Arch Report 3227 Faunal chapter 209 RS

Introduction

The West Stow faunal sample is among the largest in Britain, and the bones are in an excellent state of preservation. The study of a faunal collection of this size and quality can produce vast amounts of both quantitative and descriptive data on the relative importance of the animal species, butchery patterns, ages at death, and animal sizes. A way was needed to record these data so that (1) a wide range of osteometric and descriptive information could be recorded for each bone or fragment; (2) the data could be grouped and regrouped according to archaeological phase, feature type, and the like; and (3) the data thus recorded could be compared to other sites in Britain. The computer based osteometric archaeozoology programme devised by Roger Jones of the D. o. E. Ancient Monuments Lab (Jones n.d.) was designed to meet these needs. This system allows a bone worker to record the identification, archaeological context, and measurements for each bone. In addition, up to 14 descriptive fields may be used to record various non-metric features such as butchery and dental pathology. The D. o. E. system was used to record all the animal bone remains from the West Stow site. A brief description of the type of information which can be recorded using this system follows.

Initially each bone fragment is identified to species and anatomical part. Mnemonic codes ~~were~~ are used for common species and all anatomical elements to insure speed and accuracy of recording. In addition to specific identifications, the system allows for higher order identifications (e.g., sheep/goat, small artiodactyl) for those fragments which ~~could~~ can not be fully identified to species. The zoological identification is followed by a five-digit archaeological context number. Using these

context numbers it is possible for the faunal sample to be sorted by chronological phase and feature type. Thus it is possible to group all bones which were recovered from Anglo-Saxon Phase 1 contexts together, or to compare the bones recovered from huts to those recovered from pits. Due to the size of the West Stow faunal sample, these re-groupings would be impossible without the aid of a computer.

The zoological identification and context number are followed by a fixed series of measurements. The computer coding system included the standard measurements which have been defined by von den Driesch (1977). This will allow the West Stow metrical data to be compared to other sites, both in the United Kingdom and on the continent. A detailed metrical series is necessary in order to reconstruct the size and stature of the West Stow domesticates.

The measurement data are followed by a series of descriptive field Using mnemonic alphanumeric codes, one can describe the side and part of the bone preserved, the sex of the animal, the state of epiphyseal union of the long bones, the state of dental eruption and wear on the teeth, and the presence of any butchery marks. In addition one can note the presence of gnawing, pathology, dental pathology, and bone working. This depth of recording is not only desirable, but necessary if one is to obtain a reliable picture of the animal economy at West Stow. Data on epiphyseal union and dental eruption provide information on kill-patterns and ages at death of the major domesticates. This, in turn, may allow us to make inferences about the economic uses to which these animals were put. Detailed study of butchery marks and fragmentation patterns may allow us to reconstruct the ways in which the animals were butchered, distributed, consumed, and disposed of.

Presence or absence of pathology can give us much information on the state of health of the West Stow animals. Data on bone working will reveal which bones were regularly chosen for working and the techniques by which these bones were modified. These data will also aid in the interpretation of finished bone artifacts. Finally, data on handedness are necessary for calculation of minimum numbers of individuals and similar estimates of the relative importance of the species represented at the site. Thus, detailed description of each bone fragment is neces if one is to attempt to reconstruct Anglo-Saxon husbandry and hunting practices.

The processing and analysis of the West Stow faunal data are not yet completed, and this report will include only interim findings. This preliminary report will include a summary of the species present at the site and an introductory discussion of the metrical data for cattle, sheep, and pigs. Analysis of the data on bone working has been completed, and the results will be presented ~~here~~ in full in another section of this report. Preliminary evidence for kill-patterns in sheep, based on a study of dental eruption and wear on maxillae and mandibles, will also be discussed here. Interim analysis of the West Stow bird bones is also included. A more complete summary of the zooarchaeological evidence from West Stow will be included in a forthcoming summary report. This report will provide a full discussion of the kill-pattern for cattle, sheep, and pigs, a complete osteometric summary including comparisons with other sites, a detailed reconstruction of butchery patterns, and a discussion of the relative importance of the species present at the site, including any changes through time. The basic data upon which these summary statements will be based will be stored as a part of the D. o. E. archive and will be available to other researchers for comparative purposes. Detailed methodological and theor-

etical considerations, as well as more extensive data presentation, will be included in my doctoral thesis.[1]

Acknowledgements:

[1]The research for my doctoral thesis was funded by grants from the Wenner-Gren Foundation for Anthropological Research, The National Science Foundation (U.S.), and the Fulbright-Hayes program. My thesis will be submitted to the Department of Anthropology, University of Pennsylvania. The West Stow bone research reported here was carried out at the Faunal Remains Project, Department of Archaeology, University of Southampton. The author would like to thank Jennie Coy who, in addition to identifying and analysing the bird remains, has provided constant support and encouragement throughout the project. Thanks are also due to Roger Jones of the Ancient Monuments Laboratory who designed the computer-based recording system used to record the West Stow faunal material. In addition, he has provided the statistical information which has been used to write much of this report.

Species Identified and Relative Proportions

The West Stow faunal collection produced the remains of a wide range of animal species. The domestic mammals included cattle, sheep and goat, pig, horse, dog, and cat; the wild included red deer (Cervus elaphus), roe deer (Capreolus capreolus), hare (Lepus sp.), rabbit (Oryctolagus cunniculus)*, bear (Ursus arctos), badger (Meles meles), and beaver (Castor fiber). Bird bones identified were of domestic fowl, domestic goose, and domestic duck/mallard, plus wild species including heron, swan, wild goose, wild duck, teal, goshawk, hen harrier, crane, moorhen, lapwing, golden plover, greenshank, woodcock, snipe, common gull, herring/lesser black-backed gull, thrush, and starling. All but starling and goshawk were recovered from indisputably Saxon contexts. Remains of two freshwater species of fish, pike (Esox lucius) and perch (Perca fluviatilis), were also present at West Stow. Examples of both were recovered from contexts contemporary with the occupation of the SFBs. In addition, the bones of frog (Rana sp.) and toad (Bufo sp.), common shrew (Sorex araneus), mole (Talpa europaea), and water vole (Arvicola terrestris) were identified. There was also one rat bone recovered, the context and specific identification of which are still under study.

