of the skull is very well preserved, also fragments of the pelvis and lower limbs.
DENTITION:

	R															L
														A	c	
Maxilla								1	2	3	4	5	6	7	8	
Mandible	5	4	3	R	R			1	2	3	4	5	6	/		

Calculus: moderate, periodontal disease marked to maxilla and mandible, alveolar recession moderate-considerable.

BURIAL 49
Int 41/F517. Body: F524 (1990)
Body stain only. No bone recovered.

BURIAL 50
Int 41/F588; Int 12/Grave 1 in Area C (Longworth and Kinnes 1980)
No bones available.

BURIAL 51
Int 41/F 590; Int 12/Grave 2 in Area C (Longworth and Kinnes 1980)
PRESERVATION: Chemical analysis by M J Hughes (SHSB I, 60-62) found a concentration of calcium phosphate. The pH of the soil was not found to account for the different states of preservation of bone in the burials.

BURIAL 52
Int 44/F215. Body: F 219 (3090); F220 (1396)
AGE : Adult (young-middle)
SEX : Unknown
BONE PRESERVATION: Poor; calvarium and fragments of the right upper limb and left lower limb are all that survive.
DENTITION:
Maxilla 6 7 8 (side unknown)

BURIAL 53
Int 48/F 349. Body : F 351 (1583)
Body stain only. No bones recovered.

BURIAL 54
Int 50/F141. Body : F162 (1196), F188 (1261)
BONE PRESERVATION: All that survives are a fragment of mandibular molar (? 1st), and Maxillary premolar, both with very little attrition suggesting young age.
DENTITION:

Maxilla	4/5	
Mandible		6

BURIAL 55
Int 50/F341. Body : F379 (1535)
AGE : Adolescent–young adult
SEX : Unknown
BONE PRESERVATION: Poor; maxilla and fragments of skull and stain of ? R. tibia. Also 4 fragments of tooth crown, ? mandibular molar.
DENTITION: Laterality not known

			O	O
Maxilla	7	6	5	4

Enamel hypoplasia maxillary premolar.
COMMENT: No wear to the teeth, maxilla very poor preservation, some bone around premolars suggesting unerupted or erupting 12+ years.

9.2 **Final report on cremations by F Lee**

The cremated bone from Mounds 2, 5, 6, 7 and 18

by Frances Lee [edited S Hirst]

Methodology

The cremated bone was recovered and each fragment given a separate finds number. The remaining soil was then sieved to be certain that none of the cremated bone was lost.

Each fragment was next examined and the weight, size, colour, and type of fracture recorded. Wherever possible the bone was identified along with any other distinguishing feature such as pathological lesions. An attempt was also made to establish the minimum number of individuals present, the age at death and the sex of the individual.

Age at Death

The methods employed in ageing cremated remains are the same as those employed for inhumations, however the degree of fragmentation imposes greater limitations. The age categories in this study are as follows.

Infant	0–2 years
Child	2–12 years
Adolescent	12–18 years
Adult	18+ years

The estimation of age relies heavily on the development of the dentition (Ubelaker 1978) and on the appearance and fusion of the long bone epiphyseal plates. The absence and fragmentation of the pubic symphyses and sternal ends of the ribs makes ageing impossible by these methods. At Sutton Hoo ageing was entirely reliant upon the appearance and dates of fusion for the epiphyseal plates as the dentition was not present in any of the four cases.

Sex of the Individual

The sexing of cremated human remains is problematic. The degree of fragmentation made the assessment of the morphological differences in the adult skeleton impossible.

Non metrical traits

Non metrical traits and epigenetic variations are descriptions of minor morphological differences in the skeleton and were recorded where visible according to Berry and Berry (1967) and Finnegan (1978).

Appearance of the bone

The colour, types of cracking and warping were recorded for each fragment, and the total

weight of the sample given.

The cremated bone from Mound 2

Eleven fragments of bone were retrieved during the excavation and sieving of Mound 2 weighing a total of 1.05 grams. No single fragment could be positively identified as human and only three fragments appeared to be calcined, or burnt. It is the authors opinion that this does not represent a human cremation.

