EAST LONDON ROMANO-BRITISH CEMETERIES; PUBLICATION REPORT ON THE CREMATION BURIALS AND CREMATION RELATED CONTEXTS.

by
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I. INTRODUCTION.

Cremated bone was recovered from 377 contexts spread across seven of the adjacent sites comprising the East London Romano-British cemeteries. The contexts from which cremated bone was recovered represent a variety of cremation-related features including urned burials, unurned burials, pyre debris dumps, a probable pyre site and a number of miscellaneous features which may be unurned burials, pyre debris dumps or some other form of ritual deposit. Small quantities of bone were also recovered scattered or redeposited in secondary features within the area.

In archaeological literature, the word 'cremation' is commonly used where what is expressly meant is 'cremation burial'. This usage tends to detract from the fact that cremation is a process, a form of disposal of the dead involving deliberate burning of the body with its attendant ritual, and that the subsequent recovery of bone from the pyre site and burial of remains occurred only in the final part of that process. The variety of cremation-related features identified in this report clearly illustrates that not all buried cremated bone constitutes a 'burial'. To avoid any misunderstanding, the word 'cremation' has been used throughout this report in its proper sense, cremation burials are referred to as such.

II. METHODS

On receipt, fills (see p.00/section **please fill-in relevant page or section number** for on-site recovery methods and post-excavation procedure) from the various contexts had been wet sieved and a small number had been sorted or partially sorted.

All contexts were sorted and bone from the >5 mm fractions was extracted for examination together with any pyre debris and pyre goods. The 2 mm and <2 mm fraction residues were retained *en masse*.

Samples

Several of the large contexts comprising pyre debris dumps were collected as a number of strip samples (Figure 00). During examination of the bone these samples were treated as separated entities (Table 1), the results from the context as a whole being drawn together in analysis (Table 2).

Residues

All the residues were scanned by the writer and identifiable bone fragments (see below), together with fragments of artefacts and pyre debris, were removed for further examination. It was not possible to give the weight of bone in these residues, which generally contained large quantities of pea-grits etc. Consequently, when considering the total weights of bone (Tables 1 and 2) and weights of bone from the 2 mm fraction

(Table 1), it should be remembered that it has not been possible to present the full weight of bone in the 2 mm fraction.

Osteological Procedure

Analysis followed the writer's standard procedure for the examination of cremated bone (McKinley 1989 and 1994a).

The cremated bone extracted from each context was passed through a sieve stack of 10, 5 and 2 mm mesh size. The relative weights of bone from each sieve and the maximum skull and long bone fragments, illustrates the degree of bone fragmentation in each context (Table 1).

Identifiable bone was separated for further examination being divided into skull, axial, upper and lower limb categories (Table 1). This has the potential to demonstrate any deliberate bias in the skeletal elements collected for burial. 'Identifiable' bone is defined as fragments which may be identified to a particular bone or group e.g. 'femur', 'proximal finger phalanx', 'thoracic vertebra'. Where a fragment could only be identified as, for example, 'long bone shaft', 'upper limb' or as 'long bone articular surface', this was not considered detailed enough to include with the 'identifiable' bone. Some areas of the skeleton are, by their nature, easier to identify than others even as small fragments e.g. skull, a factor which must be considered in the analysis of the significance of skeletal elements included in a context.

Animal bone fragments (mostly cremated) were extracted and forwarded to the archaeozoologist (**p.00**). Pyre and grave goods additional to those extracted by the finds staff were also recovered and forwarded to the appropriate specialist (**p.00**).

Full details of all identified bone are presented in the archive report including;

- the number of identified bone fragments with descriptions of morphology and pathological lesions
- bone measurements taken in addition to those presented in table 1.
- variations in the colour of individual bone fragments from the buff/white of full oxidation
- any coloured staining to bone fragments or adhering substances
- a brief note on animal bone fragments recovered and pyre/grave goods removed during the osteological examination.

Number of individuals

The number of individuals represented in a context was ascertained either from obvious age-related differences in size and development of the bone as between immature and adult individuals, or by duplication of identifiable bone fragments - skull fragments are particularly useful in this respect as many areas of the skull are easily recognisable even as very small fragments and occur either singly or in pairs. (see McKinley 1989, 1994a for further discussion).

Care must be exercised to ensure that duplicate bones are not intrusive either as a result of post-depositional site disturbance, or in consequence of the accidental inclusion at time of burial of unrecovered debris from previous cremations.

Age

Age of immature individuals was assessed from the stage of tooth development (Van Beek 1983) and ossification/epiphyseal bone fusion (Gray 1977, McMinn and Hutchings 1985). The age of adults was assessed from the stage of epiphyseal (McMinn and Hutchings 1985, Webb and Suchey 1985) and cranial suture fusion, and other age-related degenerative changes to the bone (Bass 1987). Age categories used;

age	**years**	**age code**

infant	0-4	1
juvenile	5-12	2
subadult	13-18	3
young adult	19-25	4
mature adult	26-45	5
older adult	45 +	6
adult	18+	7
subadult/adult	13+	9
older mature/older adult	30+	12

Where insufficient evidence was present to aid age assessment there may be overlaps between categories, e.g. subadult/adult, younger mature adult (25-30 years), older mature/older. NB. age codes have not been used in this report but may be referred to elsewhere in the volume.

Sex

Sex was ascertained from the sexually dimorphic traits of the skeleton (Bass 1987), including the maximum cranial vault thicknesses '1a' and '1b' according to Gejvall (1981).

As with age assessment, a combination and scoring of traits were used in order to overcome any methodological bias (see McKinley 1993a, 1994a for further discussion) or variations in sexual dimorphology within the group. Levels of reliability reflect the quantity and quality of available traits on which to base the assessment; '??' denotes 'possible', '?' denotes 'probable'.

III. SUMMARY OF RESULTS.

The weight of bone from all contexts containing bone is presented in Table 1. Where a context comprised several samples, data is presented for each sample together with the total for the context.

A summary of the results is presented in Table 2. Contexts comprising only scatters of bone or small quantities of redeposited bone for which the type of original deposit could not be ascertained have not been included.

All weights are given in grams (g) to one decimal place. All measurements are given in millimetres (mm). Unless stated as otherwise, all bone, human and animal, is cremated/burnt.

West Tenter Street (WTN).

In order to present a full view of the excavated cemetery, it was decided to incorporate Tony Waldron's (TW) results from his examination of bone from the West Tenter Street burials (1986). His data have been presented here in a format compatible with the writer's, but because data collection procedures were not entirely compatible there are omissions (see Waldron 1986 for TW's methods, not as given in this report).

All contexts examined by TW are marked '#' in Tables 1 and 2. Bone from four contexts included in TW's report was received for examination by the writer. Unfortunately, it was not possible to ascertain whether this represented the same bone examined by TW or if it was material additional to that seen by him, consequently the writer's results are presented separately in both Tables 1 and 2.

Unurned burials or pyre debris dumps (?un/?pd).

The nature of these deposits was not always clear due to lack of definition in site recording in some instances and variation in recovery methods in others (see p00), often with the added complication of site disturbance. As the integrity and interpretation of these deposits could not be assured they have been designated as a group ('?un/?pd').

Unurned burials, with or without indications of some form of organic container and/or inclusions of pyre debris in the backfill, when undisturbed show a concentration of bone, usually at the base of the grave cut (see p.00 e.g. Baldock Burleigh and Matthews pers. comm.). This demonstrates deliberate recovery and deposition of bone and contrasts with the incidental inclusion of bone left at the pyre site and mixed with other pyre debris as is seen in the debris dumps.

It was not always noted on site whether bone occurred as a concentration or mixed throughout the fill and many of the contexts were disturbed. Some of the contexts did not include other pyre debris which would suggest they represented burials. Others were undisturbed and contained small quantities of bone spread through the fill with other pyre debris, suggesting they were more likely to be debris dumps.

Each of the ?un/pd? contexts was assessed individually, using the context description and other archaeological components, the level of disturbance, and quantity of bone recovered. It was concluded that at least 16 (38%) were probably unurned burials (designated '?1' in 'No. ind.' field in Table 2); 14 (33%) were inconclusive but were assessed as possible unurned burials (designated '?' in 'No. ind.' field in Table 2); evidence from the remaining contexts suggested they were more likely to represent pyre debris rather than burials (no entry in 'No. ind'. field Table 2).

Key to Tables:

Disturbance (Dist.)

*	disturbed.
?	disturbance level unknown
	undisturbed

Type

u	urned cremation burial
?un/?pd	?unurned burial/?pyre debris/?memorial
cb	cremation burial mode of deposition unknown
ps	pyre site
pd	pyre debris dump
r	redeposited
r i	redeposited in an inhumation grave
u lid	urned burials with intact lid
l	layer
$	incomplete recovery of context
%	% of pyre debris deposit recovered
u/s	unstratified

Table 1.

lb	long bone
Sk	skull
Ax	axial
UL	upper limb
LL	lower limb

Table 2

No.Ind. number of individuals identified

Pathology/Morphological variation

exo	exostoses
ddd	degenerative disc disease
o.p.	osteophytes
d.l.	destructive lesions
p.d.	periodontal disease
m.v.	morphological variation
Schmorl's	Schmorl's nodes
a.m.t.l.	*ante mortem* tooth loss
o.a.	osteoarthritis
pnb	periosteal new bone
d.c.o.	distal centre of ossification
c.a.	congenital absence
nb	new bone

C	cervical
T	thoracic
L	lumbar
vert	vertebra
p.	proximal
d.	distal
ap	articular process
sp	spinal process
tp	transverse process
tube.	tuberosity
S	sacral
man.	mandible
r/l	right/left

Animal

u/b	unburnt
imm.	immature
p/s	pig/sheep size

Pyre/grave good

b/g stn.	blue/green staining
w.b.	worked bone
FAS	fuel ash slag
obj.	object
ad.sub.	adhering substance
Cu-	Cu-alloy
s	sherd
g	glass
m	mortar
f/bc	fired/burnt clay

Distribution of bone

An overall total of 111, 339.1g of bone was examined (8, 160.4g by TW), 95.2% of which was recovered from identifiable features, the remainder being redeposited or from scatters.

	with intact lid	**undisturbed**	**disturbed**	**redeposited**	**total**
urned burial	8	17	46	21	92
burials (type unknown)				11	11
pyre debris		15		4	19
pyre site & unurned burial		1			
*?unurned burial/?pyre debris **		10	29	3	42

Table: 3 Number of features containing cremated bone. (* see above for probable interpretation).

Condition of bone and disturbance

The bone was in good condition and showed no wear such as may indicate detrimental soil conditions. Parts of the cemetery area had suffered varying degrees of disturbance from inter-cutting features, notably inhumation graves cutting cremation burials. There was also some modern disturbance.

The level of disturbance is of importance when considering aspects of pyre technology and ritual, it may affect the integrity of the context, the quantity of observable bone within it and the bone fragment size. About 27% of the burials were undisturbed (Table 3), as were *c*. 26% of the ?unurned burial/?pyre debris contexts. Similarly with the pyre debris dumps, consideration must be given in interpretation to the probable size of the sample being assessed and how representative it is of the whole.

IV DEMOGRAPHY.

Cremated bone from the pyre debris dumps represents material not collected for inclusion in a burial, and cannot be taken to be indicative of individuals not already counted from the burials. The bone identified from the pyre debris dumps will be discussed as a separate entity elsewhere and is not included in this section (see section **V**).