Although complete quantifative data are not yet available for the West Stow site, estimates of the relative importance of the major domesticates (cattle, sheep and goat, and pig) can

*The rabbit bones may be intrusive and are probably not contemporary with the occupation of the site.

be made for the Saxon faunal material. For the preliminary analysis, the SFBs were subdivided into Phases 1, 2, and 3. Only those huts which could be phased are included in the preliminary totals. In addition, this interim study is limited to those bones which were clearly contemporary with the occupation of the buildings. Post-hut fill was excluded. Phase 3 totals include animal bones from 7th century SFBs and faunal material from some of the 7th century ditches. Animal bones from SFBs only are included in the Phase 1 and Phase 2 totals. The fragments identified for each major domesticate are presented in Tables 1, 2, and 3.

From the tables it is clear that the West Stow animal economy was a mixed one, employing substantial numbers of cattle, sheep and goats, and pigs in all three phases. In terms of fragment counts, sheep (and goats) are always the predominant species, followed by cattle, and then pigs. Cattle, however, would have been the most important source of meat. The numerical superiority of sheep/goat in the phased hut material is notable, as the complete West Stow faunal assemblage included roughly equal numbers of cattle and ovicaprids (approximately 30,000 fragments of each). The implications of this intra-site variability will be discussed in detail in the forthcoming summary report. However, it should be remembered that this interim report is almost exclusively limited to faunal material which was contemporary with the occupation of the SFBs. Small anatomies, such as the sheep/goat teeth which are so well represented here, could literally have "fallen through the floor-boards." One might

therefore expect a higher proportion of small species in the material that is contemporary with the occupation of the huts.

The relative importance of the major domesticates shows some stability through time. Cattle fragments comprise approximately 35% of the faunal sample in all three phases. However, there is an increase in the proportion of sheep/goat and a corresponding decrease in pigs in Phase 2, and this is followed by a reversal in Phase 3. These changes in the proportions of ovicaprids and pigs are statistically significant at $p = 0.01$*. If this is a true reflection of economic change, the changes in the proportions of sheep/goat and pigs may represent responses to altered circumstances, such as access to and availability of forest and pasture. The reasons for these changing proportions will be considered in more detail in the summary report.

The West Stow pattern of mixed animal husbandry was augmented by a limited amount of hunting. The remains of both red deer and roe deer are present in the faunal samples from all three phases. Although deer bones are always present in very low numbers, the deer remains include post-cranial material, in addition to antler tines, and thus represent hunting as well as antler working.

The relative importance of sheep and goats deserves further comment. In all three phases, sheep fragments outnumber goat bones by a substantial margin. However, it must be emphasized that goat bones were present in all three Anglo-Saxon phases.

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*Using both a test of the significance of the difference between proportions and a Chi-square test.

Table 1

Phase 1 - Fragments Identified by Species and Anatomy

	CATTLE	SHEEP/GOAT *	PIG
Horn Core	52	75	—
Skull	246	191	35
Maxilla	56	102	69
Mandible	242	486	155
Scapula	129	138	87
Humerus	85	139	55
Radius	89	257	36
Ulna	61	47	45
Carpals	40(2)[a]	17	4
Metacarpals	86	194	92
First Phalanx	133	49	38
Second Phalanx	65	12	20
Third Phalanx	49	7	20
Sesamoid	5	—	1
Pelvis	135	105	85
Femur	80	84	54
Patella	7	4	1
Tibia	49(5)[b]	223(1)[b]	56 (54)[c]
Calcaneus	46	42	32
Astragalus	39	45	14
Tarsals	23	15	5
Metatarsals	110	193	90
Metapodials	11	8	15
Atlas	13	17	13
Axis	26	12	8
Sacrum	13	5	6
Hyoid	14	19	—
Upper Teeth	304	206	73
Lower Teeth	191	338	118
Tooth Fragments	2	9	11
	2358	3030	1492
Total (Percent)	(34.27%)	(44.04%)	(21.69%)

* Includes 579 sheep fragments and 4 goat fragments.
a Includes ancillary metapodials
b Includes malleolus in parentheses.
c Includes pig fibula. in parentheses.

Table 2

Phase 2 - Fragments Identified by Species and Anatomy

	CATTLE	SHEEP/GOAT *	PIG
Horn Core	39	86	—
Skull	333	325	163
Maxilla	69	109	53
Mandible	266	467	94
Scapula	180	174	66
Humerus	98	167	44
Radius	99	280	23
Ulna	88	72	32
Carpals	62(2)[a]	12	7
MetaCarpals	110	205	51
First Phalanx	105	85	60
Second Phalanx	83	33	14
Third Phalanx	47	20	14
Sesamoid	4	—	—
Pelvis	113	126	51
Femur	96	96	39
Patella	12	9	4
Tibia	122(7)[b]	286(1)[b]	43(34)[a]
Calcaneus	44	52	14
Astragalus	42	54	7
Tarsals	23(2)[a]	10	20
Metatarsals	107	237	40
Metapodials	8	11	14
Atlas	17	14	7
Axis	11	12	1
Sacrum	19	14	—
Hyoid	23	48	1
Upper Teeth	233	296	66
Lower Teeth	275	452	70
Tooth Fragments	12	35	7
Total	2751	3788	1039
(percent)	(36.30%)	(49.98%)	(13.71%)

* Includes 682 sheep fragments and 9 goat fragments.

a

b Includes Malleolus in parentheses

c Includes pig fibula in parentheses

Table 3

Phase 3 — Fragments Identified by Species and Anatomy

	CATTLE	SHEEP/GOAT *	PIG
Horn Core	13	—	
Skull	50	42	31
Maxilla	12	18	15
Mandible	56	83	23
Scapula	39	27	26
Humerus	20	39	17
Radius	13	69	10
Ulna	17	13	12
Carpals	18	1	2
Metacarpals	13	31	14
First Phalanx	28	18	9
Second Phalanx	16	6	6
Third Phalanx	14	2	6
Sesamoid	1	—	—
Pelvis	38	25	28
Femur	13	22	17
Patella	1	—	1
Tibia	18	82	9 (6) **
Calcaneus	15	6	4
Astragalus	9	11	4
Tarsals	5	—	2
Metatarsals	20	41	14
Metapodials	5	2	11
Atlas	1	2	1
Axis	4	3	1
Sacrum	3	3	1
Hyoid	—	2	
Upper Teeth	39	68	6
Lower Teeth	40	87	23
Tooth Fragments	4	4	2
		698	
TOTAL	531		301
(percent)	(34.71%)	(45.62%)	(19.67)

* Includes 121 identifiable sheep fragments and 2 fragments of goat

** Fibula in parentheses.

The lower number of goat bones might result not only from the presence of fewer goats than sheep at the site, but also from different patterns of economic usage. If goats were kept primarily for dairying, while sheep were used for both meat and milk, one might reasonably expect to find fewer goat bones in the West Stow domestic refuse.

