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THE ANIMAL BONES FROM SOU 31, F 2048

(Six Dials Excavations, Hamwic)

Report to the Historic Buildings

and Monuments Commission

Jennifer Bourdillon
Faunal Remains Unit
Department of Archaeology
University of Southampton

ANIMAL BONE FROM SOU 31, F 2048 : THE MAJOR BONE-WORKING PIT FROM THE SIX DIALS EXCAVATIONS, HAMWIC

F 2048 was chosen by the excavators for detailed study since it was clear that this feature afforded the greatest concentration of bone-working debris from the whole of the Six Dials excavations. There was the added interest that it has been phased as quite late in the Six Dials sequence - probably soon after 850 A.D., which would make it similar in date to the well F2014 on Site SOU 30, one of the main features which were taken as late for purposes of comparison in the Six Dials Variability Study (Bourdillon 1984a). Though this phasing gave it an added importance it was necessary to try to establish which factors were present through the inherent lateness of the material and which were the product of bone-working as such, and the problem was made more complex in that on the whole the bone-working industry at Hamwic grew increasingly important over time.

The pit had been excavated to the high standards set at Six Dials, and because of its particular importance the animal bone was studied exactly as for the Variability Study and not subjected to any of the time-saving short cuts adopted for some more recent Hamwic material (Bourdillon 1985a). The archive has been prepared in considerable detail so that F 2048 may serve as a standard against which other bone-working assemblages may be judged. Ian Riddler of Southampton Museums has been carrying out a major pioneering study of the Hamwic bone-working industry: he has provided the count of the antler in F 2048, and the whole of the present report has been undertaken in the closest cooperation with his work (Riddler 1985 a and b).

F 2048 was a circular pit some 2.0 m in diameter and 1.3 m deep. Its original function was not clear, but the two primary layers (c. 5515 and 5516) contained few bones. Most of the animal bone was found in the general rubbish layers (predominantly in c.5261 and in 5683, but also in 5274, 5275 and 5291). Context 5683 also contained considerable quantities of oyster and mussel shells. As has often been found in Hamwic features, the main rubbish layers were overlain by other contexts (in particular c. 5239 and 5247) which accumulated most likely as a form of infilling as the main layers sank into the ground, and these layers were also rich in bone. Hamwic pits frequently show the greatest concentration of bone-working offcuts in the infilling layers at the top, but F 2048 was unusual in that there were a great many sawn offcuts in the rubbish layers as well.

Most contexts were sampled for sieving. Results for this have been presented separately.

THE PRESENTATION OF THE ARCHIVE:

The tables have been drawn up for ease of visual comparison, to take account both of possible differences between worked and unworked material in the present pit and also to enable easy comparisons between different sorts of assemblages - late with late and worked with worked.

The most useful comparisons are with the Six Dials Variability Studies (Bourdillon 1984a and 1984b) and, amongst the features there analysed, with the bone-working pit F 1005 on SOU 31; with pit F10675 on Site 30 which was not part of the Variability Study but which was later identified as one of the last features in the Six Dials pit sequence, perhaps even the latest of all (Bourdillon 1985b); and with Site SOU 32, which contained important bone-working residues, but which because of its early excavation to quick rescue standards and the simplified recording of its animal bone (Bourdillon 1985 c) is not available for total comparisons of data.

Recording was made according to the normal A.M.L. system. Material was also weighed in species groups, context by context and with separation of worked and unworked material, and these weights were recorded direct through dBase II. The main computer archive is available at the Faunal Remains Unit: there is a treasury of three checked and corrected data files, each in order of species/context/anatomy - F2048CUT.TSY for offcuts and F2048NOT.TSY for unworked material, both of these for normal trench recovery, and F2048SMP.TSY for material from the soil samples. Weights are recorded in file F2048WTS.DBF.

Records have been made by context, normally with the appropriate 4-digit figure; the context record for all worked offcuts has been prefixed with '88' so that such material is immediately apparent in the measurement catalogue, and material from the soil samples has been prefixed with '99'.

The following print-outs from the archive are available both at the Faunal Remains Unit and at Southampton Museums:

Table 1: all unworked material (from F2048NOT.TSY)

Table 1: all unworked material, from top/rubbish/bottom layers

Table 1: all worked offcuts less antler (from F2048CUT.TSY)

Table 1: all worked offcuts less antler, from top/rubbish/bottom layers

Table 1: all unworked material from the soil samples (from F2048SMP.TSY)

Measurement Catalogue for all unworked material
(from F2048NOT.TSY via A.M.L. programme MET104)

Measurement Catalogue for all worked offcuts less antler
(from F2048CUT.TSY via MET104)

Mandibles of Cattle, Sheep and Pig
(from data in F2048NOT.TSY via d-Base)

Weight of worked off-cuts by species/layer/box (from F2048WTS.DBF)

and many supporting Table 2s

RESULTS

A total of 3020 unworked fragments was identified from normal recovery, plus 2724 worked offcuts, 1790 of which were of antler (Table 1). Weights for this material are given in Table 2. Sieving from 7 contexts (with samples of 5 litres taken from each context) produced a further 181 unworked identified fragments, (Table 3), plus many very small fragments with signs of working which are still under study by Ian Riddler.

From normal trench recovery there were also 2877 unidentified fragments which showed no sign of working, and 184 unidentified offcuts; the small size of such fragments is indicated by their low mean fragments weights - 4.4 g for the unidentified offcuts, and only 1.5 g for those that were not worked (Table 4). From the soil samples the unidentified material came in even smaller fragments - 840 such fragments had a total weight of 190g, and a mean weight of only 0.2g.

The State of the Material

The abundance of unidentified material (Table 5) may be a first indication of taphonomy and of site formation processes. There was little of such material among the sparse bone finds of the primary layers, but generally it may be said that there was more small unidentifiable material in this pit than in the Six Dials study generally, where present rates were matched only by the material in the working pit F 1005. For the main identified species, too, the fragments were generally smaller and lighter than those studied elsewhere at Six Dials, and again the closest comparisons are with the boneworking pit F1005 (Table 6). The mean fragment weight of the cattle offcuts was close to that of F1005, but the mean fragment weights for the antler were very different between the two boneworking assemblages (Table 7).

The rates of erosion and of burning were virtually at par with the standard set in the Variability Study (Table 8). By contrast the rate of chewing was much higher. Since erosion was normal and since there was little difference between the main

rubbish layers and the top layers, the higher rate of chewing would seem more likely to be caused by some closeness of dogs to the activities represented by the pit remains rather than to a degree of careless deposition with material left lying for some time before final burial. The worked offcuts (Table 9) seem to been better preserved than was the unworked material, and they may have been deposited very quickly in the pit.

THE REPRESENTATION OF THE SPECIES

Tables for relative representation have been constructed separately for worked offcuts and for unworked bone, but bones which bear no signs of working may nevertheless have arrived in the pit in direct association with bones which had been worked. Since for the concentration of its offcuts F 2048 is in a class of its own (Table 10), the results even of its unworked material may show some concomitant bias.

Representation of the wild species

Table 10 shows that F2048 was rich in antler, particularly by weight. Most marked in Table 11 is the relative increase in postcranial red deer as compared with the general standard for Hamwic. Though still less than 1% of the identified assemblage this rate is up tenfold from the Six Dials Variability Study as a whole, and it is up sevenfold from the bone-working pit (F1005) in that study. It is interesting that in the whole of the Variability Study there were no worked offcuts from postcranial deer, for in F 2048 there were seven such fragments and the readiness to use red deer for working will surely have led to the wider presence of the species in this pit. All postcranial deer bones came from rubbish layers. Skull fragments predominated, but there were bones from several parts of the body (Table 12), with a minimum number of three individuals from the tibia. It is of interest that there were some good sized bones in this assemblage: a left proximal tibia gave a width of 76.5 mm and a left distaal tibia one of 47.0 mm, both considerably larger than modern comparative material in the collection of the Faunal Remains Unit, material with which Hamwic red deer is generally closer in size.

All the antler which could be identified to species came from red deer; postcranial roe deer was indeed found, but sparsely as always.