The cremation from Mound 5

1560 fragments of cremated bone, weighing 679.5 grams were excavated from a wrecked burial pit at the centre of Mound 5. The grave had been so comprehensively robbed that no evidence for its original structure survived (Bulletin 1989: 13). It was the excavators' opinion that the burial was originally placed in a copper alloy bowl, however most of the cremated bone was found in disorganised heaps which had been scattered by burrowing rabbits.

Although much of the cremated bone was unidentifiable a sizeable proportion could be placed in broad bone types, long bones, flat bones, cranium and vertebrae, and in some cases a more accurate identification proved possible. A significant proportion of the skeleton including the lower legs, skull, upper limb, trunk and vertebrae were identified leading one to suppose that most of the skeleton was present, however the total weight of the sample would suggest otherwise (see Discussion). None of the fragments was duplicated in any way and it was considered that a minimum of one individual was present.

The age at death was only possible to establish in broad terms. The cranial sutures were all unfused, and the thickness of the cranial vault was not great, suggesting a young age, adolescent to a young adult. Sexing proved impossible, the bones appeared to be from a slight individual, but this may be an indication of age rather than sex. Nor were any observations on the presence of any abnormalities or pathological lesions possible.

The colour of the cremated bone fragments from the Mound 5 cremation ranged from cream to light grey through to black with cream predominating. Much of the bone was well calcined and had characteristic patterns of cracking while other pieces did not appear to have been well cremated. Some of the bone was heavily covered in a concretion, which, when attempts were made to remove it, revealed a grey-white and generally angular piece of bone with a hollow centre black in colour (a minimum of sixteen instances). The author has not come across this before, but it has been suggested that this may reflect a process similar to the development of the sandmen or bone which was fully carbonized.

On cremation bone not only splits but cracks and warps, the greater the heat the greater the degree of fragmentation, distortion and splitting. 79.7% of the sample was over 15 mm in size (38% of the total number of fragments), indeed the pieces ranged up to 51 mm in length (see Table 5.2). The larger pieces tend to be fragments of the long bones of the lower limb, while the small fragments are from the ribs, vertebrae, and flat bones. The majority of fracture types recorded in Mound 5 were linear or longitudinal (52%) and curved transverse fractures (28.4%); twisting and some checking occurred but in substantially reduced numbers.

By far the most interesting features of this cremation are the injuries sustained to the head. A minimum of nine fragments of bone, and possibly ten, exhibit injuries to the cranial vault which are consistent with those inflicted by a sharp-edged instrument such as the blade of a

knife or sword. None of these has any evidence for healing or indeed any bone reaction, which suggests that the injuries were either the cause of death or occurred after death.

Unfortunately, the fragmentary and incomplete nature of the bone assemblage makes it impossible to state with absolute certainty where these injuries occurred although the general area of the skull has been indicated. Descriptions of the injuries for each fragment of bone are given below. One fragment of bone argues for at least one of the assaults being inflicted after death: 40445, a rectangular piece of bone with cuts on three sides and the fourth side represented by part of the lambdoid suture. The three cuts are at right angles to each other which is unlikely to have occurred in an attack while the individual was living. The motive behind this action is unclear, but the precision of the cuts makes the author wonder if an attempt was being made to remove a segment of bone as in cases of trephination. The other fragments have no obvious pattern to the position of the injuries and might indeed have been the result of an armed assault. Many or indeed most of the injuries are incomplete with the full length of the incision unknown. Moreover the skull was incomplete and there may have been more cuts. Finally, there was no evidence for any blade injuries to any other part of the skeleton from this cremation.

Frontal bone

40724, 40007 and 39358—Injury to the left side of the frontal bone diagonally from the coronal suture downward towards the supraorbital ridge, measuring 33.5 mm in length (incomplete). There is also an area of iron deposit to 40724 on the broken fragment of bone which looks as if a metal object had been inserted. However, given the degree of iron panning across the site this interpretation must be viewed with caution. On fragment 40007 close to the coronal suture, there is a small shallow depression within the realms of normality.