The West Stow pattern of mixed animal husbandry with sheep/goat the predominant species (at least in the contemporary hut material) compares well with the East Anglian Middle Saxon faunal assemblage from North Elmham Park (Noddle 1980). At North Elmham Phase I the proportion of sheep and goat was 39.39%; of cattle, 31.90%; and of pig, 28.71%*. In contrast, the Wessex Saxon sites of Hamwih (Bourdillon and Coy 1980) and Portchester Castle (Grant 1976) produced a considerably higher proportion of cattle. Thus, patterns of regional variation in Anglo-Saxon husbandry are beginning to emerge from the zooarchaeological record.

Anatomical groupings. The cattle, sheep/goat, and pig fragments were grouped into five anatomical classes: head, forelimb, hindlimb, feet, and teeth. The head category includes the skull and horn cores, maxilla and mandible, plus the axis and atlas vertebrae; the forelimb includes scapula, humerus, radius, and ulna; the hindlimb is comprised of pelvis and sacrum, femur, patella, tibia, and fibula; and the feet include all**

*Proportions recalculated to exclude other species.

**Thoracic, lumbar, and the remaining cervical vertebrae have been excluded here and will be included in the summary report.

other anatomical categories except loose teeth. In the summary report, more detailed division of the anatomies will be possible when proximal and distal portions are taken into account. This will allow for a more fine-grained analysis of the anatomical distributions of the different species. Explanations for the differences in distributions of anatomical elements will also be considered in the summary report. Among the factors which must be considered are butchery practices, fragmentation patterns, differing disposal patterns, and differing ages at death.

The proportion of cattle fragments in each anatomical group is consistent through all three Saxon phases.* Cattle skull fragments are most frequently recovered, while bones of the hindlimb are most poorly represented. One might expect relatively low numbers of cattle long bones from contexts contemporary with the occupation of the huts. It will be interesting to see whether cattle limb bones are better represented in other types of features.

The proportions of ovicaprids and pigs in the different anatomical classes show some variation through time. This variation might be linked to the changing importance of sheep/goat and pig in the different phases. Ovicaprids show a relative decline in skull fragments and an increase in hindlimb bones in Phase 3. The proportion of fragments of pig skull also declines in Phase 3, while both fore- and hindlimb proportions increase. A substantial number of loose teeth of sheep and goats are present in all three phases, while the loose teeth of pigs are comparatively rare, especially in Phase 3.

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* See Table 4.

Table 4 : Anatomical Distributions

Phase 1 - Anatomical Distribution of Cattle, Sheep / Goat, and Pig

	CATTLE		SHEEP / GOAT		PIG	
	Frag	%	Frag	%	Frag	%
Head	649	27.52 %	902	29.96	480	32.17
Forelimb	364	15.44	581	19.17	223	14.95
Hindlimb	334	14.16	421	13.89	256	17.16
Feet	614	26.04	573	18.91	331	22.18
Teeth	397	16.84	553	18.25	202	13.54
TOTAL	2358		3030		1492	

Phase 2 - Anatomical Distribution of Cattle, Sheep/Goat, and Pig

Head	758	27.55	1061	28.01	319	30.70
Forelimb	464	16.87	693	18.29	165	15.88
Hindlimb	363	13.20	531	14.20	171	16.56
Feet	646	23.48	720	19.01	241	23.20
Teeth	520	18.90	783	20.67	143	13.76
TOTAL	2751		3788		1039	

Phase 3 - Anatomical Distribution of Cattle, Sheep/Goat, and Pig

Head	142	26.74	148	21.20	71	23.59
Forelimb	89	16.76	148	21.20	65	21.59
Hindlimb	73	13.75	132	18.91	62	20.60
Feet	144	27.12	111	15.90	72	23.92
Teeth	83	15.63	159	22.78	31	10.30
	531		698		301	

When all the species are compared, substantial differences in the percentages of bones falling into the five anatomical classes are apparent. Skull fragments of all species are relatively common, but they range in frequency from 21.2% (sheep/goat Phase 3) to 32.17% (pig Phase 1). In all three species, limb bones are comparatively poorly represented. Forelimb fragments outnumber hindlimb bones among cattle and sheep/goat, while hindlimb bones are more common among pigs. This is certainly due to the presence of large numbers of pig fibulae. When quantitative data are available from pits, ditches, and Layer 2, more complete anatomical analyses will be possible.

Measurements

All the West Stow bones were measured following the recommendations of von den Driesch (1977). This interim report will include measurement data for cattle, sheep, and pigs only. Statistics for the other species will be included in the forthcoming summary report.

Cattle. Measurements of the West Stow cattle indicate that they were of good size, comparable to the cattle remains from other Anglo-Saxon sites. Selected measurements have been summarized in chart form for the scapula (Table A), humerus (Table B), radius (Table C), metacarpus (Table D), femur (Table E), tibia (Table F), astragalus (Table G), and metatarsus (Table H). When these measurements are compared to the extensive metrical series from the Middle Saxon urban site of Hamwih (Bourdillon and Coy 1976), the measurements are remarkably similar, both in means and ranges. The range of measurements also compares well with North Elmham Phase 1 (Noddle 1980). When the greatest lengths of the cattle astragali from West Stow are compared to those from other sites (summarized by Maltby n.d.), the West Stow means of 61.2 mm. (Period 1), 59.6 (Period 2), and 60.6 mm. (Period 3) are well within the Saxon range. Shoulder height estimates* range from 105.0 to 121.4 cm. (41.3-47.9 in.) with a mean of 113.2 cm. These estimates are well within the Hamwih range of 101.7-137.7 cm.