Minimum numbers are given, with additional tentative identifications where the integrity of a context may be severely compromised and/or the interpretation of the context is under question. The latter largely comprises the '?un/?pd' category (Tables 1 and 2, see section **III**.), and some redeposited burials and disturbed burials in which very little bone remained (<50g).

Numbers of individuals

A minimum of 92 individuals were positively identified from the burials. A probable 20 others (designated '?1' in 'No. ind.' field in Table 2), giving a total of 112, were identified from a combination of probable unurned burials, and some disturbed and redeposited burials. A possible additional 24 individuals (designated '?' in 'No. ind.' field in Table 2), which would give a total of 134, were identified from contexts, the integrity and interpretation of which is open to question and far from conclusive.

Age category	**Total No.**	**Females**			**Males**		
		?	**??**	**Total**	**?**	**??**	**Total**
infant	4		1	1			
older infant/young juvenile	2						
young juvenile	1						
juvenile	1						
young subadult	1						
subadult	?1						
immature	1						
older subadult/young adult	1						
older subadult/adult	1						
subadult/adult	2/?3/??11						
young adult	3/?4			1			
young/mature adult	1/?4/??5	1	1	3			
mature adult	4/?8/??9	2	3	5		1	1
older mature adult	30/??31	2	4	14	2	4	12

mature/older adult	1/??3						
older mature/older adult	15/?17/??18	3	4	8			2
older adult	8/??9	1	2	3			1
adult	15/?21/??24	4		5			1
>infant	1						
unaged	?2/??8						

Table 4: Overall number of individuals identified in each age and sex category. The total numbers presented represent a cumulative total incorporating the probable (?) and possible (??) figures; the total number of females and males include the possible (??), probable (?) and unquestioned identifications.

Age

Ten (*c*. 11%), probably 11 (*c*. 10%) individuals were immature. Four (*c*. 4%) individuals, probably five (4.5%), or 13 (*c.*10%) if the possible ('??') burials are included, were subadult/adult. Seventy-seven (*c*. 84%) individuals, probably 92 (83%), or 103 (*c*. 77%) including the possible burials, were adult.

The figures correspond closely with those from contemporaneous cremation cemeteries reported by Wells (1981): from Puckeridge/Skeleton Green 7.7% were immature individuals, 12.8% from Cirencester and 11% from Welwyn. From Baldock Area 15 (McKinley 1991a unpublished), of 486 individuals 12% were immature and 70% adult, and at Westhampnett (McKinley 1995a unpublished) 10-12% of the 33 individuals identified were immature, and 81% adult. As in the East London Cemeteries, no infants of less than one year old were identified from either of the last two cemeteries, in contrast with the St. Albans cemetery of St. Stephen's (297 individuals; McKinley 1992 unpublished), where of the 21% immature individuals identified from the cremation burials, two were foetus/neonates.

According to Brothwell (1971), in a 'normal' population the ratio of infants <1 years to the total number of individuals between 0-20 years should be between 4:1 and 4:3. Though there is not always the complete absence noted here, in many cremation cemeteries the above ratio is far from 'normal'. The reasons for this apparent absence of young infants could be numerous and have been discussed in more detail elsewhere by the writer (McKinley 1989 and 1994a). For example, the bone of such young infants does survive cremation (both in modern crematoria and on pyres) but the fragments are obviously very small and fragile. The fragility of the bone may predispose it to

preferential destruction in adverse soil conditions or loss as a result of disturbance. Another possible area of loss may be in multiple cremations; these most commonly comprise an adult with an immature individual (see below), and where the mourners felt incumbent to include only *c*. 50% or less of the adult remains in the burial, it is not impossible that in some multiple cremations they could have omitted to include any of the infant bone in the burial.

The total absence of very young infants noted in the cremation cemeteries of Romano-British date is mirrored in many of the inhumation cemeteries. There is evidence to suggest that such individuals did not 'qualify' for the same burial rite as other members of the 'population', and that they were often buried outside the confines of the cemetery (Philpott 1991 p.232). In any demographic consideration, it is important to remember that we have a limited view of the 'population' and some elements may be almost entirely absent (Ubelaker 1974).

The greatest number of individuals was noted in the 'older mature adult' category, with 7-9% of the 'population' in the 'older adult' category. At all three of the contemporaneous cemeteries of Baldock 15, St. Stephen's and Westhampnett, the greatest number of individuals were in the 'older mature/older adult' categories. Both Baldock 15 and St. Stephen's show a greater percentage of individuals within the 'older' adult category at 16%. This difference is not off-set by the number of individuals it was not possible to identified closer than 'subadult/adult' or 'adult' (*c*. 33%), which was lower at St. Stephen's (18%), but higher at Baldock 15 (39%).

Sex

Fifty-six adults were sexed, including five from probable unurned burials and two from possible burials. That is 53% of the total 'population' or 63% of the adults including just the definite burials; 48% of the total 'population' including the probable burials; or 42% including the possible burials.

Thirty-nine females, including four from probable burials and two from possible burials, were identified. That is 35% of the total 'population' and 43% of the adults including just the definite burials; 33% of the total and 40% of the adults including the probable burials; 29% of the total, 38% of adults including the possible burials. Seventeen males, including one from a probable burial, were identified. That is 17% of the total 'population' and 21% of the adults including just the definite burials; 15% of the total and 18% of the adults including the probable burials. Whilst the figures may reflect the ratio of females to males, their significance is severely compromised by the fact that a large proportion of the population, both total (47%) and adult (36%), could not be sexed.

For both sexes, the greatest number and median figure was in the 'older mature adult' category, including 38% of the females and 71% of the males. The percentages within the 'older adult' group were fairly equal, comprising 8% of females and 6% of males. No significance between the sexes was noted in the age distributions.

From Baldock Area 15 (McKinley 1991a unpublished) 44.7% of adults were sexed, 57.5% from St. Stephen's (McKinley 1992 unpublished). In both cemeteries a greater number of females than males were identified, 37.1%:20.4% from St. Stephen's. It was felt that the significance of this variation in numbers between females and males should be treated with caution as there may be a bias within cremation burials in the ease of identifying females (McKinley 1994a, and 1992 unpublished).

At St. Stephen's, the greatest number and median range for females was in the 'older mature adult' category, for the males from St. Stephen's and both sexes at Baldock 15, the greatest number and median range was in the 'older mature/older adult' category. In

both cemeteries, there appeared to be a greater percentage of individuals of both sexes in the 'older adult' category than noted at ELC, with 21% female and 29% male burials at St. Stephen's, and 33% female, 21% male at Baldock. This may reflect a genuine difference in age structure between the cemeteries, though consideration must be given both to the broad overlap of some age categories and the high percentage of individuals it was not possible to sex.

Plots

The cemetery has been divided into a series of 29 'plots' (see **p.00**), each containing a variable number of burials (Table 5). Cremation burials were designated within 13 of the plots, however, there is no record from the osteological analysis of plots 11 (hay) and 24 (hoo) containing any cremation burials. Four plots, 1 (scs), 14/15 (mnl), 20 and 22 (hoo), each comprised only a single cremation burial. The seven plots comprising more than one individual varied in size from six to 29, or a possible 46 individuals. Three 'cremation burials' from hoo did not have a designated plot.

plot no.	**site**	**number of burials**	**number of individuals**
1	scs	1	1
2	wte & msl	26/?36/??43	29/?39/??46
3	mst	13	14
11	hay	0	0
14/15	mnl	1	1
16	wtn	6	6
17	wtn	6/?8/??12	6/?8/??12
20	hoo	1	1
21	hoo	10/?12/??13	11/?13/??14
22	hoo	1	1
24	hoo	0	0
28	hoo	17/?21/???29	18/?22/??30

29	hoo	3	3

Table 5: Number of burials/individuals in each plot. The numbers presented represent a cumulative total incorporating the probable (?) and possible (??) figures

The single burial plots comprised a young adult female (1), an older mature/older adult (14/15), an older mature adult (20) and a young juvenile (22).

A slight variation was noted in the age distribution between some of the plots (Table 6). Two plots, 16 and 29, contained no immature individuals. In plot 28, the single immature individual comprised only *c*. 3% of the total, much lower than the average of 10-11%. The numbers of immature individuals in plots 2, 17 and 21, though small, gave a percentage fairly close to the average. In plot 3, where 14 cremated individuals were identified, 29% were immature. In other respects, there was no significant variation from the overall figures.

The greatest number of individuals in an age category and median figure are similar to the overall figures, falling in the 'mature adult' or 'older mature adult' categories. Plots 3, 16, 17 and 21 had no individuals in the 'older adult' category, plots 2 and 28 being above the average of 7-9%, with 21% and 14-17% respectively.

The significance of these observations is tempered by the small number of burials present in some plots (see Table 5). It should be noted that the majority of individuals in plot 17 were identified by a slightly different procedure (Waldron 1986) and using slightly different age categories to the others, which may have affected the appearance of this plot in comparison. It should also be noted that in the adult age ranges there is a degree of overlap between categories which render observations on the number of 'older' adults tentative. In view of the limitations imposed on the sexing of cremation burials already discussed above, it was not felt that the slight differences noted between the plots could be attributed with any significance.

phasing

The criteria and methods by which the cemetery has been phased are outlined in Chapter **00.** Four phases having been designated, the overall frequency for both cremation and inhumation burials providing a background against which individual aspects of the cemetery may be measured (Table 7).

	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
whole cemetery	16.5%	16.5%	33%	33%
cremation burials	27.4%	21.6%	26.3%	24.3%
immature individuals	54.8%	36.3%	8.3%	
older mature/older adults	25.8%	24.5%	34.2%	15.5%

older adults	4.3%	41.1%	38.7%	16.0%
females	33.2%	26.5%	28.6%	11.4%
males	35.0%	26.9%	21.0%	6.9%

Table 7: Percentage distribution of burials within the four phases, with distribution for cremation burials of major age groups, female and males.

The cremation burials are divided relatively evenly between the phases (Table 7), but comparison with the underlying figures for the cemetery show cremation to have been the predominant rite in the first two phases, decreasing in relation to inhumation burials in the latter two.

The percentage of immature (<18 years) individuals show a distinct change over time, though the significance of this observation is tempered by the small number of immature individuals identified. The majority are seen within Phase 1, with a substantial fall-off in Phases 2 and 3, to none in Phase 4. This division contrasts markedly with the figures for the older adults, which were comparatively very low in Phase 1, peaking in Phase 2, then decreasing to below average in Phase 4. The peak in the older mature/older adult category falls in Phase 3, figures for Phases 1 and 2 being close to the average for cremation burials, that in Phase 4 being slightly lower than average.

Minor fluctuations observed between the sexes are probably of little significance, particularly since gender could not be assigned to so many individuals (*c*. 47%).

V. PYRE TECHNOLOGY AND RITUAL.

V. 1 Pyre Sites

The existence of large dumps of pyre debris (see **V. 2**) within the confines of the cemetery, would suggest that the cremations were conducted in the immediate vicinity. Evidence for pyre sites however, is scant. Only one probable pyre site was excavated, mst 268/9 in plot 3 (Phase ?1-3), which appears to comprise a *bustum* type deposit, i.e. the pyre and burial occurred as a single *in situ* event.