Parietal bone (Left)

40445—This is arguably the most interesting piece of bone. One side of this broadly rectangular fragment is represented by the lambdoid suture. It is uncertain whether this fragment of bone is from the occipital or parietal side of the suture, but the author is inclined to feel that it is more probably from the left parietal bone. Blade injuries occur on three sides of the bone at right angles to each other. Again there is no evidence for any bone reaction.

Bones of uncertain position

40728—Small area of bone from the sagittal or coronal suture, with a small oblique injury at right angles to the suture cutting the outer table approximately 16 mm in length, but incomplete.

40960—Blade injury cutting the outer table of the cranial vault. Exact position uncertain, but thought to be the parietal bone close to the coronal suture. One of the cuts is 25 mm in length and oblique. The second incision again only cuts the outer table and is 10 mm in length and incomplete.

40986/88—Long diagonal angled break, possibly the result of the irregular side of a blade injury.

41014—Part of lambdoid suture, with an oblique blade injury measuring approximately 21 mm along the entire length of the fragment, and cutting through the cranial vault.

Occipital bone

38934—Oblique blade injury, approximately 17 mm in length, running up to the lambdoid suture. It is uncertain whether this fragment is from the occipital or parietal bone.

40817—Superior angle of the occipital bone with lambdoid sutures meeting at the lambda. Approximately 26 mm from the lambda along the lambdoid suture is a small oblique injury with the force inflicted from behind and to the right. The centre of the incision is missing, postmortem. On the right the cut measures 8 mm and 5 mm on the left. The wound penetrates the outer table but the diploe and inner table remain rough and uncut.

Summary

The burial at the centre of Mound 5 was of a single individual, young in age of unknown sex. Fragments from most of the body suggest that most of the cremation was present at the time of burial but had been disturbed. The cremation process does not appear to have been particularly efficient with the majority of the assemblage in the 15 mm and over category although this only represents 38% of the fragments. The most interesting feature are the blade injuries to the skull of which there at least nine incidences. It is uncertain whether they were the cause of death or occurred after death, but the author would argue, in at least one instance, 40445, for the assault occurring after death. Finally, it should be considered that this individual may have achieved their status by the method of death.

The cremation from Mound 6

An east-west robber trench cut across Mound 6 had effaced all structural traces of the original burial. However, from the fragments which were recovered, the burial was thought to resemble the cremations from Mounds 4, 5 and 7: a cremation placed in a bronze bowl, covered or wrapped in cloth (see above Chapter 4).

1588 fragments of bone were recovered weighing 557.25 grams, 41% of the total weight was identified as animal bone while only a handful of fragments were positively identified as human. These include fragments of a human skull, the odontoid peg of the axis, the 1st proximal phalanx of the hand and a fragment of the pubic symphysis of the pelvis. This represented an adult individual, and, although a more precise age could not be given, it was noted that some of the cranial sutures appeared to be open. The fragment of the pubic symphysis was small and was not sufficient to give an indication of sex. No anomalies or pathological lesions were noted.

The degree of fragmentation was not great, the majority (60%) were over 15 mm in length, while only 10% were under 10 mm. This varies slightly when the positively identified animal bone was removed, with 47% of the total weight over 15 mm in length while 15% was under 10mm (see Tables 3-5). The explanation for this may lie in the heavier nature of the animal bone.

The colour of the bone was cream to white, but cream with a light grey interior was not uncommon. Occasionally, fragments were a deeper grey and very exceptionally (two instances) black fragments of bone were recorded. Overall, the colour of the calcined bone was similar to the cremations in the other mounds at Sutton Hoo. The patterns of fracture were recorded and included longitudinal splitting along the length of the bone (predominantly long bones), transverse fractures and some curved transverse fractures. Checking, twisting

and warping also were recorded but only in a handful of cases.