There was a slight increase in the abundance of wild bird and of fish by normal trench recovery, but recovery from the soil samples has proved generally to be a better indication of abundance and these gave no wild bird at all and no great concentrations of fish. Amphibian bones were found only in the soil samples and from two contexts - c.5291 which was low in the pit but which formed one of the rubbish deposits, and c. 5515, one of the two primary layers.

Representation of the less common domestic species (Table 13)

Unworked fragments of horse were was also well represented, though not uniquely so: late contexts at Hamwic have tended to be richer in horse than the earlier ones. The pattern of distribution over the body, however, makes it clear that the abundance of unworked horse bones reached the pit in clear association with the bones intended for working, for there were many side metapodial bones to match the high concentration of horse metapodial offcuts (Table 14). It is interesting that the pattern of the working of horse bones would seem to have changed towards bones of the feet and also towards the tibia, in contrast to the great preference for the radius that was seen, say, on site 32 (Table 15); and the very use of horse bones for working stands in great contrast to the complete absence of worked horse bones from F 1005, the most nearly comparable pit on Six Dials.

F 2048 was richer in domestic fowl and goose than would have been expected from a late Hamwic context. Goat on the other hand was rare. There were only two fragments of dog, from radius and from tibia, both found in rubbish contexts: neither was measurable but it is interesting that both were small for it seems to be only in the later Hamwic contexts that any dogs other than basic medium-sized animals are found.

Relative Representation of the main domestic species

For the relative representation of cattle, sheep and pig (Tables 16 and 17) what is most surprising is that unworked cattle bones are relatively scarce. It is not simply that such cattle bones have arrived at the pit in a usual pattern of supply but that so many of these were worked that the remaining tally was low - the pattern of Distribution over the Body in cattle offcuts (Table 18) shows an overwhelming bias to metacarpus and metatarsus, and most of these bones must have been brought in deliberately for this purpose since in the overall unworked record (Table 19) the bones of the feet and ankles are not markedly less well represented than in the Variability Study as a whole.

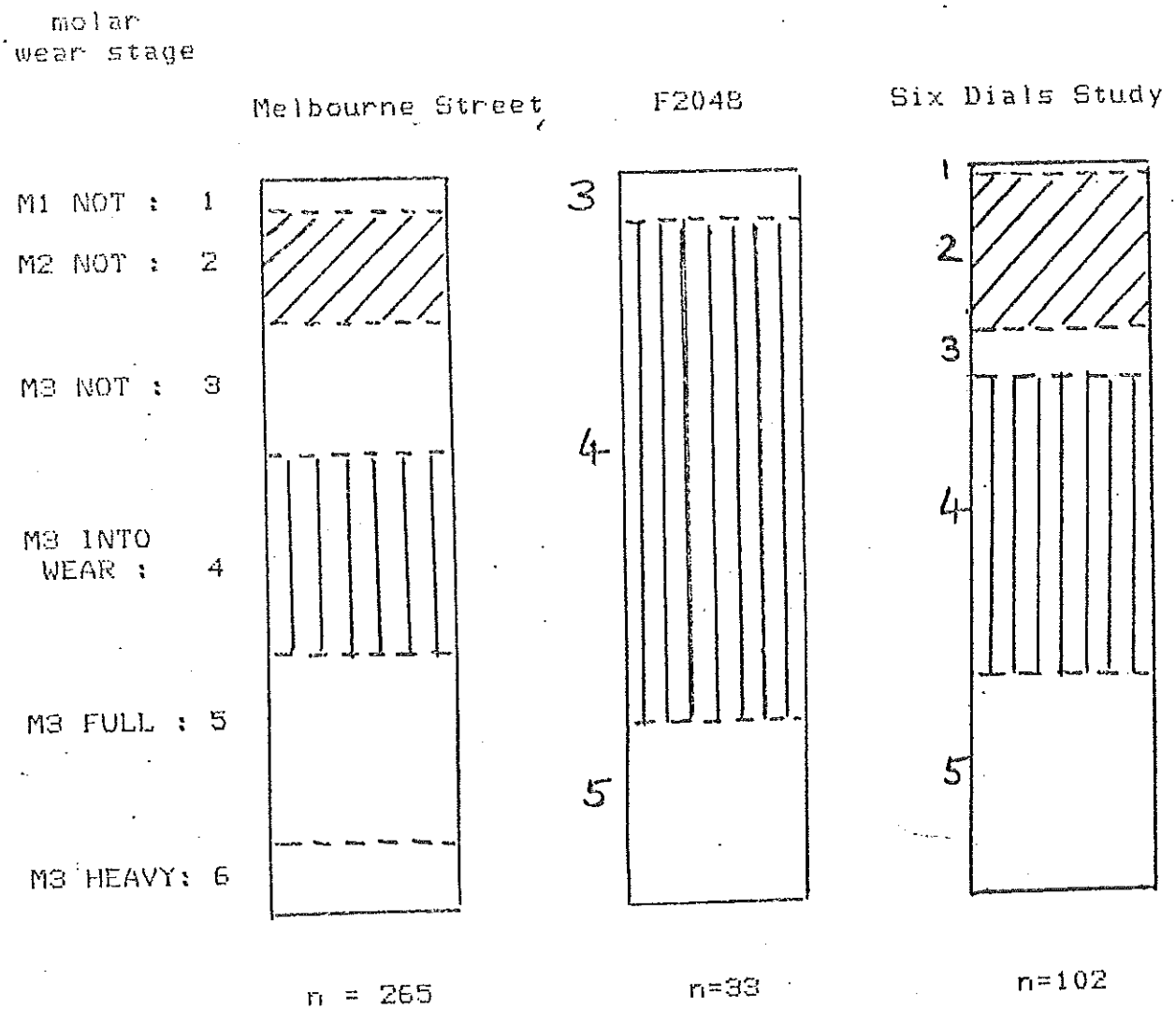
Pig is poorly represented, but this has been noted and discussed before for the later Hamwic contexts. There is a higher than usual representation of head fragments and of ribs, and a decrease in the longbones (Table 20).

Sheep, on the other hand, are very strong indeed. This is not likely to be through any affinity with bone-working, since although some sheep bones were worked - and worked more frequently than in any other Hamwic sites or features that have yet been studied - a total of 18 sheep offcuts is minimal when set against the 1361 unworked fragments, and the pattern of the Distribution over the Body is not far off the Six Dials norm for sheep (Tables 21 and 22).

In looking for some explanation other than the bone-working concentrations to account for the prominence of sheep, one thing that is evident at once is the pattern of toothwear which gives a surprisingly high number of young adult mandibles, where the lower third molar is still coming into wear (Table 23). This is in great contrast to the pattern established for the major assemblage from Hamwic Melbourne Street (Bourdillon and Coy 1980) and also for Six Dials as a whole (Figure 1), though F 2013 in that study was noted at the time as giving an unusual and very homogeneous pattern of ageing on a large concentration of sheep mandibles. No clear explanation could be found, but such concentrations could be linked with some decision of husbandry. Alternatively they might reflect industrial uses, though the present concentration would not seem to be related to F2048's links with the bone-working industry. These concentrations form an aspect of the Hamwic bone record which would bear closer attention in the future.

FIGURE 1

SHEEP AGEING BY MANDIBLES COMPARED



Each block represents an entire population. The horizontal lines divide the population into those Killed (above the line) and those still living (below it) at the start of each stage of tooth eruption or wear.

For F2048 a few mandibles were indeterminate between two age-groups and these have been allocated pro rata: more precise data are to be found in Table 23.

The Sizes of the Domestic Animals

The sizes of the main domestic mammals have presented a special area of interest in the Southampton material, and the relevant tables (24 - 30) have been arranged to give a direct visual appraisal not only of differences between worked and unworked material but also of possible changes over time. Data for F 2048 are located near the centre of the page: the comparisons which are placed above are for groups which either span the main years of settlement at Hamwic or are phased earlier than F 2048, whilst below F 2048 on the page are placed first the late contexts extracted from the Variability Study, and then the data for SOU 169, F 10675, probably the latest feature on Saxon Six Dials.