There is a general paucity of evidence for pyre sites from any period in which the rite of cremation was in use, by far the most commonly excavated cremation-related feature being cremation burials. With the exception of the *bustum* type, cremation pyres leave very shallow evidence of their existence. An experimental pyre cremation conducted by Dr. Alistair Marshall and the writer in 1993 demonstrated the shallow depth to which the effects of the pyre had penetrated *c*. 0.10-0.12 m. Were pyres constructed directly on the ground surface or over a shallow under-pyre draught-pit, which appear to be the most common forms (McKinley 1994a and 1995a unpublished), and that surface subsequently truncated, it is not implausible that little or no evidence of *in situ* burning would be noted in excavation.

Mst context 268/9 comprised a pit *c*. 1.80 x 1.0m, *c*. 0.68 m deep. The primary, 0.30m deep fill of charcoal, including charred lengths of wood, cremated bone and other burnt artefacts was sealed by a secondary fill. A 0.02 m deep rim of *in situ* red-burnt (oxidised) earth was noted on the upper margins of the pit. The form and archaeological components recovered from this feature would support the interpretation as a pyre site. However, did it also comprise the burial place?

The *bustum* type deposit supposedly results from the *in situ* collapse of the pyre into a relatively deep pit over which it has been constructed. This pit subsequently forms the burial place with no further movement of any of the debris. In view of the manner in which a pyre collapses on burning - a gradual down-wards collapse onto itself, finally leaving the cremated bone in roughly correct anatomical order on top of the other debris - a layered deposition would be expected with charcoal and charred wood with a few fragments of cremated bone forming the major primary deposit, and the mass of cremated bone and pyre goods concentrated immediately above this. Since, supposedly, no collection of bone for burial occurs, all the remains should be present, and theoretically, if undisturbed, the bone should be in anatomical order.

838.1g of bone was recovered from context 268, its precise location within the 0.30 m deposit was not recorded which may imply it was mixed in with other debris. The quantity of bone represents, at maximum *c*. 84% of the total expected bone weight, probably more in the region of 50% (McKinley 1993b and 1994a). The feature had been substantially cut through the centre by a later inhumation burial which may have removed some of the cremated bone. However, all skeletal elements are represented amongst the bone fragments available for examination (Table 1), which would suggest, since the later burial cut through the 'axial' area of the feature, that the remains were not laid anatomically.

Other supposed *bustum* have been found in contemporaneous cemeteries elsewhere in Britain (Philpott 1991, Struck 1993), including ten at St. Stephen's cemetery in St. Albans (Frere 1987, Niblett pers. comm.). These features ranged in size from *c*. 1.10 x 0.60m to 1.75 x 0.70m, 0.70-0.50m deep, with a red-rim of *in situ* burning on the upper margins of the pits. However, only a maximum of 41% by weight of the total expected bone weight (McKinley 1992 and 1993b unpublished) was recovered from the five undisturbed pits, which would suggest there was not the supposed undisturbed continuum between cremation and burial attested by the *bustum* form. Other features of this type excavated at some of the Northern frontier forts (Philpott 1991), for example Low Borrow Bridge, Cumbria (McKinley, 1993a unpublished), contained even smaller quantities of bone.

The lack of complete, or even near complete, bone recovery noted in some of the undisturbed British *'bustum'*, together with the apparent mixing of the remaining bone with other debris in the pit, would suggest that some of these features do not comprise burials. Paucity of bone in some features designated as *bustum* has also been noted in contemporaneous Continental sites (Struck 1993). The evidence would suggest that some features which appear similar to *bustum* in form, comprise only the pyre site, the burial having taken place elsewhere. The disturbance to msl 268 preludes a definite interpretation, although pyre site and burial in this instance is not unlikely.

Other, contemporaneous types of pyre site are suggested by the 'burnt platforms' excavated at Ospringe, Kent (Whiting *et al*. 1931) and the brick-constructed 'cremators' excavated by Davey in St. Albans (1935, see McKinley 1992 unpublished for further comment).

V. 2 Pyre Debris Dumps.

Sixteen contexts in plots 21 and 28 (hoo), comprising a mix of burnt material including charcoal, cremated bone, charred seeds, fuel ash slag and various (?burnt) artefacts, represent dumps of pyre debris. The contexts appear to form parts of at least seven separate areas of deposition (Figure 00), occurring either as surface spreads of material, or as dumps into shallow features which may have been deliberately dug for the purpose, or have already been in existence and re-used incidentally or deliberately. NB. Fuel ash slag is a general hearth slag which may form when a fire is constructed over a highly siliceous soil, various trace elements may betray the type of fire (Evans and Tylcote 1967, Henderson *et al*. 1987). Its occurrence amongst pyre debris is not unusual in cremation-related features of any period and displays the siliceous nature of the underlying soils and the temperature attained within the lower parts of the pyre at some point in cremation (McKinley 1989 and 1994a)

The lack of evidence for pyre debris dumps elsewhere in the cemetery cannot necessarily be taken as illustrating their non-existence (see *unurned burials or pyre debris dumps?* below). Other areas suffered greater horizontal truncation than the hoo site, which may easily have erased such shallow or surface features. The excavators also feel (p.00) that the significance of such deposits, and consequently their appropriate treatment, may have been overlooked in previous excavations (hoo being the most recently excavated of the sites).

Most of the excavated dumps were subject to 100% recovery, but some were only sampled (Tables 1 and 2). As these deposits represent deliberate dumps of material from successive cremations in a similar way to burials, 100% recovery is necessary for analysis and interpretation of the number of cremation episodes represented. It will be apparent from Figure 00 that most of the contexts, including those subject to 100% recovery, were effectively 'sampled' since some were truncated by later features and most extended beyond the limits of the excavated areas. Consequently, the results obtained from the debris dumps present only a minimum.

30995.3g of bone, that is 27.8% of the total weight examined, was recovered from pyre debris dumps. That cremation burials rarely, if ever, contained the entire cremated remains of an individual is well documented (section **IV.1**). The bone recovered from the debris dumps represents bone not collected for inclusion in the burial, disposed of along with other pyre debris, presumably in clearance of the pyre site(s) for re-use.

The quantity of debris produced by a cremation may vary depending on the size of the individual being cremated (immature individuals would required less fuel, though there may have been other considerations e.g. wealth), the weather (increased wind dispersing more of the finer wood-ash), and the length of time between cessation of cremation and collection of bone for burial and deposition of pyre debris. In an experimental pyre cremation conducted in 1993 (Marshall and McKinley in prep.), 3.8kg of wood ash remained from the 900kg of wood used to construct the pyre, i.e. *c*. 10L (*c*.4% by weight). The pyre had been allowed to burn-out over-night, and in the light force 3 wind, much of the fine wood ash had dispersed. A second experiment conducted in 1994, in which the pyre, once burnt down, was deliberately cooled and the debris collected 7-8 hours after the pyre was lit, resulted in a considerably larger quantity of charcoal being recovered.

Plot 21; Pyre debris dump 916/946

The largest of the pyre debris dumps, context 916/946 in plot 21, formed a spread of material in a series of uneven, shallow features, truncated through the centre and at the southern end by later features. The excavated area probably represented *c*. one third of the original horizontal spread, though an unknown depth of material may have been truncated, the maximum depth at excavation being *c*. 0.21 m.

26039.5g of bone (84% of that from the pyre debris) was recovered from this spread, which was excavated in 11 strips (Table 1, Figure 00). Assessment of the quantity distribution of bone within the dump is based on a comparison of the percentage by volume of material collected from each strip for sieving (from a total of *c*. 955 litres), compared with the percentage by weight of bone from each strip (Table 8).

It will be apparent that there is a greater concentration of bone in the southern, and less peripheral context 916, with a significant concentration in strip 108. Noticeably less bone was recovered from the north-western strips 124-125, situated on the margins of the dump area. The distribution is not particularly surprising given the spatial distribution of the strips.

No.	**size of 'sample'**	**% total**	**wt. of bone**	**% total wt.**
916:	360L	37.7%	14694.6g	56.4%
: 96	30L	3.1%	571.2g	2.2%
: 107	130L	13.6%	4732.4g	18.2%
: 108	150L	15.7%	7035.6g	27.0%
: 109	50L	5.2%	2354.8g	9.0%
946;	595L	62.3%	11344.9g	43.6%
: 113	5L	0.5%	171.7g	0.05%
: 116	50L	5.2%	1200.3g	4.6%
: 117	90L	9.4%	2086.0g	8.0%
: 119	75L	7.8%	1572.5g	6.0%

: 121	135L	14.1%	2546.0g	9.8%
: 124	120L	12.6%	1616.8g	6.2%
: 125	120L	12.6%	2231.6g	8.6%

Table 8: distribution of bone within pyre debris dump 916/946 by strip sample.

To assess the minimum number of individuals within this debris dump, the identifiable bone fragments in each strip were tabulated, and a tally made of the minimum numbers of each fragment (Table 9). In this way a minimum of 17 individuals were identified, including 2 immature individuals. Combining these minimum numbers with the identifications for age and sex, a minimum figure of 19 individuals is obtained; including four immature individuals comprising a young infant *c*. 1 yr., an older infant 3-4 yr., a young juvenile and a young subadult; and 15 adults including an older subadult/young adult, a mature adult, an older mature/older adult, an older adult and an adult, with a minimum of two females and one male.

These figures represent a combination of information from 916 and 946, but although these context represent the same area of deposition, they are separated by a later cut 4 m wide. Although it is not impossible that bone fragments from a single individual may have spread across the two contexts, it is improbable that this would be so in every case, but impossible to prove conclusively given the nature and form of the deposits.

The greatest number of individuals identified within one strip was seven from 108, including a young infant, older infant, young juvenile, young subadult, older mature/older adult, older adult and an adult. Possible links between the strips were implied by the recovery of fragments of what were probably the same individual from adjacent strips, with no evidence of duplication. For example, fragments of young infant bone were recovered from strips 108 and 109, fragments of juvenile bone from strips 117, 119, 121 and 124, and parts of what may have been the same older adult were recovered from strips 107 and 108.

Smaller 'sample' blocks, with vertical as well as horizontal divisions may have enabled more detail to be extracted on individual deposits of pyre debris. However, that no horizontal divisions were evident in excavation would suggest that subsequent deposits were made in fairly rapid succession. The dating evidence for this context is limited (100%) to Phase 1.

Since the excavated debris dump represents only *c*. one third of the probable original deposit, this would suggest, on a crude extrapolation, that the debris of up to 57 cremations may have been deposited in this area alone.

A minimum of 11, but possibly up to 14 individuals were identified from cremation burials in plot 21 (Tables 5 and 6), including only one immature individual, an infant. The number of burials is less than the actual and the postulated figures from the debris dump. There may be several possible explanations for this discrepancy. None of the sites comprised total excavation of the cemetery and there are undoubtedly more burials within the area of 'plot 21' outside the excavated area. This particular debris dump may not have been exclusive to cremations buried in plot 21, though those in the adjacent plot 28 are more likely to be linked to debris dumps found within that plot. With particular

reference to the immature numbers from the debris dump, since it is know not all cremated bone was collected for burial, it is possibly in a dual cremation of an adult with an immature individual (a common form of dual cremation - section **V.5**), that where 50% or less of the adult remains may have been included in the burial, the remains of the immature individual may have been overlooked completely.

What the numbers of individuals identified do demonstrate is that there are likely to be, or were, many more cremation burials in the area than have been excavated.