In summary, a single adult of unknown sex was buried in Mound 6 with a significant amount of cremated animal bone. The body was by no means complete, indeed, only a very small proportion of human body could be positively identified, but given the disturbance and robbing of the burial and mound, this is not surprising.

The cremated bone from Mound 7

The cavity containing the original burial in Mound 7 had been by and large undisturbed, despite excavation of the mound in the nineteenth century, and a small hemisphere of cremated bone was recovered (Chapter 4 above, p 00).

The total weight of the cremation was 1081.3 g, approximately 1713 fragments. Very little of this was positively identified as human, the exceptions being finds 15487 and 15677 from the robber trench, which contained identifiable human remains, consisting of fragments of the proximal end of the radius and ulna. Fragments of a patella and lower leg long bone were also identified. Approximately 48% of the total weight of the sample and 53% of fragments were positively identified as animal (see Bond below).

The age at death of the individual was estimated from the proximal end of the radius to be adult. An assessment of sex proved impossible, although the radial head was noted to be large and robust.

The bone colour was predominantly cream or white, occasionally light grey and very exceptionally brown or black. The majority of fractures were longitudinal (56% of those recorded) or transverse fractures (36%), with some curved (5%) fractures mainly in the long bones. A small number had longitudinal twisting (1%) and warping (0.5%).

The size of the bone fragments can be seen in Tables 5.6–8. Table 5.6 shows that 97.5% of the total weight was over 10mm, 58.2% over 15 mm and over 91% of the fragments over 10 mm in length. When the identifiable animal bone is taken out of the sample (Table 5.7) 61% of the total weight is over 15 mm and 96.4% under 10 mm in length. Compared to Mound 6 the difference in removing the identifiable animal bone is not that great. However, it must be emphasised that a considerable amount of the cremated bone, and indeed probably most of the unidentifiable fragments, in this assemblage were animal.

Summary

The cremated bone from Mound 7 is predominantly animal bone with a handful of fragments from a human individual. These human fragments were from the robber trench and consisted of remains of the lower arm and lower limb of a single adult of unknown sex. None of the cremated bone in the small deposit found in the original burial cavity contained any identifiable human remains, but a considerable amount of calcined animal bone. It, therefore seems likely that the human cremation may have been disturbed and removed by the robber trench. If the discrete deposit was to represent the main cremation then very little attention has been made to the collection of the human remains from the cremation site.

The Cremated bone from Mound 18

Excavated from the centre of Mound 18 was a randomly dispersed deposit of cremated bone

and charcoal. A total of 631 fragments of bone weighing 168.6 grams were represented, with associated finds (see above). Very little of the cremated bone was identifiable, and that which could be identified could only be placed in a broad category, i.e. long bone, flat bone or cranium. There is no suggestion of any duplication and it would appear that one individual was present. There is little information as to the age or the sex of the individual. The cranial fragments have thin diploic space suggesting a young age and the cortical and trabecuallar bone are also young in appearance. Unfortunately, in terms of ageing, neither the diagnostic ends of the long bones nor the dentition have survived, so it cannot be determined whether this is a sub-adult or young adult.

Approximately 80% of the assemblage is unidentifiable, the size of the fragments being the limiting factor rather than any other consideration. Approximately 80% of the assemblage is under 15mm in size and 21% of the total weight under 5mm in length (see Table 5.9).

The colour of the calcined bone ranged from white to cream and occasionally to dark grey. The majority of fragments were cream in colour which is thought to represent the upper temperature spectrum (see discussion). The degree of fragmentation is greater than in the other cremations from Sutton Hoo but the young age of the individual may be one of a predisposing factor. The types of cracking were predominantly longitudinal splitting (58%) and curved transverse (34%) fracture lines, compared to the other cremations relatively few notes of cracking were recorded, again this reflects the fragmentary nature of the assemblage and more specifically the small size of the fragments.

Summary

A cremation buried in a bronze bowl was excavated from the centre of Mound 18. The majority of the assemblage is unidentifiable, but it could be established that a minimum of one individual was present of unknown sex but young in age. There was a high degree of fragmentation limiting any further information on the individual buried.