Finally, it should be noted that there is no evidence for size change through time from the West Stow cattle measurements.

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*Based on 2 radii, 3 metatarsals, and 12 metacarpals, using Fock's factors for metapodia and Matolcsi's factors for radii (von den Driesch and Boessneck 1974).

Table A: Measurements on Anglo-Saxon Cattle Scapulae *

Phase 1	Mean	Range	No. Measure
Smallest Length of The Column scapulae (SLC)	45.6 **	41.9 - 49.9	5
Greatest length of The Processus articularis (GLP)	61.8	56.9 - 72.9	8
Length of The glenoid cavity (LG)	53.9	48.6 - 59.3	7
Breadth of The glenoid cavity (OG)	43.4	38.1 - 51.3	9
Phase 2			
SLC	50.5	45.6 - 63.9	6
GLP	65.7	56.0 - 80.3	8
LG	548	49.5 - 66.9	9
BG	44.3	40.0 - 54.7	13
Phase 3			
SLC		45.8	1
GLP		—	—
LG		68.6	1
BG		40.4 - 59.8	2

* All measurements following von den Driesch (1977).
** All measurements in mm.

Table B : Measurements on Anglo - Saxon Cattle Humeri

	Mean	Range	No. Measured
Phase 1			
Breadth of the distal end (Bd)	74.3	73.3 - 75.3	3
Breadth of the trochlea (BT)	66.7	63.0 - 68.3	5
Phase 2			
Bd	73.1	64.8 - 86.3	7
BT	67.8	62.3 - 76.3	6
Phase 3			
Bd	74.4	69.7 - 81.9	4
BT	69.1	65.8 - 72.5	4

Table C : Measurements on Anglo - Saxon Cattle Radii

Phase 1			
Breadth of the proximal end (Bp)	74.0	65.2 - 88.4	14
Breadth of the proximal articular surface (BFp)	68.4	59.8 - 80.3	16
Phase 2			
Bp	71.0	67.4 - 73.5	10
BFp	64.8	62.1 - 68.1	9
Phase 3			
Bp		-	
BFp		-	

Table D: Measurements on Anglo-Saxon Cattle Metacarpi

	Mean	Range	No. Measured
Phase 1			
Breadth of the proximal end (Bp)	54.1	46.6 - 63.6	15
Breadth of the distal end (Bd)	53.9	48.4 - 62.6	14
Phase 2			
Bp	53.9	46.8 - 66.0	23
Bd	56.4	49.4 - 68.6	16
Phase 3			
Bp		51.2 - 51.3	2
Bd		50.5 - 53.1	2

Table E: Measurements on Anglo Saxon Cattle Femora

Phase 1			
Depth of the Caput femoris (DC)	40.9	39.0 - 44.9	7
Phase 2			
DC		40.1	1
Phase 3			
DC		42.4	1

Table F: Measurements on Anglo-Saxon Cattle Tibiae

	Mean	Range	No. Measured
Phase 1			
Breadth of the distal end (Bd)	56.3	50.8 - 67.4	18
Depth of the distal end (Dd)	42.6	38.9 - 50.1	15
Phase 2			
Bd	56.2	50.5 - 65.5	25
Dd	43.0	31.8 - 51.5	12
Phase 3			
Bd	57.3	52.0 - 68.5	6
Dd		41.2 - 44.1	2

Table G: Measurements on Anglo-Saxon Cattle Astragali

	Mean	Range	No Measured
Phase 1			
Greatest length of the lateral half (GLl)	61.2	54.2 - 65.8	27
Greatest length of the medial half (GLm)	55.8	49.8 - 60.0	28
Breadth of the Distal End (Bd)	40.0	34.9 - 45.5	28
Depth of the lateral half (DL)	34.7	30.6 - 37.7	27
Phase 2			
GLl	59.6	53.6 - 65.8	30
GLm	54.7	48.4 - 60.8	31
Bd	38.3	35.1 - 43.0	31
DL	33.7	29.7 - 39.0	30
Phase 3			
GLl	60.6	56.1 - 70.3	7
GLm	55.7	52.8 - 64.0	7
Bd	40.0	35.5 - 46.9	6
DL	34.3	32.0 - 40.0	7

Table H: Measurements on Anglo-Saxon Cattle Metatarsi

	Mean	Range	No Measured
Phase 1			
Breadth of the Proximal End (Bp)	45.3	40.0 - 53.1	12
Breadth of the Distal End (Bd)	52.6	46.8 - 61.1	15
Phase 2			
Bp	44.0	39.7 - 51.2	15
Bd	48.9	45.8 - 53.5	13
Phase 3			
Bp	46.0	41.6 - 50.4	3
Bd	-	46.2	1

Sheep and Goats. Measurements of sheep scapulae (Table I), humeri (Table J), radii (Table K), metacarpi (Table L), femora (Table M), sheep/goat tibiae (Table N), sheep astragali (Table O), and sheep metatarsi (Table P) are included in the interim report. Measurements on goat bones are fewer in number and will be discussed in the summary report. As is the case with cattle, there is no evidence for size change through time in the West Stow sheep measurements.

When the West Stow measurements are compared to those from North Elmham Phase I, the ranges of distal tibial breadth, breadth of the proximal radius, and trochlear breadth on the humerus are remarkably similar. Likewise, the differences between the West Stow and Hamwih sheep measurements are not significant. Distal tibial breadth is the cost commonly taken measurement on ovicaprid bones (Maltby n.d.). Mean tibial breadths for other Anglo-Saxon sites range from 25.2 mm. for the Middle Saxon site of Sedgeford to 26.3 mm. for the late Saxon remains from Thetford. The West Stow means of 26.2 (Phase 1), 26.4 (Phase 2), and 26.3 mm. (Phase 3) are near the top of the Anglo-Saxon range. It should be noted that the West Stow means are closest to those from the East Anglian sites of North Elmham and Thetford.