Plot 28 pyre debris dumps

The six other debris dumps excavated were scattered across plot 28, mostly in the southern portion (Figure 00). Three of these dumps were only sampled, 1535 as two spits one at 7-17% the other 80%, 1297/1589 *c*. 50%, and 1590/1638/1707 *c*. 20%, which places constrains on interpretation, and the figures obtained must be viewed as a minimum.

Although several of these dumps appear to be similar in nature to that in plot 21, with large spreads of material incorporating debris from several cremations, three of the dumps subject to total recovery (491, 521/553 and 600) appear to comprise debris from a single cremation (491 and 521/553 may be debris from dual cremations), or, at maximum, two (Table 10).

From the cremation burials in plot 28 (Tables 5 and 6), a minimum of 18, or a possible 29 individuals were identified, including only one immature individual. As outlined above, there may be a number of possible explanations for the implied difference in numbers of cremated individuals noted in the debris dumps and the burials.

context	**bone wt.**	**% recovery**	**individuals identified**	**dump type**
491	227.7g	100%	1) juvenile 2) adult	?single
521/553	123.8g	100%	1) om/o adult 2) infant/juvenile	?single
600	317.5g	100%	adult	single
1297/1589	752.4g	*c*. 50%	1) o.infant/y.juvenile 2) adult 3) om/o adult	multiple
1535	1169.6g	*c*.46-80%	1) juvenile 2) om/o adult	multiple
1590/1638/1707	2137.1g	*c*. 20%	1) o.infant/y.juvenile 2) om/o adult 3+4) adults ?5) immature	multiple

Table 10: Plot 21 debris dumps (om - older mature, o older, y young)

efficiency of cremation and collection

The efficiency of cremation reflected in the bone from the pyre debris dumps is similar to that noted in the bone from the burials (section **V.3**); *c*. 65% of the pyre debris contexts show some variation, compared with 100% of the lidded urned burials, *c*. 66% of the other urned burials and *c*. 50% of the unurned burial or pyre debris contexts. There is

nothing to suggest selection of bone fragments for burial based on the efficiency of cremation.

The maximum fragment size of 79 mm noted from the pyre debris dumps is considerably less than that of 112 mm from the urned burials, 122 mm from the lidded urned burials and 110 mm from the ?unurned/?pyre debris contexts. The average maximum fragment noted from the pyre debris dumps (Table 11) is close to the overall average, but also much lower than those recorded from the urned burials. The average percentage of bone recovered from the 10 mm fraction (Table 11) is also lower than in most other types of deposit, further demonstrating the general tendency for a lower bone fragment size in the pyre debris dumps.

The factors which affect the size of cremated bone fragments are outline in section **V.4.2**. There is no evidence to suggest that the bone disposed of as pyre debris was in anyway deliberately fragmented further than bone destined for burial. It is the mode of deposition - unprotected by an urn and being left dumped in an open spread of material - which is most likely responsible for the generally smaller fragment sizes.

As outlined in section **II,** some bone fragments are easier to recognise than others, the size of the fragments making a significant contribution (Mckinley 1989 and 1994a). The nature of the bone and mode of deposition also have an affect on its survival, spongy bone being more prone to break-up or crumble in adverse burial conditions than compact bone (McKinley 1994b). These factors account for the slightly higher percentage of skull fragments and correspondingly slightly lower percentage of axial bone fragments amongst the 'identifiable' bone from the pyre debris dumps and ?unurned/pyre debris? contexts than in the burials. There is no evidence to suggest that particular skeletal elements were being selected for burial and others discarded (section **V.4.3**).

position

The debris dump in plot 21 was situated on the southern edge of the burials. In plot 28, the larger, multiple spreads of debris also tended to be marginal. One of the single dumps was well to the north of any known burials. The other two single dumps were adjacent to a burial (521/553 and burial 564), and cut by a burial (600, cut by 594); in neither of these instances was the pyre debris related to the respective burial.

Large spreads of pyre debris representing successive dumps of material have not been excavated at contemporaneous sites elsewhere in Britain. The shallow, almost surface form of the features probably render them vulnerable to truncation, which may in part be responsible for their relative rarity.

Dumps of debris, apparently from individual pyres, have been recorded however, either in shallow cuts or deeper pits. At the Late Iron Age cremation cemetery of Westhampnett (Fitzpatrick and Powel pers. comm.) a series of pyre sites and debris dumps were located on the peripheries of the burials. A series of 27 badly plough damaged pyre sites and/or pyre debris dumps, each apparently representing single, or at maximum two individuals, were found on the northern edges of the Baldock 15 cemetery (Burleigh and Matthews pers. comm.). At least one of the cremation-related features at Lankhills appears likely to be a debris dump (Clarke 1979) and large pits containing pyre debris were excavated at Trentholme Drive, York (Wenham 1968).

unurned burials or pyre debris dumps?

The nature of the contexts designated unurned burial or pyre debris dump (?un/?pd), and

the consequent interpretative problems, have been outlined in section **III**.

The overall average weight of bone from the contexts was 179.1 g (Table 11), which is considerably lower than from other burials contexts. Several undisturbed deposits contained as little as 6.2g, 25.0g or 26.6g of bone, i.e. a maximum of 0.6%, 2.5% or 2.6% of the expected weight of bone from an adult cremation (McKinley 1993b). 81% contained varying quantities of pyre debris. The majority of the features were concentrated in plots 28 (*c.* 45.5%) and 2 (40.5%), with 7.1% in plot 21. Three features were not designated to a plot.

Unurned burial:-

Varying quantities of pyre debris were recovered from the backfills of a minimum of 23% of the urned burials. The percentage varied between plots; 19% in plot 2, 20% in plot 21, 29% in plot 28, 31% in plot 3 and 33% in plot 29, i.e. the frequency was not necessarily linked to the presence of known pyre debris dumps. The recovery of some pyre debris from the backfills of cremation burials is not uncommon in Romano-British cemeteries. Small quantities of pyre debris were recovered as discreet deposits, i.e. not mixed with the cremated bone, in 50.5% of the burials (urned and unurned) from St. Stephen's (Niblett pers. comm., McKinley 1992 unpublished). At Baldock 15, where *c*. 60% of the cremation burials were unurned and *c*. 40% urned, 78% of the former had pyre debris in the burials pits in contrast with only 16.5% of the latter (McKinley 1991a unpublished). In the unurned burials, the pyre debris was recorded as occurring either above or below the cremated bone, the implication being, in almost all case (many burials were disturbed) that the bone had been included as a separate deposit from the pyre debris (Burleigh and Matthews pers. comm.).

The high probability of some unurned burials in the East London Cemetery is suggested by comparison with these and other contemporaneous cremation cemeteries. It is of note that a considerable higher percentage of the unurned burials from Baldock 15 contained pyre debris in the pit fills than did the urned burials.

The distribution by phase of urned and unurned burials (probable and possible - section **III**) suggests that the latter mode of burial became more common in the later phases;

	Phase 1	**Phase 2**	**Phase 3**	**Phase 4**
cremation burials	27.4%	21.6%	26.3%	24.3%
urned burials	36.85%	25.2%	26.0%	11.8%
?unurned burials	20.9%	9.7%	33.85	35.6%

Pyre debris dump:-

The pyre debris dumps excavated in plots 21 and 28 comprised both large spreads of multiple deposits and deposits from single cremations. The debris was dumped in relatively shallow cuts, possibly pre-existence rather than deliberately cut for the purpose. Deposits of debris from single cremations within a pit would not be any great departure from the single deposits in the shallow features already noted both here and at Baldock 15.

phasing

No pyre debris dumps were assigned to Phase 4 (see Table 7). Of the multiple deposits,

75% were assigned to Phase 1, 25% to Phase 3; the single deposits were assigned to Phase 1 - 17%, Phase 2 - 55%, Phase 3 - 28%. The percentage distribution for the ?un/?pd contexts interpreted as most likely to be pyre debris dumps extends across all the phases, peaking in Phase 4; Phase 1 14.8%, Phase 2 12.1%, Phase 3 27.4% and Phase 4 45.6%. These figures suggest there may have been variations over time in the method of debris disposal, the large dumps of material giving-way to single, possibly pit, deposits with time. Such a policy may results from overcrowding in the cemetery area and a need for more compact, 'tidy' disposal of debris.

V. 3 Efficiency of Cremation.

The efficiency of cremation is reflected primarily in the colour of the bone (Shipman *et al* 1984), fully oxidized bone being buff-white. The process is affected by the inter-dependant needs of sufficient time, temperature and oxygen supply (McKinley 1989, and 1994a), a deficiency in any one of which may result in incomplete cremation, though in some circumstances the effects may be counter-acted by a positive variation in one of the other factors e.g. lower temperature for longer duration. NB. Both the length of time for which the pyre will burn and the temperature are largely dependant on the quantity of fuel used in construction.

It should be noted that the perception of what was considered 'full/efficient cremation' may have varied both geographically and over time (Barber 1990 p381, McKinley 1994a p79-80).

Although the vast majority of the bone was the buff-white colour indicative of complete combustion, many burials contained a varying numbers of bone fragments showing black (charred), blue or grey colouration. Some bone from all eight of the lidded urned burials showed colour variations, as did fragments in *c*. 66% of the other urned burials and *c*. 50% of the ?unurned burial/pyre debris contexts. Burials from all plots were affected, between 12.5% (plot 17) and 77% (plot 3) (plots with >one burial only).

In 32 (48%) of the burials where colour variation was noted, only a few fragments, often only one, of between 1-3 bones were involved, an entire bone was never affected in these instances. In 36% of the burials, between 4-10 bones/bone groups may be affected (bones from different sides were counted individually; several e.g. tarsals, thoracic vertebrae or phalanges were counted together as a group). Between 10-20 bones/bone groups were affected in 11% of the burials, 24-25 in 3%.

The proximal femur and shaft most commonly showed a colour variation (32 burials); between 20-26 burials showed variations in the skull vault, thoracic and lumbar vertebrae, innominate and the tarsal bones; between 11 and 18 showed variations in the temporal vault, cervical vertebrae, ribs, upper limb bones, patella and tibia; all skeletal elements were affected in at least one instance.

A variety of factors affect the rate at which bones in different parts of the skeleton oxidise in cremation (Mckinley 1989 and 1994a), distribution of soft tissues, type of bone (i.e. compact as vers. spongy bone), and position of individual bones in relation to the peripheries of the pyre, being the more obvious. The pattern of cremation seen here does not suggest anything abnormal in the mode of cremation, but would imply a general and over-all lack of efficiency, probably related to insufficient time and/or temperature, both of which could be related to the quantity of fuel used to construct the pyre. It is possible that complete combustion of the bone was not considered necessary.