The cremated bone from Burial 14

(Analysis by N-G Gejvall in SHSB 1, 98. No results for Burial 13.)

AGE : sub adult; below 20 years, perhaps below 18
SEX : probably a male.

Discussion and comparison of the cremations

The cremations under discussion here are from Mounds 5, 6, 7 and 18. The Mound 2 remains are not included in this summary as they are not considered by the author to represent a cremation (see Mound 2, above).

All four of the burials had been disturbed. The cremations in Mounds 5, 6 and 7 had all been robbed and/or excavated in antiquity while Mound 18 had been extensively damaged by ploughing. All four cremations were similar in that they had been collected after burning and wrapped in a piece of cloth and placed in a bronze bowl. There was no suggestion of any burning in the mounds, so it is probable that the cremations took place in a pyre or pit and were later collected and placed in the burial mound as a secondary burial.

Although much of the cremated bone was unidentifiable, it was often possible to place the

bone in broad categories such as long bones, flat bones, cranium and vertebrae, and in some cases a more accurate identification proved possible. All of the cremations from the mounds had a minimum of one individual present. The age at death was only possible to establish in broad terms. In Mounds 6 and 7 both were adult, the cranial sutures in the cranium from Mound 6 still being open, while in Mounds 5 and 18 the thickness of the cranial vault and the condition of the sutures suggest young individuals, adolescent or young adult. None of the cremations discussed here could be accurately sexed.

The overall weight of the cremated bone varied considerably, ranging from 168.6 grams in Mound 18 to 1081.3 grams in Mound 7. Mounds 5 and 6 had similar amounts with 676.5 grams and 557.25 grams respectively (see Table 22). Evans (1963) estimates that 1.6 kg is the average weight for a single cremation whilst Krogman (1962: 232) records the average weight of a dry fat free skeleton as between 2-4 kgs. This suggests that all the cremations excavated were incomplete bodies. Mound 5 has the most complete individual with fragments from most parts of the body. The cremations from Mounds 6 and 7 have a large amount of cremated animal bone in their assemblage. In Mound 7 the only identified human bone comes from the backfill of the robber trench, the discrete deposit of bone from the original burial cavity appears to be animal with no identifiable human remains. The cremated bone from Mound 6 also was recovered from the robber trench which had effaced all traces of the original burial (see above p. 00), and like Mound 7 was predominantly animal with a handful of human fragments.

The colour of the cremated bone fragments ranged from cream to white to light grey and very rarely dark grey to black. The efficiency or otherwise of the cremation has been suggested from the colour and degree of fragmentation of the bone assemblage. When burnt, bone follows a progressive colour change with white representing the most calcined bone, burnt at the highest temperature, while blackening of the bone reflects charring. This would suggest that the bone from Sutton Hoo was burnt at a reasonably high temperature, although some fragments which are cream in colour do not appear to be that well calcined. The relationship between colour and temperature may not be quite so simple, indeed experimental work by Parker (1985, 18) has suggested that the colour of calcined bone many not simply be determined by temperature, but that the amount of oxygen supplied to a fire is a crucial factor. Where there is a free circulation of air, such as in a pyre, the bone would be expected to have a uniform colour. This is the case at Sutton Hoo where over 90% of the bone is cream in colour.

On cremation bone not only splits but cracks and warps, the greater the heat the greater the degree of fragmentation, distortion and splitting. To some extent the degree of fragmentation depends on the size of the unburnt bones, with the larger pieces from Sutton Hoo tending to be fragments of the long bones from the lower limb, while the smaller fragments are from the ribs, vertebrae, and flat bones. Table 8 shows the proportion of fragments in each size category by fragment number and weight. The amount of information forthcoming from these cremations corresponds directly to the size of the fragments. Mounds 5, 6 and 7 have between 63-90% of all fragments over 10mm representing 90-98% of the total weight of the assemblage. Indeed Mound 5 has in the order of 80% of the total weight over 15 mm and it is not coincidental that it is this cremation which yields the most information. Mound 18 on the other hand, has a greater proportion of smaller fragments compared to the other mounds with approximately 77% under 10 mm (39% of the total weight), and most of these unidentifiable.