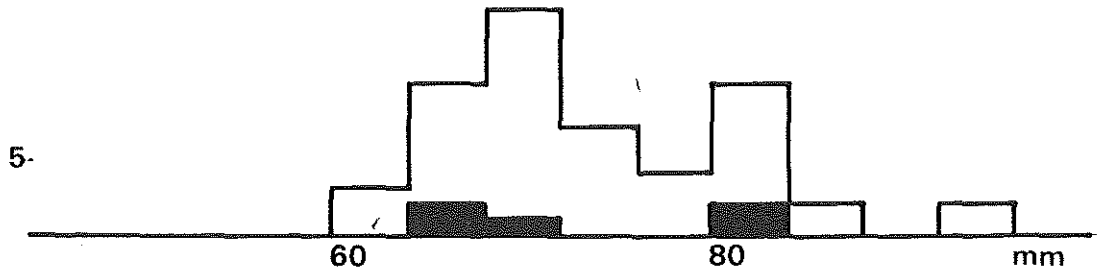
The Six Dials Variability Study suggested that in the later Six Dials contexts there was a slight falling off in the sizes of cattle sheep and pig. Since in F 2048 the overwhelming number of measureable sheep bones, and all the measureable pig bones, were not worked, for these two species an analysis of size could be carried out without making allowances for working bias. When Size Factors are established (Table 24), a system whereby individual measurements of articular width are set against the relevant mean measurements for the large Hamwic corpus of Melbourne Street (Bourdillon and Coy 1980), it would seem that there was indeed some falling off in F2048 in the sizes of sheep and pig - for sheep much less so than in the late contexts of the Variability Study, but for pigs very markedly more so.

With so many worked cattle bones it is important first to discover whether or not the bone-working industry made any selection of cattle bones for size. Size Factors calculated separately for unworked cattle bones and for offcuts have suggested that it was bones from larger individuals that were often preferred, certainly in the bone-working pits from Site 32 (Bourdillon 1985c and Riddler 1985a) and in the later-phased pits from the Variability Study though perhaps not in F 1005 (Bourdillon 1984a). Driver (1984) found definite evidence of selection for size from the bone-working concentration on Site 14 at the southern edge of Hamwic.

The good numbers of measurements which have now been collected have given the chance to look at the problem more closely. Data is summarised in Tables 25 - 30 for those cattle bones that are most commonly worked - though at least where the metapodia are concerned it must be remembered that such bones have often been worked to such an extent that they have been rendered immeasurable and that even with the great increase in sample size a strong degree of bias may remain.