The efficiency of cremation does not appear to be particularly related to the age or sex of the individual. No extensive variation in colour was noted in infant or juvenile burials, which may be due to the purely practical consideration that a smaller quantity of fuel

would be necessary to cremate the smaller frame. Extensive poor oxidation of the bone was noted in 11 burials. All skeletal areas, from both sides, were involved. Some bone fragments were merely charred, although the full range of colours from brown-black-blue-grey-white were present, and a single bone e.g. the femur, would display a variety of colours throughout both the length and occasionally, the thickness of the bone. These burials included both females and males, and comprised urned or redeposited urned burials from plots 2 (11.5%), 3 (15.4%), 14/15 (1 of 1), 16 (17%), 21 (10%) and 28 (17.6%). No spatial distribution is suggested and no significant variation in distribution of these burials by phase is evident.

soft tissue residue

Small quantities a light, brittle, 'slag-like' substance were recovered from two of the pyre debris dumps (916/946, 1590) and two of the urned burials (1025, 1259). The black residue has been noted by the writer in several other archaeological cremation burials, amongst ashes in modern crematoria and in experimental pyre cremations (McKinley 1994a; Marshall and McKinley in prep.). This represents charred, i.e. incompletely oxidised, soft tissue residues. Being extremely brittle it is prone to fragment easily, particularly in archaeological cremations with the additional pressures exerted by burial and excavation. Consequently, archaeological specimens are rarely recovered, and then usually only as very small pieces. Examples from Romano-British burials include small quantities from Coburg Road, Dorchester (McKinley 1992), and several large fragments from a water-logged burial excavated at Purton, Wiltshire (McKinley 1991b unpublished).

Two fragments of a pale yellow/brown substance were also recovered. This is similar in colour to the fuel ash slags which are not uncommonly recovered in cremation burials (section **V.1**), but without the vitreous appearance. A similar material has occasionally been noted in modern cremations and in experimental pyre cremations. This is not fuel ash slag, but may be a soft tissue residue of some sort, similar to the black residue (analysis on-going).

The occurrence of soft tissue residues, however small the quantities, demonstrates that there was incomplete combustion of soft tissues as well as bone. In experimental pyre cremations (Marshall and McKinley in prep.) large quantities of charred soft tissues, noticeably lung, intestine, bowel and spinal longitudinal ligament, remained as a charred tissue on the pyre wood-ash bed 8-9 hours after cremation had commenced. Even during 'next-day' recovery of material from the pyre, some charred soft-tissues remained, particularly ligament.

The overall efficiency of cremation has been noted as being consistently poorer in Romano-British burials that in those of other periods, where observation of the extensive variations noted here are rare (e.g. McKinley 1995b (B.A.) and 1995a (I.A.) unpublished, McKinley 1994 (A.S.)). The ostentatious, water-logged burial from Purton, Wiltshire showed an overall poor level of cremation (McKinley 1991b unpublished), many fragments being black or blue. At Baldock 15 (McKinley 1991a unpublished) a large minority of burials showed colour variations as noted here, and two partial-cremation burials were excavated from shallow graves, in which the axial areas of the skeleton were unburnt and clearly articulated at time of burial. About 12% of the burials at St. Stephen's cemetery, St. Albans, showed varying levels of cremation efficiency, several with overall deficiency similar to that seen here (McKinley 1992 unpublished). At Westhampnett (McKinley 1995 unpublished), 22% of the Romano-British burials showed some cremation-related variation in colour as compared with only 3% of the Iron Age burials.

The efficiency of cremation does not appear to be related to the sex of the individual, or, with the exception of immature individuals noted above, to age. The inefficient oxidation of the bone seen in the apparently 'high status' Purton burial would suggest that wealth was not a consideration. (Analysis of the 'reflected status' of the East London burials may support or contradict this observation). As observed above, it may be that complete combustion of the organic components of the bone was not considered necessary by the Romano-British. Another possible factor may be who was conducting the cremation. The pyre debris found in association with the cemeteries indicate that, unlike in the later large Anglo-Saxon cemeteries which appear to have functioned as the place of burial alone, Romano-British cemeteries often functioned as crematoria as well. This being so, it is possible that the cremations, particularly in urban centres, were performed not by the family of the deceased, but by paid attendants, who may not always have been as through as they could have been. In contemporary India at the commercial centres of cremation fuel is the over-riding expense, were the situation similar in Romano-British cemeteries and the relatives of the deceased unable to afford much fuel, the efficiency of the cremation would be affected.

V. 4 Collection of Bone for Burial.

Cremation is best achieved with the corpse placed on top of the pyre, and such positioning of the body is supported by osteological, historical and ethnographic evidence (McKinley 1989 and 1994a, Barber 1990 p.380). Experiments have shown that the body maintains it's vertical position in relation to the rest of the pyre throughout the cremation process, so that on completion the clean, buff/white bone rests in roughly correct anatomical position above the wood ash of the pyre (Marshall and McKinley in prep.).

The bone in cremation burials was obviously separated for burial, even where other pyre debris was present in the grave fill. Full bone recovery from the pyre would be time consuming but relatively simple, the bone would require no cleaning and could easily be picked-off the bed of wood ash once cool (Marshall and McKinley in prep.). Most ethnographic and historical sources suggest pyres were/are left over-night before collection of bone for burial (e.g. Dubois and Beauchamp 1943, Hiatt 1969), though contemporary reports of 'commercial' Indian cremations indicate the entire pyre debris is consigned to the river after about 3-4 hours (*The Sunday Times* 13.7.86).

There is some evidence for accelerated cooling (not to be confused with curtailing) of the pyre; in the *Aeneid* Virgil refers to the Trojans having ...'washed in wine the thirsty ashes of the remains'... prior to collection of cremated bone from the pyre, and in Homer's *Iliad,* Achilles instructs Agammemnon to ...'first put out with gleaming wine the pyre [Patroklos'] that is still burning'... (23: 237), but this was only after the pyre had burnt overnight and ...'the fire had died down and the flames were over'... (23: 228). In experiment (1994, Marshall and McKinley in prep.), *c*. 12 gallons of water poured over the pyre 7 hours after it commenced cooled the bone, but left the charcoal bed still too hot to collect bone by hand. An alternative mode of collection, were it considered necessary to recover the bone before the pyre were cool, would be to rake the bone fragments from the top of the pyre, once off the charcoal base they would cool rapidly.

The entire cremated remains were rarely, if ever, included in the burial. In effect, all cremation burials are essentially 'token'. Elements of skull, axial, upper and lower limb were included, indicating the presence of the entire body, and there was no obvious preference for any particular skeletal element in the vast majority of cases. The level of recovery varied considerably, but the reasons for the variation are unclear.

V. 4. 1 Weight of bone

Observations at modern crematoria (McKinley 1993b) have shown that the weight range of collectable (<2 mm fraction) bone from an adult cremation is *c*. 1000-2400g (the minimum being a very elderly, gracile female), with an average of *c*. 1650g. Elsewhere weights of 1600-3600g have been noted (Evans 1963), but it is unclear whether this includes bone dust as well as archaeologically compatible bone of <2mm fraction.

Table 11 shows the average weights of bone obtained from the contexts as a whole, all the urned burials, the lidded urned burials (all undisturbed) and the other undisturbed urned burials (see section **V.2** for pyre debris and ?un/pd? contexts).

	Averages							
type of deposit	**total wt.**	**% 10mm fraction**	**% 5mm fraction**	**max. frag.**	**% id. skull**	**% id. axial**	**% id. u.limb**	**% id. l.limb**
all contexts	286.7g	64.3%	23.1%	35.8mm	36.1%	14.9%	15.1%	29.6%
u lid burials (all u/d)	1104.6g	78.2%	17.7%	92.2mm	22.1%	22.8%	17.1%	38.0%
u/d urned burials**	845.0g	66.1%	29.0%	66.5mm	27.2%	25.7%	19.1%	27.9%
all urned burials *	743.3g	53.0%	24.7%	58.8mm	27.7%	29.6%	13.3%	27.1%
pyre debris dumps		48.3%	46.1%	38.2mm	38.8%	13.4%	17.8%	29.3%
?un/?pd	179.1g	53.7%	41.8%	34.0mm	38.6%	16.3%	18.7%	29.4%

Table 11: Average bone weights, measures and distribution for different cremation-related contexts. (u.lid - lidded urn, u/d undisturbed, ?un/?pd unurned burials or pyre debris dumps (see section III), * excluding the lidded urned burials, ** excluding TW identifications from all except total weight because of different recording methods). Average total bone weight for pyre debris dumps not included because of sampling strategy. (information collated from Table 1).

The maximum weight of bone from a burial was 1948.2g from a disturbed urned burial (older mature adult female), with a minimum of 2.2g from the disturbed urned burial of a subadult/adult. A maximum weight of 1731.7g was obtained from the lidded urned burials (older mature adult male), with a minimum of 206.4g (older infant), the minimum adult weight being 511.4g (older adult female). From the other undisturbed urned burials, the maximum bone weight was 1657.5g (older mature adult female), with a minimum of 57.3g (adult), 630.0g (immature).

The weight of bone in a burial is not related to the sex of the individual, and although in general an adult burial will contain a greater weight of bone than that of an immature individual, this may not always be the case. Both the average and maximum figures obtained from the lidded urned burials were greater than from the other undisturbed urned burials. The significance of this observation must be tempered by the fact that

some of the other urned burials, both disturbed and 'undisturbed' may originally have had lids - ceramic or otherwise.

The great range of weights obtained from undisturbed adult burials, 57.3-1713.7g, has no obvious explanation. It may be that the time expended on collecting bone for burial in some way reflected the 'status' of the deceased in whatever terms that may have been calculated. Comparison of the weights of bone from these burials with associated aspects of the burial rite may offer further illumination. While it is known from the quantity of bone recovered from the pyre debris dumps that much of the bone not included in burials was simply discarded, it is not impossible that some was retained for other purposes such as tokens of remembrance (Wells 1981).

A weight range of 84-2127g was recorded by Wells for the Puckeridge burials (1981), with average weights of 214 g (series 'A'), 634 g (series 'B') and 796 ('SG'). Wells noted a similar range, 37-2381g, and average, 584g, at Welwyn (1981). In both cases these are for all burials, no distinction being made with reference to the level of disturbance, type of burial or age of the individual. The undisturbed adult burials from the contemporaneous cemetery of Baldock 15 (McKinley 1991a unpublished), had a weight range of 1-1599.1g with an average of 452.0g from the unurned burials, 100.0-1419.0g with an average of 619.2g form the urned burials. At St. Stephen's (McKinley 1992 unpublished), the average weight of bone from the undisturbed, urned adult burials was 899.6g with a range of 71-1447.2g, an average of 824.0g from the unurned burials and 640.0g from the boxed burials. A lower range of 190.9-618.3g with an average of 333.5g for the undisturbed, urned adult burials, and 302.9-687.1g with an average of 531.7g for the undisturbed combination burials at Westhampnett (McKinley 1995a unpublished), was related to lower levels of bone survival.

The weights of bone from plot 2 are consistently higher than the averages for the cemetery (Tables 11 and 12), those from plot 17 and 21 consistently lower. The significance, if any, of this observation may be demonstrated in other associated patterns, but disturbance does not appear to have been a factor.

Plot No.	**Urned burials**	**Av. bone wt.**	**U/d urned burials**	**Av. bone wt.**	**U/d lidded urned burials**	**Av. bone wt.**
1	1	959.0g	1	959.0g		
2	17	1040.5g	2	1407.5g	3	1469.7g
3	8	827.1g			1	206.4g
16	3	728.7g	2	750.0g		
17	6	152.5g	2	343.6g		
21	10	503.3g	2	415.7g		
28	10	796.1g	5	967.3g	4	1054.2g

Table 12: Showing average bone weights for all urned burials, undisturbed and lidded burials by plot. Redeposited burials and plot 16/17 burials subject to repeat identification (see section **II**) not included.