A wide range of shoulder height estimates are available for the West Stow sheep, and these range from 54.0 to 68.8 cm. (21.3-27.1 in.). The distribution of shoulder height estimates appears bimodal, with peaks at approximately 59 and 63 cm. Once again, the range of the West Stow shoulder height estimates falls within the Hamwih range of 50.1-70.9 cm.

Table I - Measurements on Anglo - Saxon Sheep Scapulae

	Mean	Range	No. Measured
Phase 1			
SLC	19.0	14.7 - 22.9	27
GLP	31.7	27.6 - 35.5	21
LG	25.0	22.2 - 29.4	21
BG	20.0	17.6 - 22.9	23
Phase 2			
SLC	18.6	14.6 - 21.4	33
GLP	31.7	28.0 - 36.1	19
LG	24.8	22.4 - 28.0	20
BG	19.0	16.8 - 23.5	21
Phase 3			
SLC	17.5	14.8 - 19.6	8
GLP	30.0	26.8 - 33.0	4
LG	24.2	21.9 - 26.7	4
BG	18.1	16.1 - 20.0	2

Table J - Measurements on Anglo - Saxon Sheep Humeri

Phase 1			
Bd	29.5	26.2 - 34.0	35
BT	28.2	25.1 - 32.0	30
Phase 2			
Bd	29.5	25.6 - 33.8	34
BT	27.6	24.4 - 31.9	34
Phase 3			
Bd	29.6	27.4 - 31.8	11
BT	28.0	26.1 - 29.4	10

Table K: Measurements on Anglo-Saxon Sheep Radii

	Mean	Range	No Measured
Phase 1			
Bp	30.9	27.7 - 35.6	17
BFp	28.1	24.5 - 32.1	18
Phase 2			
Bp	30.1	27.0 - 35.9	17
BFp	27.3	21.8 - 32.0	17
Phase 3			
Bp	30.5	27.5 - 33.3	5
BFp	27.4	25.2 - 29.7	5

Table L: Measurements on Anglo-Saxon Sheep Metacarpi

Phase 1			
Bp	23.0	20.5 - 26.4	45
Bd	24.8	22.7 - 27.0	16
Phase 2			
Bp	22.9	17.4 - 26.2	42
Bd	24.9	22.3 - 27.1	19
Phase 3			
Bp	23.4	20.6 - 25.3	4
Bd		26.2	1

Table M: Measurements on Anglo-Saxon Sheep Femora

Phase 1			
DC	19.9	19.4 - 20.4	3
Phase 2			
DC	—	19.5 - 19.7	2
Phase 3			
DC		18.7	1

Table N: Measurements on Anglo-Saxon Sheep and Goat Tibiae

	Mean	Range	No. Measured
Phase 1			
Bd	26.2	22.4 - 29.4	35
Dd	20.2	17.8 - 22.5	25
Phase 2			
Bd	26.4	23.8 - 29.5	56
Dd	20.6	18.1 - 22.1	27
Phase 3			
Bd	26.3	23.6 - 29.0	9
Dd	20.9	19.4 - 23.2	4

Table O: Measurements on Anglo-Saxon Sheep Astragali

Phase 1			
GLl	28.0	26.0 - 29.9	24
GLm	27.1	24.8 - 30.8	24
Bd	18.7	16.9 - 21.0	23
Dl	15.7	14.0 - 17.0	24
Phase 2			
GLl	28.1	25.3 - 31.3	39
GLm	26.7	24.3 - 29.7	41
Bd	18.2	16.0 - 20.2	37
Dl	15.6	13.4 - 17.9	41
Phase 3			
GLl	27.9	26.6 - 29.6	5
GLm	26.8	25.0 - 27.9	5
Bd	17.8	16.6 - 18.8	5
Dl.	15.5	14.3 - 16.8	5

Table P: Measurements on Anglo-Saxon Sheep Metatarsi

	Mean	Range	No. Measured
Phase 1			
Bp	20.2	18.1 – 23.6	27
Bd	23.1	21.6 – 24.7	10
Phase 2			
Bp	20.6	17.5 – 24.7	40
Bd	24.2	22.3 – 26.4	14
Phase 3			
Bp	—		
Bd	23.6	20.0 – 25.7	3

Pigs. West Stow produced a substantial quantity of pig remains, a hallmark of Anglo-Saxon sites in Britain. There is no conclusive dental evidence for wild boar at West Stow. Measurements on the lower M_3 (Table Q) range from 28.4 to 37.0 mm. (greatest lengths). All are within the domestic range, although the 37.0 mm. measurement is quite large. It is, however, not incompatible with a large domesticated boar. The lower third molar lengths are consistently longer than those recorded from Melbourne Street, as the Hamwih lower third molars range from 25.5 to 34.0 mm. in length. However, the longest of the West Stow M_3 are smaller than those from North Elmham which range to over 38 mm. in Period 1 and to more than 40 mm. in Period 2.

Measurements on pig scapulae and long bones are summarized in Tables R-U. In contrast to the dental evidence, the West Stow post-cranial measurements fall within the Hamwih ranges. The ranges of the distal tibial breadth, proximal radial breadth, distal humeral width, and the smallest length of the scapular neck also compare quite closely with the evidence from North Elmham Period 1. No complete pig long bones were recovered from the phased Saxon material from West Stow, and therefore no estimates of shoulder heights could be made.