The type of fracture may also give information about the cremation practices. Baby (1954) suggests that the type of fracture varies between fleshed and defleshed cremations. Curved

transverse lines, irregular splitting and warping and splintering are all indicative of fleshed cremations, while there is no warping in defleshed skeletons. Again, this relationship may not be quite so simple and it is probable that the types of cracking also reflect the inherent properties and morphological structure of the bone. For example, long bones or round bones have predominantly longitudinal splits and curved cross hatches, while flat bones such as the pelvis and cranium have more random cracks. In the samples discussed here longitudinal and transverse fractures predominate. This may simply reflect the greater resilience of long bones to fracturing at temperature whilst the flat bones are more likely to form the unidentifiable and smaller fragments of the assemblage.

The most interesting aspect of all these cremations are the blade injuries to the skull of the individual in Mound 5. A minimum of nine fragments had cuts to the cranium with no evidence for healing. Many of these were incomplete cuts. All were consistent with injuries caused by sharp edged instruments such as a sword, spear of knife. The incision was usually at an angle which would have resulted from a downward slicing action. The injuries cut through the outer table of the skull and often the diploe and inner table. **[See RR]** shows the likely position of these injuries, although it should be noted that due to the fragmentary nature of the skull, this reflects the general area of the skull rather than the exact location. Fragment 40445 is particularly intriguing. This is a rectangular piece of bone with blade injuries on three sides at right angles to each other, the fourth side being represented by the lambdoid suture. No obvious parallels are known, but it would almost appear that the intention was to remove the fragment. This occurs in trephinations, when an attempt is either made to surgically remove a fragment of bone or as part of a postmortem ritual. The presence of the satellite burials around Mound 5 and the suggestion of ritual killing in at least four of these by decapitation and hanging makes postmortem ritual an increased possibility for the central burial. Indeed it may not be inconceivable that the individual achieved the status afforded it in the burial by the method of in which he died.

Finally, none of the other cremations have any evidence for violent assaults, nor do they have associated burials arranged around the circumference of the mound setting Mound 5 apart from others.

Summary

The four cremations from Sutton Hoo on first appearance have many similarities. All four are represented by single bodies placed in a bronze bowl, wrapped in a cloth. However, the Mound 5 cremation is the only body which is reasonably complete. Mounds 6 and 7 had a considerable amount of cremated animal bone with only a handful of human fragments associated, while the fragments from Mound 18 were too small to provide much information on the cremation. Mound 5 is set apart not only by the injuries to the skull but also by the presence of satellite burials surrounding the central cremation.

10. SELECTED STUDIES : RADIOCARBON DATING

10.1 Prehistoric Dates

10.1.1 Dating programme

INT	Find	Cont	Feature	Descr	Mat/wt	Lab no	Asses	Date	Cal
41	41757	1238	F 122	gulley	charc		OK?		

48	2433-4	1048	F 29	pit	bone 114.9g				
48	8010-8012	1535	F 330	sump	charc. 4.2 g		TS?		
53	55-9	1007,1004	valley section	Ploughed Buried soil BA or IA	charc.		?		
55									

10.2 **Early Medieval dates**
10.2.1 *Radiocarbon dating*

10.2.1.1 Dating Programme

Burial	Mound/INT	Find	Cont	Feature	mat./wt	Ass.*	Lab No	Result	95 %
1	M1			lamp	bees wax	OK	BM 640	478-568	
1	M1				chamber or coffin	OK	BM 688	649-739	
1	M1					NC			
2	M2					NC			
3	M3					NC			
4	M4					NC			
5	M5					NC			
6	M6					NC			
7	M7	11937-12658	1254	cremation	charc. c.50g	OK?	BM **		
8	M14					NC			
9	M17	8283,8285		Body F 359	bone 240.6g				
10	M17	8121-8162	1575	Horse F 355	bone, 9kg				
11	M18			cremation		NC			
12	M20		1402	Coffin F147 with body	stain	NC			
13	11			cremation					
14	11			cremation					