Analysis of bone weight by phase shows no date-related pattern in the quantity of bone recovered for burial. Weights of bone from undisturbed burials analysed in the five categories of <100g, 100-500g, 500-1000g, 1000-15000g and >15000g, each have percentages close to those for 'cremation burials' shown in Table 7.

The weight/phase percentages for all burials (i.e. disturbed and undisturbed) shows a larger number of low bone-weight burials in Phases 3 and 4, with a corresponding lower number of high-weight burials in the later phases. Comparison of these figures against those for the undisturbed burials would suggest there was a higher level of disturbance to Phase 3 and 4 burials.

V. 4 2 Fragmentation

Numerous factors contribute to the fragmentation of cremated bone including cremation, collection, burial, excavation and post-excavation treatment (McKinley 1994b), none of which involve deliberate breakage of the bone prior to burial. Post-depositional disturbance, including surface pressure resulting in cracks/fissures in pottery, may cause bone to break along fissures developed during cremation. It should be remembered that measurements included in osteological reports are indicative of post-excavation fragment sizes and do not necessarily reflect the size of fragments at time of deposition. The closest estimate to actual depositional fragments sizes is obtained from undisturbed burials.

Table 11 shows the average percentage of bone in the 10 mm fraction and the average maximum fragment sizes from the different types of burial deposit (see section **V.2**. for pyre debris and ?un/pd? contexts). The maximum percentage of bone recorded in the 10 mm fraction was 83.6% from an undisturbed urned burial, the maximum from an undisturbed lidded urned burial being 83.6%. A maximum fragment size of 122 mm was recorded from a lidded urned burial, the maximum from an undisturbed urned burial being 112 mm.

As has been demonstrated elsewhere (McKinley 1994b and 1992 unpublished), the progressively higher figures obtained from urned burials, undisturbed urned burials and lidded urned burials, show that burial in an urn offers the bone protection against post-depositional fragmentation; that disturbance results in a decrease in bone fragment size; and that a lid, by surpressing the infiltration of soil which 'dries-out' the bone and causes fragmentation during excavation of the bone from the fill, offers still further protection.

A increase in bone fragmentation may also have an affect on the quantity of bone recovered. In some circumstances spongy bone may crumble to 'dust' as it breaks-up on excavation, resulting in a lower recoverable bone weight (McKinley 1995a unpublished, section **V.4.1** above). The greater weight of bone noted in the lidded urned burials may be more a consequence of bone survival than a 'cultural' phenomena.

Each 'plot' contained only a few undisturbed burials, which renders the significance of any observed spatial differences in bone fragmentation questionable. Lower than average readings were obtained from burials in plots 17 and 21, while higher than average readings were noted in plot 2, but since only two burials were involved in each case comment is limited (Table 13). The same plots also have lower and higher than average

bone weights respectively (Table 12). These two observations may be linked by variations in bone survival similar to that suggested for the lidded urned burials (see previous para), alternatively, they may have some cultural aspect linked to minor variations in pyre technology.

Plot	Undisturbed urned burials			Undisturbed lidded urned burials		
	No.	**% 10mm fraction**	**max. frag.**	**No.**	**% 10mm fraction**	**max. frag.**
1	1	44.1%	53 mm			
2	2	83.1%	83 mm	3	79.9%	106.7 mm
3				1	75.3%	54.0 mm
16	2	76.5%	64.8 mm			
17	2	42.5%	27.0 mm			
21	2	42.1%	41.5 mm			
28	4	70.4%	85.8 mm	5	77.7%	91.0 mm

Table 13: Average weight of bone in 10 mm fraction and average maximum fragment size from undisturbed burials in each plot. (Numbers excluding plot 16 burials identified by TW since different methods were used in analysis).

Analysis of fragmentation by phase shows no significant variation over time to suggest different treatment of remains.

Overall, the fragment sizes noted in the burials are within the normal range (McKinley 1994b) and there is no evidence to indicate deliberate fragmentation of bone prior to burial.

V. 4. 3 Skeletal elements within burials

It is normal to observe a selection of bone (apparently random) from each skeletal area within a burial, irrespective (other than in extreme circumstances e.g. substantial disturbance) of the overall quantity of bone included. The percentages of identified bone (Tables 1 and 10) in each area is rarely equal for a variety of reasons including the natural inequality in percentage by weight (*c*. 18.2% skull, 20.6% axial, 23.1% upper and 38.1% lower limb in a complete dry skeleton), disturbance, ease of identifying different skeletal areas and bone survival (McKinley 1994a, sections **II** and **V. 4. 2** above), but there is rarely any apparent deliberate bias in the elements included in the burial.

Assessment of disturbed burials is of limited use since an unknown quantity of bone may have been lost, disrupting the percentages of skeletal elements originally deposited. Table 11 presents the average figures for the cremation-related contexts (see section **V.2** for pyre debris and ?un/pd?). The majority of percentages recorded from each burial context

were fairly close to average i.e. +/- 10%, but the ranges were fairly broad; all urned burials (no lids) - skull 4-91%, axial 0.4-45%; lidded urned burials - skull 11-54%, axial 3-32%; other undisturbed urned burials - skull 16-52%, axial 11-33%.

The distinctive appearance of most skull fragments make them easy to identify and burials will often contain a higher percentage of identifiable fragments than the *c*. 18.2% (by weight) of the skeleton the skull comprises. In context hoo 980, an urned burial, <50% disturbed by the insertion of an inhumation burial and containing 722.7g of bone, only 4% of the identified bone was skull. Although the disturbance may have resulted in preferential loss of skull fragments, perhaps due to their position within the burial, it is also possible that a deliberate policy at time of burial resulted in the exclusion of skull fragments. Wells (1981 p.291) noted a similar deficiency of skull fragments in burial SG 39 at Puckeridge, which included 1294g of bone (no mention of whether the burial was disturbed or not).

The level of disturbance to context hoo 1560 was unclear, rendering the significance of 91% skull from the identifiable bone, questionable. This burial had a particularly small percentage of identifiable axial bone, 0.4%, which would have a positive affect on the percentage of skull identified. Axial bone may have been preferentially lost in disturbance, either due to it being removed from the burial or because bone was so badly damaged it crumbled to dust on excavation (see **V. 4. 2**). It may be significant to note that this burial showed a lower than average percentage of bone in the 10 mm fraction (46%) and a lower than average maximum fragment size (39 mm), both of which may be related to disturbance levels.

The higher percentages of identified axial bone were recovered from burials which had been >50% disturbed.

The relative percentages from the undisturbed burials did not suggest any deliberate selection of skeletal elements for burial.

Each 'plot' contained only a few undisturbed burials which could be analysed for spatially-based differences. Most of percentages were fairly close to the averages i.e. +/- 10%, and where a slightly higher or lower reading was noted the presence of only one or two undisturbed burials in the plot precluded comment.

V. 5 Dual Cremation Burials

Two individuals were identified in four burials (*c*. 4%), three from plot 2 (*c*. 8%) and one from plot 28 (*c*. 6%). Three of the burials were of an adult (minimum one female) with an immature individual, the one other being of a young adult with an older adult (minimum one female).

The figures should be viewed as a minimum. As discussed above (section **IV**), there is a reasonable supposition that immature individuals, particularly young infants, may be overlooked in dual cremation in consequence of non-recovery from the pyre for burial, or poor bone survival.

The percentage of dual burials identified is similar to that from other contemporaneous cemeteries; 8% from Owslebury, 2% from Welwyn (Wells 1981), 5% from Baldock Area 15 (McKinley 1991a unpublished); 3% from St. Stephen's (McKinley 1992b unpublished); and 3-6% from Westhampnett (McKinley 1995a unpublished). No dual burials were reported from the burials at Lankhills (Clark 1979), Baldock Walls Field and Walls Common (Stead and Rugby 1986), Puckeridge or Oakley Cottage (Wells 1981).

Dual cremation burials most commonly include a subadult or adult, of either sex, with

an immature individual, although two adults together are not unknown. For example, at Baldock 15, 87% of the dual burials were of this combination, at St. Stephen's 89%.

The various alternative interpretations of these deposits have been discussed in detail elsewhere by the writer (McKinley 1994a), but it is felt that in many instances the implication is for both individuals being not just buried, but also cremated together. However, that bones from one cremation were sometimes retained until the bone from a second could be included prior to burial is supported by a passages in Homer's *Iliad* ...'do not have my bones laid apart from yours, Achilleus, but with them'... (1951 trans. Lattimore; 23, 83-84), and *Odyssey* (thanks to Dr. Jonathan Musgrave for drawing attention to the passage) ...your white bones lie, my lord Achilles, and mingled with them the bones of Menoetius' son Patroclus, dead before you, and separately those of Antilochus, who was your closest friend after Patroclus' death'... (1972 trans. Rieu; 24, 73-76).

In dual cremation/burials, the probability of a kinship relationship of between the individuals is compelling, particularly where an infant is buried with an adult. Close friendship obviously (see above), may also be indicated. Whichever, to be placed so close in death would suggest a comparable closeness in life.

V. 6 Cremated Animal Bone

Cremated animal bone is not uncommon in cremation burials of all periods, with variations over time in the frequency and quantity, and the species identified.

In all, 76 cremation-related contexts contained some cremated animal bone, including 45 burials (*c.* 44%); 43 (50%) of the urned burials. Animal bone was less common in immature (30%) than adult burials (52%), and a slightly higher percentage of males burials (53%) than female burials (49%) contained animal bone fragments.

The overall figures compare closely with the contemporaneous cemetery of St. Stephen's, St. Albans (McKinley 1992 unpublished) where c. 47% of the burials contained cremated animal bone, including 48% of the immature burials and 51% of the adult burials. As here, more male (73%) than female burials (50%) contained cremated animal bone **[could contact Ros Niblett and Gil Burleigh for species - though I know the latter has not had all the Baldock ones done...yet...].**

Elsewhere, the number of burials containing animal bone varies quite widely. At Westhampnett (McKinley 1995a unpublished), 3.5% of the Romano-British burials contained cremated animal bone; 10% from the military cemetery at Caerleon (Wilkinson pers. comm.); 13% at Baldock 15 (McKinley 1991a unpublished); 14% at Baldock Barrett site (McKinley 1984 unpublished); 36% from Puckeridge (Wells 1981); 37% from Baldock Walls Field (Stead and Rigby 1987); and two of the three burials from Cirencester (Wells 1982).

At Baldock 15, as here and at St. Stephen', a greater percentage of adult burials (26%) than immature burials (8.6%) contained animal bone. However, at Welwyn, Wells found 80% of the immature burials contained animal bone compared with 29% of the adult burials (1981).

The quantities of bone are usually fairly small, an average of 18g being noted at St. Stephen's (McKinley 1992 unpublished). The variety of species is relatively limited, particularly compared with the later Anglo-Saxon period (Bond 1994), pig, bird, and sheep being most often identified, with the number of species in each burial generally being limited to one or two.

As with other pyre goods, the number of burials containing cremated animal bone

should be viewed as a minimum. Where it is known that an average of only *c*. 46% of the human remains from the pyre were included in a burial, sometimes as little as 3%, it is probable that, on occasions, animal bone on the pyre may have been overlooked completely.

In common with other aspects of pyre technology and ritual, assessment on the significance of differences between the plots is limited by the small number of burials recovered from many of them.

Plot	burials with animal bone	% of burials
2	12	46%
3	8	61%
16	3	56%
17	3	56%
21	6	60%
28	11	65%
29	1	33%

Table 14: Occurrence of cremated animal bone in burials by plot (see Table 5).