Conclusions. Measurements on the West Stow domesticates show that the cattle, sheep, and pigs were all quite large and comparable in size to those recovered from later Anglo-Saxon sites. The cattle, sheep, and pigs are all considerably larger than those recovered from British Iron Age sites (cf. Harcourt 1979). There is no conclusive evidence for wild pig at the site, although there are some large pig remains present in the faunal collection which deserve further study. The metrical evidence

Table G: Lengths of Pig M_3

	Mean	Range	No. Measured
Phase 1	32.9	30.0 – 37.0	9
Phase 2	31.2	28.4 – 33.2	6
Phase 3	none measured		

Table R: Measurements on Anglo-Saxon Pig Scapulae

Phase 1			
SLC	22.3	19.6 – 25.6	22
GLP	34.7	32.0 – 37.6	9
BG	24.4	22.3 – 26.8	11
Phase 2			
SLC	23.3	19.5 – 27.3	11
GLP	36.1	33.6 – 38.5	7
BG	26.8	24.4 – 28.9	5
Phase 3			
SLC	23.9	20.3 – 27.8	9
GLP	35.0	30.8 – 40.5	5
BG	23.4	20.7 – 26.9	6

Table S: Measurements on Anglo-Saxon Pig Humeri

Phase 1			
Bd	38.6	34.1 – 43.6	12
Phase 2			
Bd	40.0	38.3 – 41.8	5
Phase 3			
Bd	–	39.7	1

Table T: Measurements on Anglo-Saxon Pig Radii

Phase 1			
Bp	28.8	25.5 – 31.0	11
Phase 2			
Bp	28.6	26.4 – 30.8	3
Phase 3			
Bp		29.7 – 30.3	2

Table 4: Measurements on Anglo-Saxon Pig Tibiae

	Mean	Range	No. Measured
Phase 1			
Bd	29.1	27.6 - 31.7	8
Phase 2			
Bd	28.6	27.2 - 30.7	4
Phase 3			
Bd	none measured		

reinforces the impression that the inhabitants of West Stow successfully practised a pattern of mixed animal husbandry.

Kill Patterns

A pilot study of ages at death was carried out on the West Stow sheep/goat mandibles and maxillae. The West Stow faunal sample was ideally suited to this type of study for in the entire faunal sample only ~~60~~ 55 bones could be clearly identified as goat while over 5000 were sheep. It is therefore likely that most, if not all, of the 1817 sheep/goat mandibles and maxillae included in this study were in fact sheep.

Although previous large scale studies of sheep/goat dental materia have emphasized mandibles rather than maxillae, the West Stow faunal sample produced large numbers of both upper and lower jaws. Therefore a system for recording dental eruption and wear on sheep/goat maxillae was developed in the course of the West Stow faunal analysis. The details of this system have been described elsewhere[1] and will not be presented in full here. The method is an adaptation of the system used by Payne (1973) to record dental eruption and wear on sheep/goat mandibles and employs 22 stages to record the state of eruption or wear on each tooth.

After scoring each tooth in the West Stow maxillae for eruption or wear, it was necessary to provide an age-wear estimate for the complete or near complete maxillae. A variant of the system used by Payne (1973: 293) to score entire mandibles was found to be most succes ful. Nine classes were defined as shown in Table 1, and each maxilla was given a single score (A-I). Those incomplete maxillae which could not be assigned to a specific category were eliminated from this portio of the study. A total of 506 maxillae could be assigned to specific classes, and the distribution of these is shown in Table 1. The modal

[1] "Animal Use and Culture Change." Paper presented at the annual meeting of the Society for American Archaeology, Philadelphia, May 1980

TABLE 1

WEAR STAGES ON WEST STOW MAXILLAE

STAGE	DESCRIPTION	NUMBER
A	DP4 UNWORN	3
B	DP4 IN WEAR BUT M1 UNWORN	56
C	M1 IN WEAR; M2 UNWORN	184
D	M2 IN WEAR; M3 UNWORN	119
E	M3 IN WEAR BUT LESS THAN STAGE 9[a]	43
F	M3 BETWEEN STAGES 9 AND 16[b]	37
G	M3 STAGE 17; M2 STAGE 17[c]	54
H	M3 STAGE 17; M2 STAGE 18 OR MORE[d]	8
I	M3 STAGE 18 OR MORE	2
TOTAL		506

[a]At stage 9 dentine is exposed on all cusps.

[b]Maxillary Stage F: dentine is exposed on all cusps, but tooth has not reached "Mature-wear".

[c]At stage 17 dentine completely surrounds 2 enamel-cementum island This is analogous to Payne's "mature-wear" phase.

[d]At stage 18 the anterior enamel island is reduced in size.

kill-off stage for the site as a whole is Stage C (M1 in wear, but M2 unworn).

The results obtained for the West Stow maxillae were compared to those for the West Stow mandibles. Initially each tooth in each Saxon mandible was recorded using Payne's stages or eruption and wear. After each tooth was scored, the jaw as a whole was assigned to one of the nine (A-I) age-wear classes defined by Payne (1973: 293) for mandibles as a whole. A total of 1311 mandibles could be assigned to specific stages (see Table 2), and, once again, those jaws which could not be so assigned were eliminated from this portion of the study. As can be seen in figure 1, the results agree remarkably well with the maxillary results.[1] The results shown in figure 1 have been depicted in proportion to the ages suggested for these categories by Payne (1973) following Silver (1964). This kill-pattern will now be considered in detail.

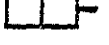
The total number of jaws (mandibles plus maxillae) falling into each of the classes has been calculated, and the proportion of the sample killed-off at each stage has been determined (see Table 3). It is apparent that more than one-third of the West Stow sheep were killed between the ages of six and twelve months (stage C). Nearly one-half were dead before the age of one year, and nearly two-thirds (64%) had been killed by the end of two years. A small but relatively consistent proportion (8-9%) of the sheep were killed in the following age groups (E-F), and a secondary mode of mortality is seen at stage G (4-6 years). Only a very small proportion (6%) of the sheep survive to more than six years (stages H and I).

Turning now to the interpretation, we see that when this pattern is compared to the possible patterns suggested by Payne (1973: 282-284)

[1] Slight differences can be attributed to the later eruption of the maxillary than the mandibular first molar.