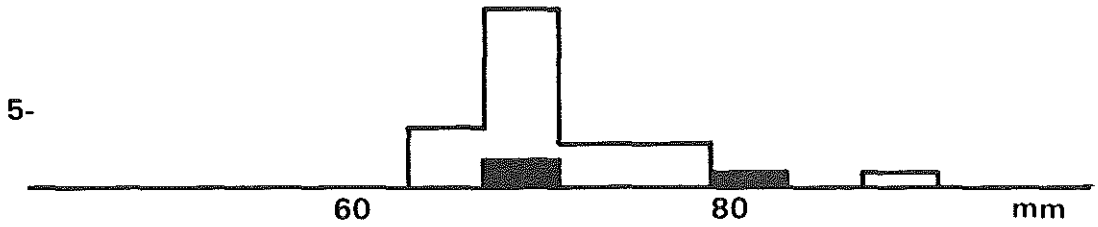
COW RADIUS PROXIMAL BREADTH — Bp

Six Dials
Studies

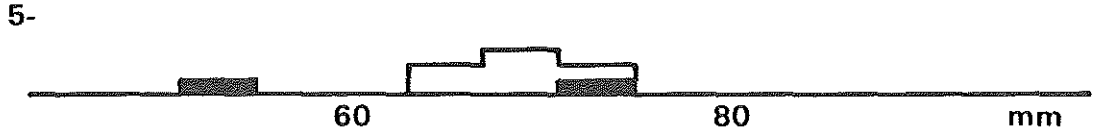


F1005

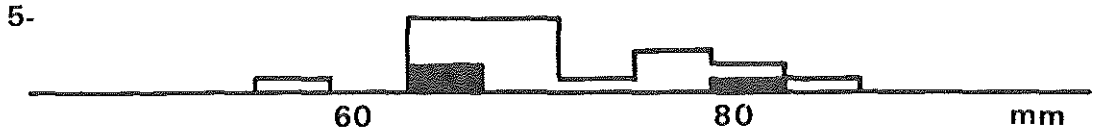
SOU 32



F2048



Six Dials
Late Contexts

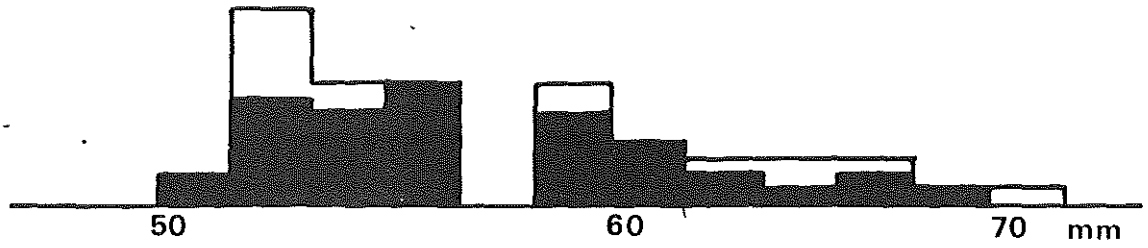


Worked

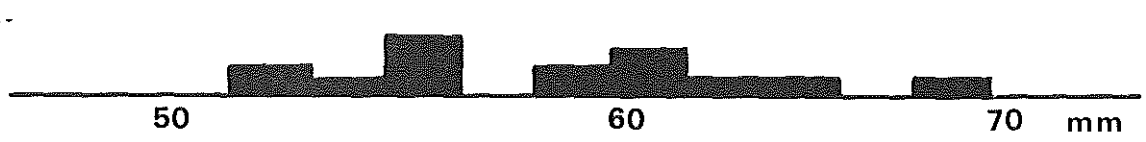
Unworked

COW METACARPUS DISTAL BREADTH — Bd

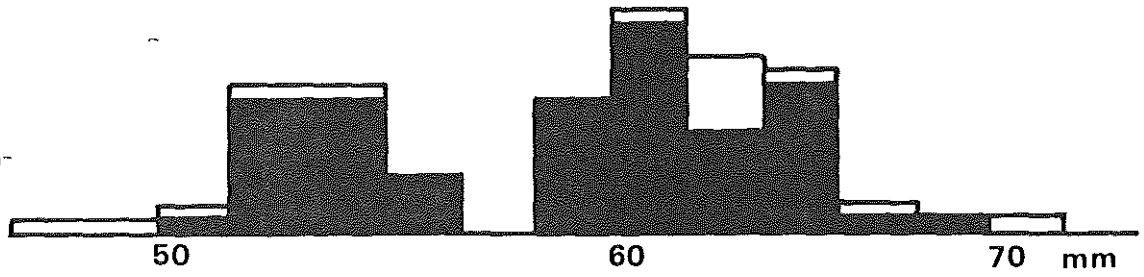
Six Dials Studies



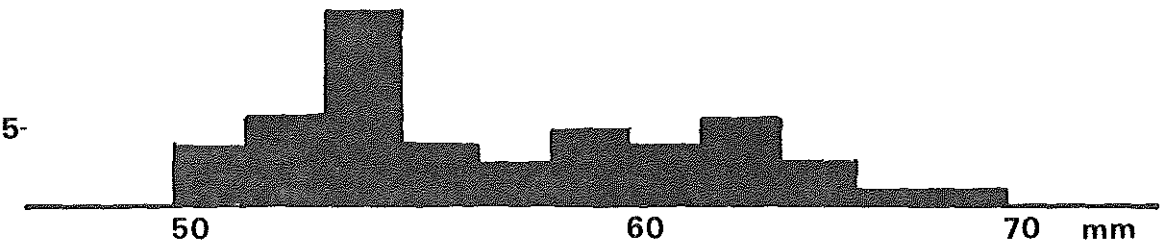
F1005



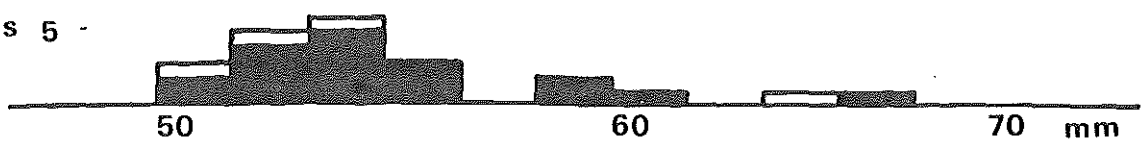
SOU32



F2048

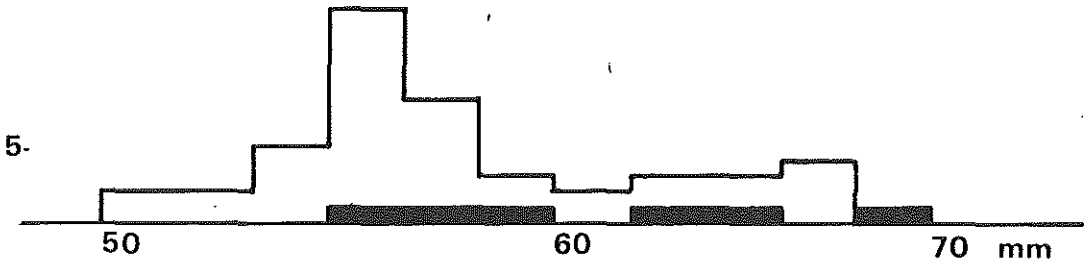


Six Dials Late Contexts

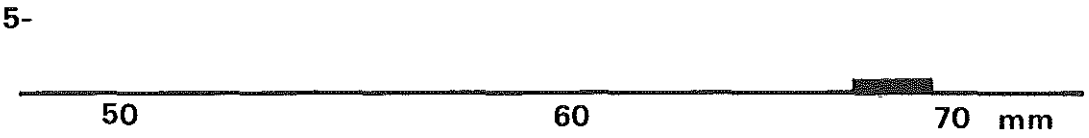


COW TIBIA DISTAL BREADTH – Bd

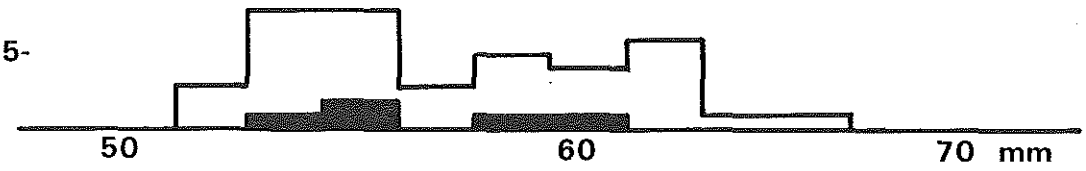
Six Dials
Studies



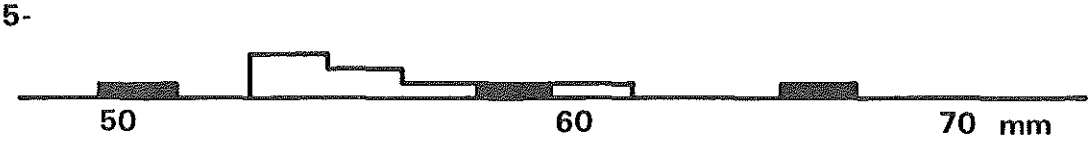
F1005



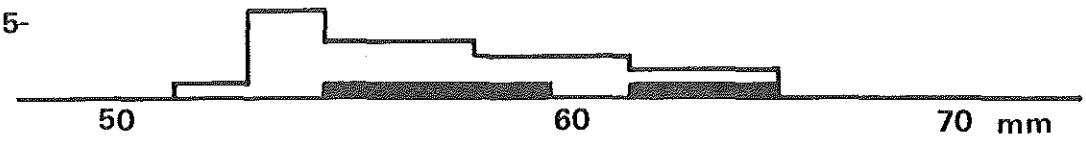
SOU 32



F2048

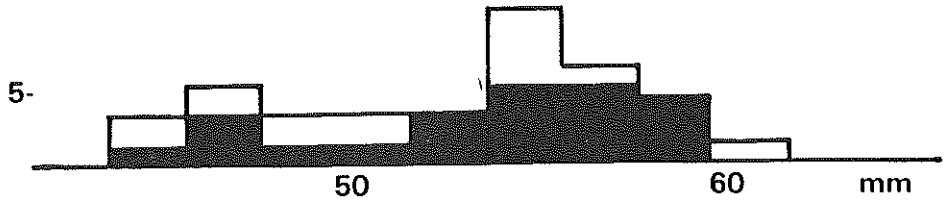


Six Dials
Late Contexts



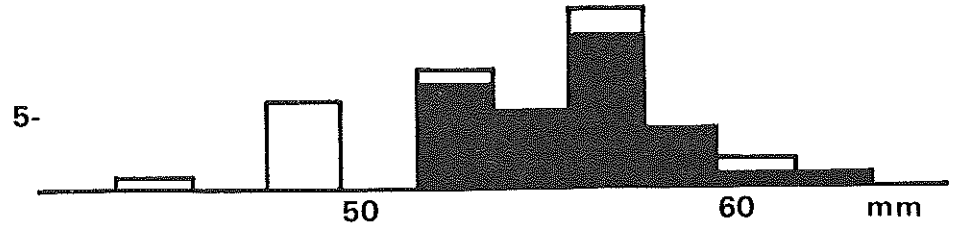
COW METATARSUS DISTAL BREADTH—Bd

Six Dials
Studies

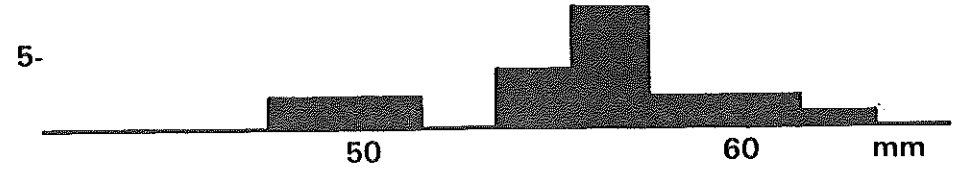


F1005

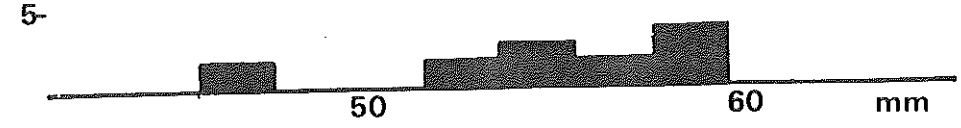
SOU 32



F2048



Six Dials
Late Contexts



Figures 2 - 5 are based on individual measurements, and in these histograms the different bones of the body do not all present the same picture. For the radius there would not seem to have been much if any selection for greater size - for the Variability Study not only is the offcut mean a little lower than the mean for the unworked material, but the co-efficient of variation is higher; for site SOU 32 the measurements of worked radii are somewhat up than those for the unworked, but this is in an unworked sample of only three bones, and for F 2048 the two radius offcuts include one that is very small indeed, so small that it had to be checked very carefully for deer. Samples for metacarpus distal width are generally much larger and one may say with greater confidence that both in F2048 and in the other assemblages here examined no selection for size has been established.

For the tibia on the other hand there may have been a certain selection for size in the material of the Variability Study and perhaps in F 2048 (but not in the small sample from site 32).