V. 7 Pyre Goods and Staining to Bone

The full discussion of pyre and grave goods may be found elsewhere in this volume (p.00), comment here is limited to a point of note with respect to recovery. Artefacts from cremation-related contexts were extracted both during excavation, and in post-excavation sorting of the bone from the 10 mm and 5 mm wet sieve fractions. Additional fragments were recovered during the osteological examination of the bone, including a few worked antler/bone objects (16 contexts) which may have been overlooked by a non-specialist.

The osteological examination included scanning the unsorted 2 mm and 1 mm fraction residues - the latter of which particularly, has rarely been retained in past excavations or seen by the specialist. From these residues numerous small fragments of cremated human and animal bone (including a distal phalanx - claw - of 2 mm length, see p.00) and artefacts were recovered. The latter included many small fragments of glass (33 contexts), copper-alloy including small melted globules (16 contexts), and three small bead of glass (2) and jet (1). Some of these objects would not have been found had the 1 mm fraction not been retained for scanning.

As has been stressed elsewhere in the report with reference to other aspects of the cremation rite, the number of burials containing pyre goods should be viewed as a minimum. Since far from all the human remains were collected for burial it is probable that not all the pyre goods were either, in addition to which there would be organic pyre goods which did not survive cremation at all, including some materials such as amber, which may survive in inhumation burials.

spot staining

Blue, blue/green and, in one instance, yellow/green spot staining was noted on bone from 19 cremation-related contexts, including 13 urned burials and two pyre debris dumps (Table 2). This staining is not to be confused with different bone colour resulting from variations in efficiency of cremation (**V.3**).

Staining was most commonly noted on fragments of the skull (47%; vault, temporal, mandible). Four contexts (21%), including one with staining on skull fragments, showed staining to fragments of scapula or humerus shaft. Fragments of thoracic vertebrae were affected in two contexts, including one where straining on the innominate was noted, and the anterior of the sacrum was stained in one burial. Fragments of rib (10%) and lower limb (10%) were less frequently involved. One fragment of tibia had yellow staining on the shaft.

Blue/green staining has been noted on bone from contemporaneous cemeteries e.g. at Welwyn Garden City (Stead 1967), green spot staining was noted on the 'smaller long bones'. Staining was also noted on bone from St. Stephen's (McKinley 1992 unpublished) and Westhampnett (McKinley 1995a unpublished). At St. Stephen's a skeletal distribution pattern similar to that noted here was evident, with the majority of staining being to fragments of vault, several fragments of radius shaft, and a few fragments of rib, humerus and tibia shaft.

A possible cause is suggested by the similarity in the colour of some of the staining and that resulting from the proximity of copper-alloy to bone. However, copper-alloy objects were only present in **[please insert the correct number!]** of the contexts where staining was noted, and where similar staining has been observed elsewhere copper-alloy objects were not always recovered from the context. Therefore, post-burial staining due to the proximity of copper-alloys in the burials cannot be the cause, at least not in all cases. If the stains do relate to the proximity of copper-alloy, it is possible that the material was adjacent to bone fragments prior to burial, either on the pyre or in some pre-burial holding-place (*cf*. the passage from the *Iliad* above), and that the copper-alloy itself was never buried. A pilot study involving quantitative X-ray florescence analysis of several blue/green spot-stained bone fragments from Spong Hill (McKinley 1994a), showed high iron and copper readings (analysis is on-going).

However, researchers in Germany have suggested that this type of staining is not related to any external agency but is caused during cremation by the manganese in the bone apatite (mineral; Herrmann pers. comm.), but it is not clear why this should apparently preferentially affect certain skeletal elements.

Observations at modern crematoria and experimental work by Dunlop (1975 and 1978) has suggested green staining results from the proximity of iron or steel to the bone during cremation, and that copper results in pink staining. Yellow staining was noted on rare occasions and only where the body was cremated in a zinc coffin (Dunlop 1975, 1978).

adhering substances

In several contexts, fragments of iron were noted adhering to bone fragments, such fusion

is caused by the iron corrosion products during burial. The fusion of a fragment of glass to a metatarsal shaft in burial wte 1179 however, probably occurred on the pyre, and may illustrate the position of the relevant artefact **[do we know what this was?]** on the pyre in relation to the body (McKinley 1994a).

An orange/yellow-coloured substance, of resinous appearance, was noted adhering, as a fairly thin spread to fragments of inner vault in one burial and humerus shaft in another. This material has been noted elsewhere by the writer, e.g. in Bronze Age burials from Withington, Cheshire (McKinley 1994 unpublished) and Twyford Down, Winchester (McKinley 1995b unpublished) The nature of this substance is as yet unconfirmed (analysis is being undertaken), but there appears to be a consistent involvement of skull fragments (mostly vault) which may be significant.

A yellow/gold or copper-coloured substance, with a glaze-like appearance, was noted adhering to/spread over bone in four contexts. In msl 692, much of the bone was involved, in hoo 916 fragments of skull, cervical vertebrae, scapula and finger phalanges; hoo 934 rib, and hoo 1511 vertebrae, rib, innominate and tibia. The nature of this material is at present unknown but analysis is on-going.

VI. PATHOLOGY AND MORPHOLOGICAL VARIATIONS.

A summary of lesions is presented in Table 2.

Incomplete recovery of skeletal remains places constraints on pathological diagnosis. The fragmentary nature of cremated bone and general incomplete skeletal recovery severely curtails pathological discussion. It is not practicable to attempt to ascertain the incidence of various conditions. Observations are limited to the type of lesions present, the number of individuals affected and the location of lesions. In all aspects, the noted pathology should be viewed as a minimum.

Pathological lesions and/or morphological variations were noted in 54% of the burials, or 48% including the probable and possible unurned burials (NB. percentages given below are calculated on the total of 134 individuals). Bone from six of the pyre debris contexts also showed lesions.

VI. 1. Dental Disease

Fifteen individuals from the cremation burials (*c*. 11%) showed some form and degree of dental disease.

ante mortem tooth loss

Ante mortem tooth loss was evident in five individuals (including two males), and in maxillae/mandibles from two debris dumps. The majority of observable loss was in the maxilla, most showing resorption of a single socket, predominantly a premolar.

calculus and periodontal disease

Tooth loss tends to increase with age and may be related to one or more factors including excess wear, diet and dental hygiene. Dental calculus harbours the bacteria which predisposes to periodontal disease which may cause bone resorption with consequent loosening of teeth, and exposure of more of the tooth surface to caries attack. During

cremation, the tooth enamel of erupted teeth tends to shatter into small fragments as it expands in the heat of the pyre, in consequence, tooth enamel and any calculus deposits are usually lost to osteological analysis.

Slight-medium periodontal disease, indicated by resorption of the alveolus, was noted in eight of the cremation burials (including six females and one male), all older mature or older adults. *Ante mortem* tooth loss was not noted in any of these individuals, though several dental abscesses were recorded in the maxilla of one (wte 1055).

caries

Carious lesions were noted in two burials and dentitions from four pyre debris dumps.

In most cremation burials, evidence of dental disease is limited to the supportive structure and the tooth roots as a result of the shattering of tooth enamel in cremation as outlined above. Consequently, evidence of dental caries tends to present only in those extreme cases where the crown of the tooth has been fully or almost completely destroyed and the remaining lesion is evident in the now occlusal surface of the root. Since the tooth crown is destroyed or lost, and the length of the root is often reduced, it is not always possible to ascertain which root is represented. Only in burial msl 3111 was it possible to see the maxillary M3 was represented, the lesion being small and cervical.

abscesses

Dental abscesses were noted in the maxillary dentition of wte 1055, where there were lesions in both canine sockets and one M3 socket, the remaining sockets all being very shallow. The right mandible from burial hoo 863 had abscesses in the P1-M1 sockets. Lesions were also noted in one dentition from pyre debris dump 916. Dental caries, often the cause of abscess formation, were not noted in the burials, but were seen in the pyre debris dump 916, though in this instance it cannot be shown conclusively that the same individual was represented (see above).

hypercementosis

A harmless condition involving the excessive formation of secondary cementation, medium-heavy hypercementosis a single tooth root from two burials and two pyre debris dumps. In only one instance, msl 311, was it possible to ascertain the tooth involved, the maxillary M3. The condition may be triggered by age, periapical inflammation, mechanical stimulation or trauma (will forward ref.)

VI. 2 Deficiency Disease.

Cribra orbitalia, manifest as pitting in the roof or one or both orbits, is believed to result from a metabolic disorder connected with childhood iron deficiency anaemia (Manchester 1983, p.79 & 82). Slight pitting was noted in the left orbit of burial hoo 1700, an older mature adult male.

Rarefication of the vertebral spongiosa, indicative of osteoporosis (probably age-related), was noted in cremation burial wte 1179, an older mature adult male.

VI. 3 Trauma

Only one burial, wtn 672, an older mature adult female, had direct evidence of trauma in the form of a slight bony callus running diagonally along the ventral surface of one rib shaft. The lesion is indicative of a well-healed fracture.

Many traumatic events do not affect the bone directly, soft tissue trauma often leaves no impression on the skeleton, but some does. Muscle/tendon and ligament strains or ruptures may be indicated by the formation of exostoses at the insertions (see below). Periosteal new bone may illustrate where infection from soft tissue trauma has spread to the underlying bone. These lesions may also develop in consequence of a number of other factors, and there may not always be sufficient supporting evidence to suggest their aetiology (see below).

VI. 4 Infections

periosteal new bone

Infection of the periosteal membrane covering bone may lead to the formation of periosteal new bone. Infection may be introduced directly to the bone as a result of trauma, or via the blood stream from foci elsewhere in the body. Lesions were noted in 10 burials (*c*. 7%), and in bone from four pyre debris dumps. Most of the individuals affected were adults, including both sexes, with the exception of two infant and one subadult burial, all three of which showed lesions in the femur shaft.

	femur shaft	fibula shaft	tibia shaft	fibula & tibia shafts	radius shaft
burials	3	3	3	1	
pyre debris dumps	4		1		1

Table 14; Distribution of periosteal new bone in burials and bone from pyre debris dumps.

Only one burial had any associated lesions which may indicate the aetiology of the infection, mst 207. Slight periosteal new bone was noted over a minimum 25 mm length of fibula shaft on all sides, slight exostoses were noted on one border of fibula shaft and one right fibula distal head had a roughened articular surface with slight osteophytes. This combination of lesions may related to a single traumatic event.

There was slight reactive new bone in the distal portion of the mandibular canal in burial hoo 564, perhaps associated with some undetected dental infection, and fine new bone across the surface of a radial tuberosity in association with marginal pitting and exostoses.

A large destructive lesion (6.4 x 5.0 mm, *c*. 8 mm deep) in the anterior right inferior surface of a lumbar vertebral body (burial hoo 1473, older adult male), is associated with the anterior collapse of the body and disruption to the surrounding surface with slight surface new bone. The nature of the lesions would suggest some form of infection e.g. non-specific osteomyelitis or possibly tuberculous infection. Lesions were not noted elsewhere in the spine (five cervical, four thoracic and two lumbar vertebrae were present), but incomplete skeletal recovery limits diagnosis.