15	50	2918, 2920, 2923-38	1112, 1114-6, 1189, 1190	body F 137	bone 406.8g	BM**			
16	50	2831, 2834	1254	body F 186	bone 8g	TS	-	-	-
17	32	763, 1980, 1982,1984,1987,1991,1993,1989,1997	1049=2107	body F254	bone			540-700	
18	32		1067=2104	body F246	bone, 14.7g	US	-	-	-
19	32	696	1069	skull F247	bone 147.8g	OK?			
20	32	2772	2009,2091	body F 248	bone, 21.7g	TS	-	-	-
21	32	2389;2391-2	2000	body F 251	bone 147.4g	OK?	BM **		
22	32	1718	2001-3	body F 252	bone 21.7g	OK (AMS)	OxA-819	680-820	
23	32	2491,2696,2699,2702	2023	body F 256	bone 229g	OK?	BM **		
24	32	2701	2053	body F 256(?)	bone 30.2g	TS	-	-	-
24	32	2696-2708	2059	body F 257	bone 287.2g	OK?	BM **		
25	32			body F 258	bone 45.7g	TS	-	-	-
26	32			body F 259	bone 229.0g	OK?			
27	32	3255	2065	skull	bone 135.9g	AMS?	OX?		
28	32			body F 262	bone	???			
29	32		1089	body	bone	TS	-	-	-
30	32	2526	2038	body F 264	bone 677.6g	OK	BM **		
31	32			body F 237	stain	NC	-	-	-
32	32	3376-9	1112	body F 238	bone 114,4g	OK?	BM **		
33	32	3378	1113	body F239	bone 85.1g	TS	-	-	
34	32		1114	body F 240	stain only	-	-	-	-

35	52	70-97	1039	body F 34	bone,60.4g	OK	BM 2825	620-780	
36	52			body F 71	bone 68.9g	TS	-	-	-
37	52			body F 72	bone 42.8g	TS	-	-	-
38	52			body F 75	stain	NC	-	-	-
39	52	183-4	1089	body F 74	bone 848.7g	OK?	BM **		
40	41	20284	1426	body F 152	bone 146.4g	OK	BM 2865	885-975	895-1035/10800-1155
41	41	41380-3	1945	body F 510	bone, 78.6g	TS	-	-	-
42-3	41	16056, 16058	1527	body F 148	bone 1868.5g	OK	BM 2824		640-780
44	41			body F 542	bone 422.1g	OK?	BM **		
45	41	22544-48	1112	body F 55	bone 289.6g	OK?	BM **		
46	41	41558-61	1928	body F499	bone 136.4g	TS	-	-	-
47	41			body F 418	bone	TS	-	-	-
48	41	43232	2033	skull F 555	bone 104.9g	OK?	BM **		
49	41	41915-6	1990	body F 524	bone 53.4g	TS	-	-	-
49	41	421388 ;41325	1962, 1265	animal in quarry pit F 129	teeth 150g	OK?			
50	12			body		NC	-	-	-
51	12			body		NC	-	-	-
52	44	16540	1396	skull F 220	bone	OK?	BM **		
53	48			body F 351	stain	NC	-	-	-
54	50	2952-3;4238-41	1261, 1196	body F162, 188	teeth/ foot	OK?	BM **		

55	50	6550-59	1444	cow in pit F 342	bone, 3kg	OK	BM **		
56	11		Pit 1	skull	bone	OK	BM 584	670-830	
	32		2063,1097	post of gibbet F165	charc.	OK?	BM **		

* OK: adequate for assay; TS: too small for BM assay; US: unusable; NC: no surviving carbon

10.2.1.2 Radiocarbon date from Harwell

HAR-6800

10.2.1.3 Radiocarbon dates by AMS from Oxford

OxA -819

10.2.1.4 Radiocarbon dates from the British Museum Lab.

List of Radiocarbon Dates [checked and with additional information from J Ambers, British Museum]