It is the cattle metatarsus which shows the greatest differences between worked and unworked bones, and for this bone of the body selection for size is quite clear. Perhaps the difference between bones of the front and the back legs lies in the respective widths of their bones, in that radius and metacarpus are generally wider and flatter and might well provide a more suitable working surface without need to have preferences as to size, whereas the narrower shafts of tibia and metatarsus would make some selection more desirable. Possibly, though, what one is seeing is the absence of many of the smaller (and most likely female) bones - the common pattern in the Hamwic material has been found to be a ratio of roughly 2 : 1 for female to male, and the metatarsus histograms do not seem to bear this out. Just possibly it is not that the larger bones were taken for working and the smaller ones rejected, but that the larger ones were worked in such a way as to leave measureable offcuts whilst many smaller ones were worked so extensively that they are lost to the data altogether.

One must remember, however, that selection was never total; even for those bones where it had been established overall many smaller bones were used and many larger bones were rejected. We do not seem to be looking at a situation where animals were reared for their special suitability in providing raw material for the craftsmen, but rather at one where the craftsmen made good use of a wide range of what was available but where their preferences and ways of working have left certain patterns in the record.

One thing that is clear is that in considering the changing sizes of of the animals like is best compared with like, so that worked and unworked material are separately compared, female with female where possible, and male with male. Where Size Factors are concerned it is to be remembered that the Melbourne Street material on which they were based had a minimal representation of worked offcuts, and where material comes from bone-working assemblages a first supposition would be that it might well be somewhat larger. If this is so then the Size Factors in Table 23 need not rule out the wider interpretation offered in the Variability Study, that there was a a slight overall decline in cattle sizes in the later years of the town.

The work which has been carried out on the animal bone from F 2048 has brought more systematic quantification to the understanding of the impact of the boneworking industry on the Hamwic animal remains. General interpretation will in future be able to make the appropriate allowances in areas of probable bias.

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SUPPORTING TABLES

for report on

THE ANIMAL BONES FROM SOU 31, F 2048

(Six Dials Excavations, Hamwic)

Report to the Historic Buildings

and Monuments Commission

Jennifer Bourdillon
Faunal Remains Unit
Department of Archaeology
University of Southampton

21. Worked Sheep Bones : Some Comparisons

22. Distribution over the Body : Sheep (excluding worked offcuts)

23. Ageing by Mandibles for Cattle, Sheep and Pig

24. Some Comparisons of Size Factors

25. Cow Radius Proximal Breadth

26. Cow Metacarpus Proximal Breadth

27. Cow Metacarpus Distal Breadth

28. Cow Tibia Distal Breadth

29. Cow Metatarsus Proximal Breadth

30. Cow Metatarsus Distal Breadth

TABLE 1

IDENTIFIED FRAGMENTS FROM NORMAL RECOVERY

a) excluding worked offcuts:

	COW	SHEEP	GOAT	PIG	HORSE	DOG	CAT	FOWL	GOOSE	DEER RED	DEER ROE	WILD BIRD	FSH	TOTAL
TOP	288	287	2	76	11		1	9	2		1	4	2	683
RUBBISH	937	1059	4	175	28	2		46	12	21	1	3	9	2296
BOTTOM	25	16												41
TOTAL	1250	1361	6	251	39	2	1	55	14	21	2	7	11	3020

wild birds:

TOP LAYERS - 3 x MALLARD (Anas platyrhynchos)
1 wild bird fragment not further identified

RUBBISH LAYERS - MALLARD
WOODCOCK (Scolopax rusticola)
1 wild bird fragment not further identified

b) worked offcuts

	COW	SHEEP	HORSE	RED DEER postcran.	RED DEER antler	TOTAL
TOP LAYERS	56	2	4	-	54	116
RUBBISH	774	23	63	11	1735	2606
BOTTOM	1	-	-	-	1	2
TOTAL	831	25	67	11	1790	2724

TABLE 2

WEIGHTS OF IDENTIFIED MAMMAL FRAGMENTS (in g)

a) excluding worked offcuts:

	COW	SHEEP	GOAT	PIG	HORSE	DOG	CAT	DEER RED	DEER ROE	TOTAL
TOP	4105	1150	30	450	165	5			10	5915
RUBBISH	14615	4890	175	1140	330		25	300	10	21485
BOTTOM	720	240								960
TOTAL	19440	6280	205	1590	495	5	25	300	20	28360

b) worked offcuts:

	COW	SHEEP	HORSE	RED DEER postcran.	RED DEER antler	TOTAL
TOP LAYERS	870	25	135	-	410	1440
RUBBISH	9560	105	945	85	7415	18110
BOTTOM	50				15	65
TOTAL	10480	130	1080	85	7840	19615

TABLE 3

MATERIAL RECOVERED FROM SOIL SAMPLES

excluding worked offcuts

context	COW	SHEEP	PIG	HORSE	CAT	FOWL	?FOWL	GOOSE	FISH	AMPHB	TOTAL
5239	4	2	2	1		1	1		2		13
5247		3	1						2		6
5261	6	10	4				1	1	10		32
5275	1	1	1								3
5291	2	1	3				1		80	6	93
5515	2	3					2			2	9
5601	3	5	1		1				15		25
TOTAL	18	25	12	1	1	1	5	1	109	8	181

TABLE 4

UNIDENTIFIED MATERIAL

	UND fragments not wrkd	UND fragments worked	UND weight (g) not wrkd	UND weight (g) worked	UND x frag.wt (g) not wrkd	UND x frag.wt (g) worked
TOP LAYERS	561	30	1005	100	1.8	3.3
RUBBISH	1814	169	2555	775	1.4	4.6
BOTTOM	2	-	25	-	(12.5)	-
TOTAL	2377	199	3585	975	1.5	4.4

TABLE 5

F 2048, excluding worked offcuts:

INCIDENCE OF UNIDENTIFIED MATERIAL

	ident. frags	UND n	UND % frags	UND % wt.	UND x frag wt (g)
TOP LAYERS	689	561	45.1	14.5	1.8
RUBBISH	2296	1811	44.1	10.6	1.4
BOTTOM	41	2	4.7	2.5	(12.5)
F 2048 ALL	3020	3464	44.1	11.2	1.5
Six Dials study:					
whole study	19182	9124	32.3	7.9	2.6
all pits	8046	3301	32.7	9.2	2.7
pit F1005 (less offcuts)	852	961	53.0	16.5	1.3
late contexts	3255	1619	33.3	8.1	2.9

TABLE 6

F 2048, excluding worked offcuts:

MEAN FRAGMENT WEIGHTS (in g) OF CATTLE, SHEEP, PIG AND HORSE

	CATTLE	SHEEP	PIG	HORSE
TOP LAYERS	14.1	4.0	5.9	15.0
RUBBISH	15.6	4.6	6.5	11.8
BOTTOM	27.7	15.0	-	-
F 2048 ALL	15.5	4.5	6.3	12.7
Six Dials study:				
whole study	21.2	6.6	12.6	58.7
all pits	18.9	6.0	11.3	43.3
pit F1005 (less offcuts)	10.0	5.8	7.3	(7.9)
late contexts	20.1	8.0	12.7	63.0

TABLE 7

MEAN FRAGMENT WEIGHTS OF WORKED OFFCUTS (in g)

	COW	SHEEP	HORSE	RED DEER postcran.	RED DEER antler
TOP	15.5	(12.5)	33.8		7.6
RUBBISH	12.4	4.6	15.0	7.7	4.3
BOTTOM	(50.0)				(15.0)
ALL	12.6	5.2	15.1	7.7	4.4
CF:					
F 1005 offcuts	15.0	2.5	-	-	0.8
F 2014 offcuts	26.2	15.0	63.3	-	7.6

TABLE 3

F 2048, excluding worked offcuts:

THE STATE OF THE MATERIAL

	ident. frags	chewed %	heavily chewed %	eroded %	heavily eroded %	burnt black %	burnt white%
TOP LAYERS	683	8.3	3.3	7.2	2.0	2.0	-
RUBBISH	2296	7.3	3.5	2.7	0.6	0.3	0.1
BOTTOM	41	11.6	3.3	7.2	2.0	2.0	-
F 2048 ALL	3020	7.6	3.5	3.8	0.9	0.6	0.1
Six Dials study:							
whole study	19182	4.2	0.9	3.9	0.8	0.6	0.2
all pits	8046	4.3	0.8	1.5	0.7	0.4	0.2
pit F1005 (less offcuts)	852	2.5	0.6	1.9	0.5	0.5	0.1
late contexts	3256	5.5	0.9	2.9	1.4	0.7	0.1