TABLE 2

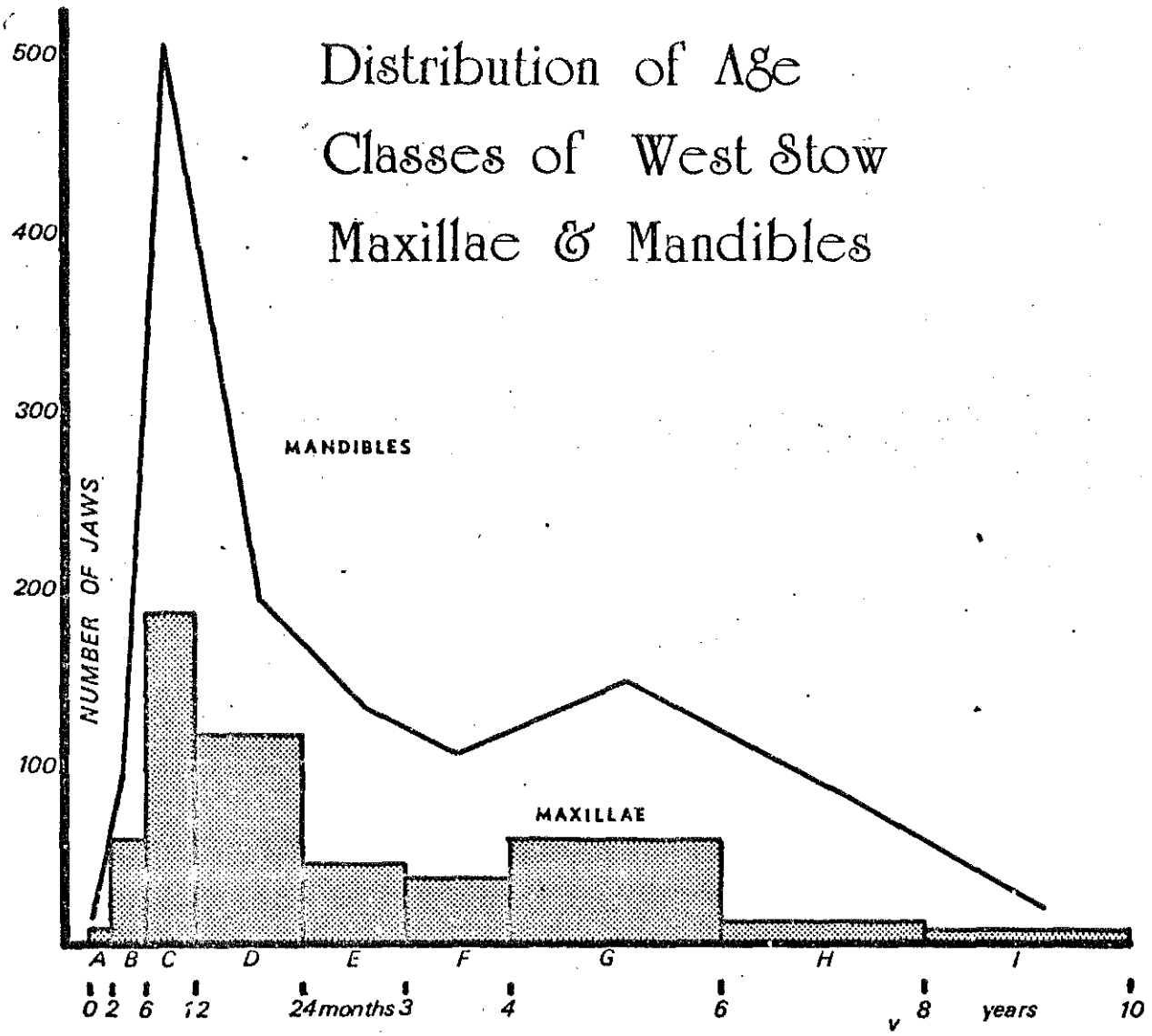
WEAR STAGES ON WEST STOW MANDIBLES

STAGE	DESCRIPTION*	SUGGESTED AGE**	NUMBER OF JAWS
A	DP4 UNWORN	0-2 MONTHS	11
B	DP4 IN WEAR; M1 UNWORN	2-6 MONTHS	93
C	M1 IN WEAR; M2 UNWORN	6-12 MONTHS	504
D	M2 IN WEAR; M3 UNWORN	1-2 YEARS	187
E	M3 IN WEAR; THIRD CUSP UNWORN	2-3 YEARS	129
F	M3 IN WEAR BUT LESS THAN STAGE 	3-4 YEARS	110
G	M3 STAGE ; M2 STAGE	4-6 YEARS	172
H	M3 STAGE ; M2 MORE THAN	6-8 YEARS	86
I	M3 MORE THAN STAGE	8-10 YEARS	19
TOTAL			1311

*After Payne (1973).

**After Silver (1964).

Distribution of Age Classes of West Stow Maxillae & Mandibles



Ages Depicted as Proportional to Those Used by Silver (1964)

TABLE 3

PROPORTION OF WEST STOW SHEEP KILLED AT EACH STAGE

Stage	Number of Jaws*	Proportion
A	14	0.77%
B	149	8.20%
C	688	37.83%
D	306	16.84%
E	172	9.47%
F	147	8.09%
G	226	12.44%
H	96	5.28%
I	21	1.16%

*Mandibles plus maxillae (N = 1817)

for meat, milk, and wool production, the West Stow pattern of mortality shows some differences from all three idealized patterns. It is closer in configuration to the meat and milk schemas than it is to the pattern Payne hypothesizes for wool production, as the West Stow pattern shows a high mortality in the first year of life (comparable to the milk pattern), but mortality in the second year is also quite high (more comparable to the meat pattern). On the other hand, in the West Stow case we see a higher kill-off in the 4 to 6 year age group than is evident in either the meat or milk model, possibly indicating some wool production for domestic use. We should not, however, expect the West Stow data to match exactly Payne's idealized patterns: sheep may be used for all of these purposes. In brief, comparison of the West Stow sheep mortality with Payne's patterns of use suggests that sheep were used for a combination of meat production and dairying. A small amount of wool may have been produced for domestic uses, but the data are incompatible with large scale wool production.

The kill-pattern described here pertains to the West Stow site as a whole. Completion of the computer runs will allow us to determine whether there are any changes through time in this pattern of mortality. The forthcoming summary report will also include kill-pattern data for cattle and pigs.