VI. 5 Degenerative Joint Disease

Some form of degenerative joint disease was noted in 55 (41%) individuals from the burials, and in bone from four pyre debris dumps. No lesions were noted in immature individuals. The distribution of spinal lesions are discussed by area e.g. cervical, thoracic, lumbar, which may include one or more vertebrae (details in archive report).

osteophytes

Irregular growths of new bone which may develop along joint margins, osteophytes may occur alone or in association with other lesions such as eburnation and pitting in the joint surface. Seen alone the lesion is largely age-related, in association with other lesions it may be indicative of disease such as osteoarthritis or degenerative disc disease (Rogers *et al*. 1987).

Lone spinal lesions were noted in 30 burials (*c*. 22%), including 11 female (30%) and six male (35%), and in bone from four pyre debris dumps. Up to two areas of the spine may be affected in one individual. The atlas-axis joint was most commonly affected (11 individuals), with other areas of the cervical spine involved in six individuals, the thoracic in nine, thoracic/lumbar in five, lumbar in five and first sacral in one. Lesions were slight-medium.

Lone extra-spinal lesions were seen in ten burials (*c*. 7%), including four female (8%) and three male (23%), and in three debris dumps. Articular surfaces may be affected uni- or bi-laterally and included the scapula glenoid fossa (three individuals), distal femur (two), acetabular rim (two) and auricular surfaces (two).

degenerative disc disease

Pitting in the vertebral body surfaces following the breakdown of the intervertebral disc may be accompanied by osteophyte formation on the surface margins. Degenerative disc disease is largely related to age and reflects wear-and-tear.

Lesions were noted in sixteen individuals (*c*. 12%), including five females (11%) and four males (29%). Lesions were also noted in bone from two pyre debris dumps.

There may be involvement of one or two areas of the spine in an individual, most commonly in the thoracic region (six individuals), thoracic/lumbar (six individuals), cervical (five), lumbar (two), cervical/thoracic (one).

Schmorl's nodes

A rupture in the intervertebral disc allowing the nucleus pulposus to protrude into the vertebral body will lead to the formation of a destructive lesion. Such lesions most frequently occur in the vertebrae subject to greatest mechanical stress at points in the normal curvature of the spine (Manchester 1983, Figs. 27 and 30).

Eighteen individuals (*c*. 13%), including seven females (19%) and seven males (41%), had lesions in between one and three areas of the spine. Lesions were most commonly seen in the thoracic region (mid-lower), 12 individuals, four had lesions in the lumbar region, two in the thoracic/lumbar and one in the first sacral.

osteoarthritis

A disease affecting the synovial joints, osteoarthritis is basically the result of age-related wear-and-tear, with predisposing factors such as previous disease, injury and obesity (Adams 1986). Manifest by osteophytes on joint surface margins with associated pitting and/or eburnation of the joint surface (Rogers *et al* 1987), the weight bearing joints of the spine and lower limb are most prone to development of the disease in modern clinical practice.

Spinal lesions were seen in five burials (*c*. 4%), including one female (3%), and in bone from two pyre debris dumps. One to two areas of the spine may be affected in one individual. Lesions were limited to the cervical (two individuals) and thoracic (four individuals) regions.

Extra-spinal lesions were see in 14 burials (*c*. 10%), including two female (8%) and three male (12%), and in bone from two of the pyre debris dumps. Between one and three joint surfaces may be affected uni- or bi-laterally in one individual. Lesions were most commonly seen in the costo-vertebral joints (10 individuals), and the temporo-mandibular joints (five individuals).

Early stages of the disease may be indicated by areas of slight pitting with no other associated lesions noted in several joint surfaces from six burials, including the sterno-clavicular joint in three burials, the thoracic vertebrae in two, and the lumbar vertebrae, costo-vertebral joints and acetabulum each in single burials. Lesions at other sites indicative of osteoarthritis were noted in only one of these individuals.

For those individuals where gender had been ascertained, males show a substantially higher frequency of lesions than females in three categories - Schmorl's nodes, degenerative disc disease and extra-spinal osteophytes. Figures for spinal osteophytes and extra spinal osteoarthritis are relatively similar. While these figures may reflect an overall difference in the incidence of lesions between the sexes, the constraints of incomplete skeletal recovery and inability to sex all of the adults, must urge caution in interpretation.

VI. 6 Miscellaneous Lesions and Condition.

gall stone

Part of a calcified mass (*c*. half), weighing 0.2g and measuring 4.8 x 5.9 mm, was recovered from burial hoo 1566, an older adult of unknown sex. The internal structure (Plate 00), clearly showing a concentricity layered form, indicates a gall or urinary stone. Gallstone formation is affected by dietary, genetic and hormonal factors, bladder stones are caused primarily by nutritional deficiency (Steinbock 1989 a, b & c).

Gall or urinary stones were recovered from three Romano-British inhumation burials and one cremation burial at Baldock 15 (McKinley 1991a and 1993b unpublished).

exostoses

Exostoses are bony growths which may develop at tendon and ligament insertions on the bone. Causative factors include age-related wear-and-tear, traumatic stress, or various diseases such as diffuse idiopathic skeletal hyperostosis (DISH). It is not always possible to be conclusive with respect to the aetiology of particular lesions.

Slight-medium exostoses were noted at between one (15 individuals) to eight (one individual, older mature/older adult male hoo 564) sites in 27 burials and in bone from five pyre debris dumps. The vast majority of individuals were older mature or older adults, including 10 females and eight males. There was no apparent difference between females and males in the location of lesions. Other than in the single instance mentioned above (see *infection*) there is no evidence to suggest the specific aetiology of these lesions, the majority of which are probably the result of age-related wear-and-tear.

bone	**burial**	**pyre debris dumps**

femur proximal shaft	17	1
iliac crest	10	4
patella anterior superior surface	11	2
humerus proximal shaft	3	
femur proximal notch	3	
lumbar spine	3	
ischial tuberosity	2	1
calcaneum posterior surface	3	

Table 15; Frequency and distribution of exostoses (including single and bi-lateral).

Single instances also occurred in the thoracic spinal process, manubrium body, ulna proximal tuberosity, pubic symphysis, radial tuberosity and femur lesser trochanter.

new bone
Burial msl 887 has slight new bone up the sides of a lumbar vertebral body indicative of ligament ossification, but with no associated lesions.

pitting, and destructive lesions
These lesions, occurring most often in an articular surface, may relate to a number of diseases including degenerative joint disease, infections and tumours. In the absence of supportive evidence in the form of associated lesions, it is not always possible to be conclusive as to the cause.
An area of pitting c. 25 x 25 mm was noted in the outer plate of the frontal/parietal vault in burial wte 1055, a mature adult male. The same individual showed fine, extensive pitting with no associated lesions in several joint surfaces including the atlas-axis articular surfaces, the right distal ulna, all surfaces of the right lunate, scaphoid and capitate, the articular surfaces of a minimum of three metacarpals, two proximal finger phalanges heads and two-?three middle finger phalanges articular surfaces. A first metatarsal proximal articular surface had similar lesions. As not all the bones of the hands were recovered it is not possible to ascertain if the condition was uni- or bi-lateral. A small destructive lesion in the side of one metacarpal head is probably associated with the pitting. The extensive and erosive nature of the lesions would not suggest osteoarthritis as a diagnosis, but a degenerative/erosive joint disease of some form is indicated for the lesions in the joint surfaces **[?RA].** Pitting in the frontal bone may relate to some isolated soft tissue infection.

Destructive lesions which were difficult to classify were noted in 11 burials and bone from two pyre debris dumps. All except one were older mature or older adults, including four males and two females.

Msl 594 and hoo 1137 had lesions at the site of the medial ligament attachment in the clavicle **[?MacGloghen ref].** Hoo 564 had a small cyst in the anterior tip of the odontoid process. Hoo 1215 has a solitary bone cyst in the articular margin of one lunate (Adams 1986).

Subchondral cysts were noted in the bodies of two cervical vertebrae in msl 887, 3 mm and 4.7 mm diameter, both also had lesions indicative of degenerative disc disease.

Several individuals had lesions in vertebral bodies which may be Schmorl's nodes; hoo 594 had destructive lesions in two lumbar bodies and presented Schmorl's nodes in six thoracic; a lesion in a thoracic/lumbar body from hoo 1564 may also represent Schmorl's nodes, though being a largely subchondral feature would render this diagnosis questionable; lesions in four thoracic vertebrae from hoo 1179 probably have the same aetiology as Schmorl's nodes noted in three other mid-lower thoracic vertebrae; similarly three thoracic vertebrae in hoo 1215 may be additional to other Schmorl's nodes noted in the thoracic spine, though similar but largely subchondral lesions in two lumbar vertebrae may render this diagnosis open to question.

Lesions noted in bone from the pyre debris dumps hoo 916 and 946 may be indicative of osteoarthritis, diagnosed in bone from the same skeletal elements in each dump, or some other form of arthropathy. This would include small destructive lesions in the margins of one middle and one proximal phalanx head from 946, and in a cervical vertebra articular processes in 916. Similar lesions in the margins of a proximal foot phalanx head in 916 have no supportive evidence.

Two, from a total of 11, thoracic/lumbar vertebrae in burial mst 399, an older infant, have destructive lesions in the bodies, *c*. 5 mm and 3 mm diameter, with some marginal sclerosis. This individual also had periosteal new bone on fragments of femur shaft. The vertebral lesions may have been cause by some form of infection or a spinal tumour.

VI. 7 Morphological Variations

These are 'normal' variations in the skeletal morphology and may, with other predisposing factors, indicate genetic relationships within a 'population' (Berry and Berry 1967, Finnegan 1978). It is necessary, however, to register presence/absence of traits in order to ascertain significance, and as this was not possible with the cremation burials, comment is limited to a note of the variant and the numbers encountered (Table 2).

Individuals from 19 burials had one or more morphological variations, including wormian bones, metopism (non-fusion of the frontal suture), os acromialie (Stirland 1984) and third centres of ossification in the first metacarpals/tarsals and phalanges of immature individuals (Weddell 1939). Variations were also noted in bone from two of the debris dumps.

VI. 8 Plots.

The percentage of individuals per plot with pathological lesions/morphological variations was higher than the overall figure of 48% in the plots containing more than one cremation burial, with two exceptions.

plot	2	3	16	17*	21	28

% individuals with lesions/variations	63%	71%	67%	0%	38%	86%
% individuals with degenerative joint disease	46%	36%	67%	0%	31%	83%

Table 16; showing percentage of individuals/plot with pathological lesions or morphological variations and degenerative joint disease.* NB. All burials in plot 17 were identified by TW in previous investigation (1986).

The variations in frequency of pathological lesions between the plots may be linked in part with the varying numbers of individuals in each plot (Table 16) and the different age distributions within them. Plot 16 contained no immature individuals, and plots 2 and 28 contain a higher percentage of older adults than the others, which is reflected in the higher percentage of individuals showing degenerative joint disease.

It was not possible to ascertain any patterns in distribution of various types of pathology between the plots, however, there was one point of interest. Plot 3 was noticeably different from the others by virtue of the relatively high percentage of immature individuals it contained (see **IV.** *Plots*). It is also different in that 55% of the individuals had periosteal new bone on one or more long bone shafts, which is a substantially higher figure than the overall 7% for the cremation burials.

Acknowledgements.
The writer would like to thank Rachel Griffin (Wessex Archaeology) for her assistance with various aspects of the computing, and for comments on pathological diagnosis.

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