TABLE 9

F 2048: WORKED OFFCUTS excluding antler

THE STATE OF THE MATERIAL

	ident. frags	chewed %	heavily chewed %	eroded %	heavily eroded %	burnt black %	burnt white %
TOP LAYERS	62	4,8	4,8	1,6	-	3,2	-
RUBBISH	871	3,8	2,8	1,0	-	-	-
BOTTOM	1	-	-	-	-	-	-
F 2048 ALL	934	3,9	3,0	1,1	-	0,2	-

TABLE 10

WORKED OFFCUTS : SOME COMPARISONS

	F 2043	F 1005	F 2014	SOU 32
a) identified fragments				
CATTLE	881	225	86	432
SHEEP	25	5	-	7
HORSE	67	-	4	13
RED DEER P/C	11	-	-	2
ANTLER	1790	1349	46	268
WHALE	-	-	-	5
TOTAL	2724	1579	136	727
b) weights in g				
CATTLE	10480	3375	2250	weights
SHEEP	130	30	-	not
HORSE	1080	-	190	available
DEER P/C	85	-	-	
ANTLER	7840	1520	310	
TOTAL	18605	4925	2750	
c)ratio of antler to other identified worked fragments				
BY FRAGMENTS	1790 : 934 1 : 0,5	1349 : 230 1 : 0,17	46 : 90 1 : 2,0	268 : 459 1 : 1,7
BY WEIGHT	7840g : 11775g 1 : 1,5	1520g : 3405g 1 : 2,2	310g : 2440g 1 : 7,9	

TABLE 11

F 2048, excluding worked offcuts:

RELATIVE REPRESENTATION OF WILD SPECIES
(by fragment count)

	ident. frags	RED DEER P/C n	RED DEER P/C %	ROE DEER P/C n	ROE DEER P/C %	WILD BIRD n	WILD BIRD %	FISH n	FISH %
TOP LAYERS	688	-		1	0.1	4	0.6	2	0.3
RUBBISH	2296	21	0.9	1	0.04	3	0.1	9	0.4
BOTTOM	41	-		-		-		-	
F 2048 ALL	3020	21	0.7	2	0.07	7	0.2	11	0.4
Six Dials study:									
whole study	19182	12	0.06	9	0.05	14	0.07	19	0.1
all pits	8046	-		2	0.02	3	0.04	4	0.05
pit F1005 (less offcuts)	852	1	0.1	-		-		1	0.1
late contexts	3256	4	0.1	4	0.1	4	0.1	3	0.1

TABLE 12

DISTRIBUTION OVER THE BODY : RED DEER

	unworked		offcuts		
	n	%	n	%	
SKULL	8	38.1			
MANDIBLE	1	4.8			
LONGBONES					
radius			1	9.1)	
ulna			1	9.1)	36.4
tibia	3	14.3	2	18.2)	
FEET / ANKLES					
metacarpus			5	45.4)	
mc / mt	1	4.8	1	9.1)	63.6
metatarsus			1	9.1)	
VERTEBRA (sacral)	2	9.5			
SCAPULA	2	9.5			
RIB	4	19.0			
	21	100.0	11		100.0

TABLE 13

F 2048, excluding worked offcuts:

RELATIVE REPRESENTATION OF THE LESS COMMON DOMESTIC SPECIES
(by fragment count)

	ident. frags	HORSE n	%	GOAT n	%	DOG n	%	CAT n	%	FOWL n	%	GOOSE n	%
TOP LAYERS	603	11	1.6	2	0.3	-		1	0.1	9	1.3	2	0.3
RUBBISH	2296	28	1.2	4	0.2	2	0.1	-		46	2.0	12	0.5
BOTTOM	41	-		-		-		-		-		-	
F 2048 ALL	3020	39	1.3	6	0.2	2	0.07	1	0.03	55	1.8	21	0.7
Six Dials study:													
whole study	19182	97	0.5	121	0.6	18	0.1	14	0.07	185	1.0	118	0.6
all pits	8046	6	0.07	14	0.2	8	0.04	6	0.07	90	1.1	83	1.0
pit F1005 (less offcuts)	852	7	0.8	13	1.5	-		1	0.1	13	1.5	1	0.1
late contexts	3256	52	1.6	32	1.0	2	0.06	6	0.2	21	0.6	-	

TABLE 14

DISTRIBUTION OVER THE BODY : HORSE

	unworked			offcuts		
	n		%	n		%
SKULL	4		10.3			
TOOTH FRAGMENT	1		2.6			
LONGBONES						
radius		)		11	16.4)	
ulna	2	5.1)	7.7	3	4.5)	43.3
tibia	1	2.6)		15	22.4)	
FEET / ANKLES						
carpal		)		1	1.5)	
second metacarpal	4	10.3)			)	
fourth metacarpal	2	5.1)			)	
metacarpus		)		10	14.9)	
mc / mt	2	5.1)	43.6	13	19.4)	56.7
metatarsus	2	5.1)		12	17.9)	
second metatarsal				2	3.0)	
fourth metatarsal	2	5.1)				
tarsal	4	10.3)				
first phalanx	1	2.6)				
VERTEBRA (cervical)	1		2.6			
SCAPULA	3		7.7			
RIB	10		25.5			
	39		100.0	67		100.0

TABLE 15

WORKED HORSE BONES : SOME COMPARISONS

	F 2046 n	%	F 1005 n	%	F 2014 n	%	SOU n	32 %
radius	11	16.4			2	(50.0)	10	76.9
ulna	3	4.5			1	(25.0)		
carpal	1	1.5						
tibia	15	22.4			1	(25.0)	2	15.4
metacarpus	10	14.9						
mc / mt	13	19.4					1	7.7
metatarsus	12	17.9						
second metatarsal	2	3.0						
	67	100.0	-		4	100.0	13	100.0

TABLE 16

F 20-45, excluding offcuts:

RELATIVE REPRESENTATION OF CATTLE, SHEEP AND PIG
by fragment count

	n (C+S+P)	COW	SHEEP	PIG	COW : SHE	COW : PIG	SHE : PIG
TOP LAYERS	651	44.2	44.1	11.7	1.0 : 1	3.8 : 1	3.8 : 1
RUBBISH	2170	43.2	48.8	8.0	0.9 : 1	5.4 : 1	6.1 : 1
BOTTOM	41	61.0	39.0	-	1.6 : 1		
F 2048 ALL	72862	43.7	47.5	8.8	0.9 : 1	5.0 : 1	5.4 : 1
Six Dials study:							
whole study	17148	58.5	32.1	14.4	1.7 : 1	3.7 : 1	2.2 : 1
all pits	7812	48.1	36.1	14.8	1.4 : 1	3.3 : 1	2.4 : 1
pit F1003 (less offcuts)	814	55.2	35.6	9.2	1.6 : 1	6.0 : 1	3.9 : 1
late cont.s	3077	66.4	25.4	8.2	2.6 : 1	8.1 : 1	3.1 : 1

TABLE 17

F 2048, excluding offcuts:

RELATIVE REPRESENTATION OF CATTLE, SHEEP AND PIG
by weight

	Kg (C+S+P)	COW	SHEEP	PIG	COW : SHE	COW : PIG	SHE : PIG
TOP LAYERS	15.7	71.9	20.2	7.9	3.6 : 1	9.1 : 1	2.6 : 1
RUBBISH	20.6	70.8	23.7	5.5	3.0 : 1	12.9 : 1	4.3 : 1
BOTTOM	1.0	75.0	25.0	-	3.0 : 1		
F 2048 ALL	27.3	71.2	23.0	5.8	3.1 : 1	12.3 : 1	4.0 : 1
Six Dials study:							
whole study	297.4	74.2	13.9	11.9	5.3 : 1	6.2 : 1	1.2 : 1
all pits	113.0	70.8	16.9	12.7	4.2 : 1	5.6 : 1	1.3 : 1
pit F1005 (less offcuts)	6.1	73.5	17.6	8.9	4.2 : 1	8.3 : 1	2.0 : 1
late cont.s	59.0	81.2	12.4	6.3	6.6 : 1	12.9 : 1	2.0 : 1