Area	Source	Lab No.	Material	Radiocarbon Result (uncalibrated Years BP)*	Calibrated date range Calender years ACE **		
					68% probability	95% probability	Date range from probability distribution (p 000)
Mounds							
Mound 1	Lamp	BM-640	beeswax	1427+-45	595 - 660	540 - 680	Early 7th century
	Chamber	BM-688	wood	1256+-45	680 - 810 or 840 - 860	670 - 890	Centred on 8th century
Mounds 2-7	No viable samples						
Mound 17 Burial 9	Human skeleton F359	UB-4422	bone collagen [possibly contaminated with consolidant]	1534+-35	430 - 600	[430 - 620]	
	Coffin, F356		[only heartwood available]				
Mound 17 Burial 10	Horse skeleton, F355	UB-4423	bone collagen	1420+- 28	617 - 656	560 - 670	Early 7th century
Int 41 Burial 12	Child Skeleton, F114		insufficient collagen				
Int 50 Burial 15	inhumation		insufficient collagen				
Int 50 Burial 16	inhumation		insufficient collagen				

Int 11 Burial 56	skull	BM-584	bone collagen	1204+-79	690 - 900 or 920 - 940	670 - 990	7-9th century
Group 1							
Int 48 Burial 17	inhumation, F9	Har-6800	bone collagen [possibly contaminated with consolidant]	1330+/-80	620 - 780	[560 - 890]	
Burial 18-21			insufficient collagen				
Int 32 Burial 22	inhumation, F109	OxA-819	bone collagen	1200+/-70	720 - 750 or 770 - 900 or 920 - 940	680 - 980	Centred on 9th c
Burial 23-26			insufficient collagen				
Int 32 Burial 27	`ploughman' inhumation		[contaminated with consolidant]				
Int 32 Burial 30	inhumation, F173	BM-3035	bone collagen	960+/-60	1020 - 1160	980 - 1220	Centred on 11th century
Burial 31-34			insufficient collagen				
Int 52 Burial 35	inhumation, F34	BM-2825	bone collagen	1250+/-80	680 - 880	650 - 980	8th-10th century
Burial 36-38			insufficient collagen				
Int 52 Burial 39	inhumation, F74	BM-3036	bone collagen	1070+-45	900–920 or 960–1020	880-1040	Centred on 10th century
Group 2							
Int 41 Burial 40	inhumation, F152	BM-2865	bone collagen	1020+-45	900 – 920 or 970 –1040 or 1100–1120 or 1140–1160	890–1160	Centred on late 10th-early 11th century
Burial 41			insufficient collagen				
Int 41 Burial 42B	inhumation, F148	BM-2824	bone collagen	1320+-40	660 -720 or 740 - 770	650-780	8th-9th century
Burial 44			insufficient collagen				
Int 41 Burial 45	inhumation, F 55	BM-3037	bone collagen	1060+-50	900-920 or 960-1030	880 - 1050 or 1090 -1120 or 1140 -1160	Centred on late 10th- early 11th century
Burial 46-55			insufficient collagen				
782	cow burial, 1444, in quarry pit	UB-4424	bone collagen	257+-26	1630 - 1670 or 1780 - 1790	1520 -1570 or 1620 -1680 or 1770 -1800 or 1940 -1950	Centred on 1650
Int 32 Gallows post	post, F165	BM-3041	wood (*betula* sp)	1180+-50	770-900 or 920-940	690-980	Centred on 9th century

Prehistoric							
Int 41	Pit, F545	BM-3033	carbonised nuts	3650+-35	2120–2090 BCE or 2040–1950 BCE	2140-1910 BCE	Centred on 2000 BCE

* Calibration were generated using v 2.18 of OxCal (Bronk Ramsey 1995), and the INTCAL 98 calibration curve (Stuiver et al 1998).

** Except BM-3033 from the prehistoric period where the date ranges are calendar BCE.