Bird Bones*

The Anglo-Saxon bird bones were mostly of domestic fowl and a large domestic goose comparable in size to the greylag goose, Anser anser. The few fragments of wild birds were mostly from edible species of water birds or waders (see below). The relative importance of domestic birds in relation to other domestic animals was comparable at West Stow and Hamwih. A total of 431 fragments of domestic fowl and goose could be assigned to Phases 1-3 at West Stow. These contexts produced a total of 15,988 fragments of cattle, sheep/goat, and pig. Melbourne Street, Hamwih produced 1183 fragments of fowl and goose and 45,455 fragments of the major domestic mammals. The relative importance of fowl and goose at West Stow is also roughly comparable to other Saxon sites, although geese are somewhat more numerous at West Stow. The Anglo-Saxon levels at West Stow included a total of 233 fragments of domestic fowl and 198 fragments of goose. At Melbourne Street, the ratio of fowl to goose fragments was 2:1, while at North Elmham (Bramwell 1980) the ratio was a minimum of 37 fowl to a minimum of 18 geese, or approximately 2:1 also. A more detailed breakdown of the domestic birds into the three Anglo-Saxon phases will be included in the forthcoming summary report.

Fowl. The West Stow fowl were measured following von den Driesch's guidelines (1977), and a complete metrical study will be included in the summary report. Preliminary analysis shows that the means of the West Stow domestic fowl measurements are somewhat larger than those from Melbourne Street, Hamwih.

*All bird bones were kindly identified by Jennie Coy of the Faunal Remains Unit, Department of Archaeology, University of Southampton. This discussion is based on her analyses.

The means of the total lengths of West Stow humeri, radii, and femora are 71.6, 61.8, and 77.5 mm., respectively. All three means are significantly larger* than their Melbourne Street counterparts. This difference must be due, at least in part, to the presence of a number of smaller individuals at Melbourne Street. This small "tail" in the size distribution at Melbourne street represents small bantams which may have been selectively bred there. West Stow lacks this small tail.

Despite the absence of these very small bantams, the West Stow fowl are often small and comparable in size to some modern bantam breeds. However, the range in size of the West Stow fowl is very large with birds ranging from modern bantam size, through game fowl size, to occasional larger specimens which compare with some modern breeds in total bone lengths. The general build of these large West Stow fowl is lighter than modern specimens, however. Capons or castrated birds were also kept.

The variability in size of the West Stow fowl makes the mean a poor statistic to use in comparisons with other sites. Comparison of the modal size classes at West Stow and Melbourne Street shows that the distributions are similar and usually bimodal. This bimodality is probably due to sexual dimorphism and may represent hens and capons. Bones of the latter would probably show delayed maturation and reach a greater length before bone growth was complete. Only mature bones were measured, and a discussion of the role of young birds must be left to the summary report.

Nevertheless, in humerus and radius there is an indication

*At $p = 0.05$ using a test of the significance of the difference between two means.

that the modal classes for total lengths are larger at West Stow than at Hamwic (see Table 1). This might suggest that the West Stow birds were stronger in the wing than the Middle Saxon birds from Melbourne street, but further statistical studies are needed to substantiate this assertion.

Table 1	Melbourne Street	West Stow
Humerus	60-65 mm	65-70 mm
Radius	55-60 mm	65-70 mm

Geese. Most goose bones were from a large species of goose which compares closely in all its measurements and anatomical characters with Mid-Saxon geese from Melbourne Street. No goose skulls were preserved at Melbourne Street, but one was found at West Stow (in SFB 2, Saxon Phase 3) showing a distinctive slight inflation of the cranial area adjoining the upper beak. This feature may be distinctive of domestication and needs further study.

Two sterna found in Phase 1 (in SFBs 27 and 37) show considerable depth of keel on the breast compared with wild greylags, greylags in captivity, and later medieval material from Wessex. This would suggest selection for meat production as would be expected.

There were occasional fragments from smaller geese, presumably from a smaller wild species, perhaps a migrant such as Anser brachyrhynchos, the pink-footed goose, or Anser albifrons, the white-front. As the measurement ranges of wild and domestic geese overlap, it would be unwise at this stage to attempt a metrical comparison of West Stow and 'Hamwic' geese.

Ducks. It is not possible to say whether the larger duck

bones were from wild mallard, Anas platyrhynchos, tamed mallard, or true domestic ducks not interbreeding with their wild counterpart. Anatomically there is no indication that they were domestic. The smaller duck bones were of wild species: a medium-sized species comparable with widgeon, and the small teal.

Wild species. The wild species are shown in Table 2 with an indication of the phases in which they were found. Apart from the crane, all these birds are breeding or migrant species for East Anglia today. A species of crane bred in East Anglia until c. 1600 (British Ornithologists' Union 1971). Details of the butchery observed on this species and the other birds will be included in the summary report together with an account of the pathologically altered bones.

Anglo-Saxon Birds	Phase I	Phase II	Phase III	Layer 2
domestic fowl	✓	✓	✓	✓
domestic goose	✓	✓	✓	✓
domestic duck or mallard, Anas platyrhynchos	✓	✓	✓	✓
heron, Ardea cinerea			✓	
swan, Cygnus sp.		✓		
wild goose, Anser sp.		✓		
wild duck, Anas sp. (wigeon-size)	✓	✓		
teal, Anas crecca		✓		
goshawk, Accipiter gentilis				
hen harrier ?, Circus cyaneus		✓		
crane, Grus sp.	✓	✓	✓	✓
moorhen, Gallinula chloropus *				
lapwing, Vanellus vanellus		✓		
golden plover, Pluvialis apricaria		✓		
greenshank, Tringa nebularia		✓		
woodcock, Scolopax rusticola		✓		
snipe, Gallinago gallinago	✓			
common gull, Larus canus		✓		
herring/lesser black-backed gull, Larus fuscus/argentatus		✓		
thrushes, Turdus sp	✓	✓	✓	
starling, Sturnus vulgaris				

* Anglo-Saxon but not phased

Prospect

The completed West Stow faunal study and the resultant archive will have important implications for zooarchaeological research. The use of the computer coding system and the size and well-preserved nature of the West Stow faunal sample will allow for an unusually detail reconstruction of paleoeconomy. Use of the computer will facilitate analyses of butchery and kill patterns, calculations of the relative importance of the animal species, and documentation of changing animal sizes through time. In addition, West Stow will provide detailed osteometric and descriptive information, recorded in a standardized way, which will allow for future comparisons with other sites. Inter-site comparisons are necessary if we are to trace changes and continuity in animal economy through time and space.

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