TABLE 18

WORKED CATTLE BONES : SOME COMPARISONS

	F 2048 n	%	F 1005 n	%	F 2014 n	%
mandible	2	0,2				
scapula	1	0,1	1	0,4		
radius	16	1,9	5	2,2	9	10,5
radius+ulna	1	0,1			1	1,2
ulna	6	0,7	1	0,4	1	1,2
tibia	18	2,2	8	3,6	8	9,3
metacarpus	177	21,3	66	29,3	38	44,1
mc / mt	375	45,1	100	44,5		
metatarsus	214	25,9	42	18,7	27	31,4
rib	21	2,7	2	0,9	2	2,3
	831	100,0	225	100,0	86	100,0
all longbones	41	4,9	14	6,2	19	22,1
metapodia	766	92,2	208	92,5	65	75,6
others	24	2,9	3	1,3	2	2,3

**midshaft fragments were quantified rather differently in SOU 32 and direct comparisons have therefore not been attempted

TABLE 19

F 2048, excluding offcuts:

DISTRIBUTION OVER THE BODY : COW
(percentaged on fragments)

	n	head	loose teeth	long bones	feet/ ankles	vert.s	girdles	ribs
TOP LAYERS	288	14.6	4.2	14.9	17.7	13.9	6.6	29.1
RUBBISH	937	15.3	4.1	9.0	14.6	13.1	8.5	35.4
BOTTOM	25	8.0	-	24.0	12.0	12.0	8.0	36.0
F 2048 ALL	1250	14.9	4.0	10.8	15.4	13.1	8.0	33.8
Six Dials study:								
whole study	9169	13.9	4.5	13.7	17.6	16.8	7.6	25.9
all pits	3833	12.1	5.2	13.6	13.8	17.9	7.9	19.5
pit F1005 (less offcuts)	449	10.9	4.0	10.9	35.9	8.8	6.0	23.6
late cont.s	2044	13.3	5.6	18.7	19.1	14.4	7.5	21.4

TABLE 20

F 2048, excluding offcuts:

DISTRIBUTION OVER THE BODY : PIG
(percentaged on fragments)

	n	head	loose teeth	long-bones	feet/ ankles	vert.s	gird-les	ribs
TOP LAYERS	76	34.3	5.3	17.1	10.5	7.9	6.5	18.4
RUBBISH	175	30.3	8.6	15.4	11.4	17.7	8.6	8.0
BOTTOM								
F 2048 ALL	251	31.4	7.6	15.9	11.2	14.7	8.0	11.2
Six Dials study:								
whole study	2474	22.6	5.6	24.1	15.7	16.6	8.7	6.7
all pits	1152	17.6	5.5	25.7	16.1	21.0	7.6	6.5
pit F1005 (less offcuts)	75	17.3	17.3	25.3	25.3	8.0	4.0	2.8
late cont.s	251	21.7	11.1	32.0	11.5	10.2	11.4	2.1

TABLE 21

WORKED SHEEP BONES : SOME COMPARISONS

	F 2048 n	%	F 1005 n	%	F 2014 n	%	SOU 32 n	%
scapula	1	4.0						
tibia	10	40.0	3	60.0			6	85.7
metacarpus	2	8.0			2	(100.0)		
mc / mt	3	12.0	1	20.0				
metatarsus	3	12.0	1	20.0			1	14.3
rib	6	24.0						
	25	100.0	5	100.0	2	100.0	7	100.0

TABLE 22

F 2048, excluding offcuts:

DISTRIBUTION OVER THE BODY : SHEEP
(percentaged on fragments)

	n	head	loose teeth	long-bones	feet/ ankles	vert.s	gird-les	ribs
TOP LAYERS	287	12.9	8.4	12.9	9.8	8.0	4.5	43.5
RUBBISH	1058	16.0	4.1	13.2	9.7	8.0	6.4	42.6
BOTTOM	16	(43.6)	(-)	(6.3)	(12.5)	(12.5)	(6.3)	(18.8)
F 2048 ALL	1361	15.7	4.9	13.1	9.3	7.9	6.0	43.1
Six Dials study:								
whole study	5500	11.2	4.0	15.1	8.4	14.3	6.8	40.4
all pits	2821	8.7	2.7	14.7	8.1	14.9	6.1	44.8
pit F1005 (less offcuts)	290	7.6	4.8	14.1	11.4	10.7	7.6	43.8
late cont.s	782	13.7	7.9	24.0	11.3	10.2	6.5	26.4

TABLE 23

AGEING BY MANDIBLES FOR CATTLE, SHEEP AND PIG

			CATTLE	SHEEP	PIG
stage	1	M1 not yet in wear			
stage	2	M2 not yet in wear			1
stage	2/3		1		1
stage	3	M3 not yet in wear	1	2	2
stage	3/4			1	
stage	4	M3 coming into wear		18	
stage	4/5			5	1
stage	5	M3 in full wear		7	
stage	5/6		1		
stage	6	M3 in heavy wear	1		
TOTAL			4	33	5

TABLE 24

SOME COMPARISONS OF SIZE FACTORS

	COW NOT WORKED	COW OFFCUTS	ALL COW	SHEEP	PIG
SIX DIALS MAIN STUDY	100.6% n=408	108.5% n=139	101.3% n=547	98.7% n=561	99.5% n=240
F 1005	(n=3)	102.3% n=64	102.3% n=67	98.0% n=20	(n=3)
SOU 32, all	100.9% n=322	106.7% n=108	102.4% n=430	99.6% n=373	98.3% n=116
F2048	98.8% n=31	104.7% n=177	103.9% n=205	98.2% n=78	97.8% n=14
SIX DIALS STUDY, LATE CONTEXTS	97.8% n=70	104.7% n=61	101.0% n=131	97.4% n=91	98.9% n=20
SOU 169, F 10675	98.6% n=57	99.3% n=5	98.7% n=62	99.1% n=80	94.3% n=22

TABLE 25 : COW RADIUS PROXIMAL WIDTH

	x	range	n	S	CV
MELBOURNE STREET ALL	73.9	60.0 - 96.1	116	7.0	9.5
SIX DIALS VARIABILITY STUDY					
not worked	73.8	62.2 - 94.1	34	7.9	10.8
offcuts	72.9	64.7 - 82.6	5	8.0	11.0
ALL	73.7	62.2 - 94.1	39	7.9	10.7
SIX DIALS SUPPLEMENTARY STUDY					
not worked	73.2	61.3 - 86.0	14	7.5	10.2
offcuts	-		-		
ALL	73.2	61.3 - 86.0	14	7.5	10.2
SOU 31, F1005					
not worked	-		-		
offcuts	(70.4)	70.4	1		
ALL					
SOU 32, whole site					
not worked	71.6	65.7 - 90.3	21	5.6	7.8
offcuts	(74.0)	69.9, 70.5, 81.7	3		
ALL	71.9	65.7 - 90.3	24	5.6	7.8
SOU 31, F 2048					
not worked	69.5	67.8 - 71.3	6	1.4	2.1
offcuts	(63.2)	54.1, 72.4	2		
ALL	67.9	54.1 - 72.4	8	5.3	8.2
SIX DIALS STUDY, LATE					
not worked	73.4	65.4 - 82.1	9	6.0	8.2
offcuts	(71.3)	64.7, 66.6, 82.6	3		
ALL	72.9	64.7 - 82.6	12	6.7	9.2
SOU 169, F10675					
not worked	70.2	59.2 - 84.4	6	8.3	11.8
offcuts	(72.4)	72.4	1		
ALL	70.5	59.2 - 84.4	7	7.6	10.8

TABLE 26 : COW METACARPUS PROXIMAL WIDTH

	x	range	n	S	CV
MELBOURNE STREET ALL	53.5	40.9 - 64.2	33	5.8	10.9
SIX DIALS VARIABILITY STUDY					
not worked	53.9	45.8 - 66.8	22	6.1	11.4
offcuts	53.9	45.8 - 62.8	46	5.1	9.5
ALL	53.9	45.8 - 66.8	68	5.4	10.0
SIX DIALS SUPPLEMENTARY STUDY					
not worked	(53.5)	47.3, 51.6, 61.7	3		
offcuts	(50.3)	50.3	1		
ALL	(52.7)		4		
SOU 31, F1005					
not worked	-		-		
offcuts	52.7	45.8 - 61.9	31	4.7	9.0
ALL	52.7	45.8 - 61.9	31	4.7	9.0
SOU 32, whole site					
not worked	58.7	45.7 - 65.6	7	6.3	10.7
offcuts		not measured			
ALL		not complete			
SOU 31, F 2048					
not worked	-		-		
offcuts	54.2	45.2 - 65.9	65	4.8	8.9
ALL	54.2	45.2 - 65.9	65	4.8	8.9
SIX DIALS STUDY, LATE					
not worked	(48.8)	47.4, 48.2, 50.7	3		
offcuts	57.3	49.3 - 62.8	10	5.2	9.1
ALL	55.4	47.4 - 62.8	13	5.9	10.7
SOU 169, F1067S					
not worked	(56.2)	47.9, 56.1, 66.3, 60.6	4		
offcuts	-		-		
ALL	(56.2)	47.9, 56.1, 66.3, 60.6	4		

TABLE 27 : COW METACARPUS DISTAL WIDTH

	x	range	n	S	CV
MELBOURNE STREET ALL	55.9	48.6 - 67.1	49	5.8	10.4
SIX DIALS VARIABILITY STUDY					
not worked	57.0	50.0 - 70.3	12	7.1	12.5
offcuts	56.2	49.1 - 69.8	40	5.5	9.8
ALL	56.4	49.1 - 70.3	52	5.8	10.3
SIX DIALS SUPPLEMENTARY STUDY					
not worked	(56.6)	50.1, 52.5, 67.4	3		
offcuts	-		-		
ALL	(56.6)	50.1, 52.5, 67.4	3		
SOU 31, F1005					
not worked	-		-		
offcuts	57.9	51.1 - 69.8	15	5.4	9.3
ALL	57.9	51.1 - 69.8	15	5.4	9.3
SOU 32, whole site					
not worked	58.5	45.5 - 71.8	14	8.1	13.8
offcuts	58.7	48.8 - 68.6	65	5.1	8.7
ALL	58.6	45.5 - 71.8	79	5.7	9.7
SOU 31, F 2048					
not worked	-		-		
offcuts	56.7	48.0 - 69.1	49	5.3	9.4
ALL	56.7	48.0 - 69.1	49	5.3	9.4
SIX DIALS STUDY, LATE					
not worked	(50.4)	50.4	1		
offcuts	55.2	49.1 - 67.5	19	5.5	9.9
ALL	55.0	49.1 - 67.5	20	5.4	9.9
SOU 169, F10675					
not worked	(56.0)	49.8, 58.9, 64.4	3		
offcuts	(53.3)	53.3	1		
ALL	(55.3)	49.8, 53.3, 58.9, 64.4	4		

TABLE 28 : COW TIBIA DISTAL WIDTH

	x	range	n	S	CV
MELROSE/DE STREET ALL	53.0	49.1 - 67.9	111	4.7	8.8
SIX DIALS VARIABILITY STUDY					
not worked	57.1	48.3 - 66.7	35	4.7	8.2
offcuts	61.3	55.0 - 68.4	6	5.0	8.2
ALL	57.7	48.3 - 68.4	41	4.9	8.5
SIX DIALS SUPPLEMENTARY STUDY					
not worked	56.2	49.7 - 66.1	6	5.6	9.9
offcuts	-		-		
ALL	56.2	49.7 - 66.1	6	5.6	9.9
SOU 31, F1005					
not worked	-		-		
offcuts	(68.4)	68.4	1		
ALL					
SOU 32, whole site					
not worked	57.7	50.3 - 68.1	41	4.7	8.1
offcuts	56.4	52.0 - 61.6	5	4.0	7.0
ALL	57.5	50.3 - 68.1	46	4.6	7.9
SOU 31, F 2048					
not worked	54.9	52.4 - 61.1	7	3.0	5.6
offcuts	(57.9)	48.5, 59.0, 66.2	3		
ALL	55.8	48.5 - 66.2	10	5.1	9.1
SIX DIALS STUDY, LATE					
not worked	56.6	50.1 - 65.5	11	4.4	7.7
offcuts	59.8	55.0 - 64.8	5	4.1	6.8
ALL	57.6	50.1 - 65.5	16	4.4	7.7
SOU 169, F10575					
not worked	56.6	52.3 - 62.6	9	3.7	6.5
offcuts	(57.2)	57.2	1		
ALL	56.7	52.3 - 62.6	10	3.5	6.1

TABLE 29 : COW METATARSUS PROXIMAL WIDTH

	x	range	n	S	CV
MILKBURNE STREET ALL	43.5	38.2 - 48.6	26	2.5	5.8
SIX DIALS VARIABILITY STUDY					
not worked	44.4	38.8 - 52.3	27	4.3	9.7
offcuts	48.3	40.9 - 54.1	21	3.1	6.5
ALL	46.1	38.8 - 54.1	48	4.3	9.2
SIX DIALS SUPPLEMENTARY STUDY					
not worked	(47.9)	41.0, 51.3, 51.5	3		
offcuts	-		-		
ALL	(47.9)	41.0, 51.3, 51.5	3		
SOU 31, F1005					
not worked	-		-		
offcuts	48.4	40.9 - 52.1	10	3.3	6.8
ALL	48.4	40.9 - 52.1	10	3.3	6.8
SOU 32, whole site					
not worked	46.1	42.1 - 51.2	6	6.8	3.2
offcuts		not measured			
ALL		not complete			
SOU 31, F 2048					
not worked	-		-		
offcuts	47.1	38.6 - 54.5	33	3.5	7.5
ALL	47.1	38.6 - 54.5	33	3.5	7.5
SIX DIALS STUDY, LATE					
not worked	41.6	39.2 - 47.8	7	3.0	7.2
offcuts	48.2	42.4 - 54.1	10	3.3	6.8
ALL	45.5	38.8 - 54.1	17	4.5	10.0
SOU 169, F10675					
not worked	-		-		
offcuts	-		-		
ALL	-		-		

TABLE 30 : METATARSUS DISTAL WIDTH

	x	range	n	S	CV
MELBOURNE STREET ALL	50.4	44.6 - 62.3	43	4.0	8.0
SIX DIALS VARIABILITY STUDY					
not worked	51.4	45.5 - 61.1	13	4.6	8.9
offcuts	54.1	40.9 - 59.6	24	4.4	8.2
ALL	53.2	40.5 - 61.1	37	4.6	8.7
SIX DIALS SUPPLEMENTARY STUDY					
not worked	(46.2)	46.2	1		
offcuts	-		-		
ALL	(46.2)	46.2	1		
SOU 31, F1005					
not worked	-		-		
offcuts	51.2	45.5 - 55.9	5	4.9	9.5
ALL	51.2	45.5 - 55.9	5	4.9	9.5
SOU 32, whole site					
not worked	51.7	45.0 - 61.8	11	5.1	9.8
offcuts	56.4	49.7 - 63.6	29	2.8	5.0
ALL	55.3	45.0 - 63.6	40	4.0	7.2
SOU 31, F 2048					
not worked	-		-		
offcuts	56.0	48.2 - 62.1	22	3.7	6.6
ALL	56.0	48.2 - 62.1	22	3.7	6.6
SIX DIALS STUDY, LATE					
not worked	-		-		
offcuts	55.0	46.0 - 59.6	13	4.4	8.0
ALL	55.0	46.0 - 59.6	13	4.4	8.0
SOU 169, F10675					
not worked	-		-		
offcuts	(49.9)	45.6, 53.2	2		
ALL	(49.9)	45.6, 53.2	2		