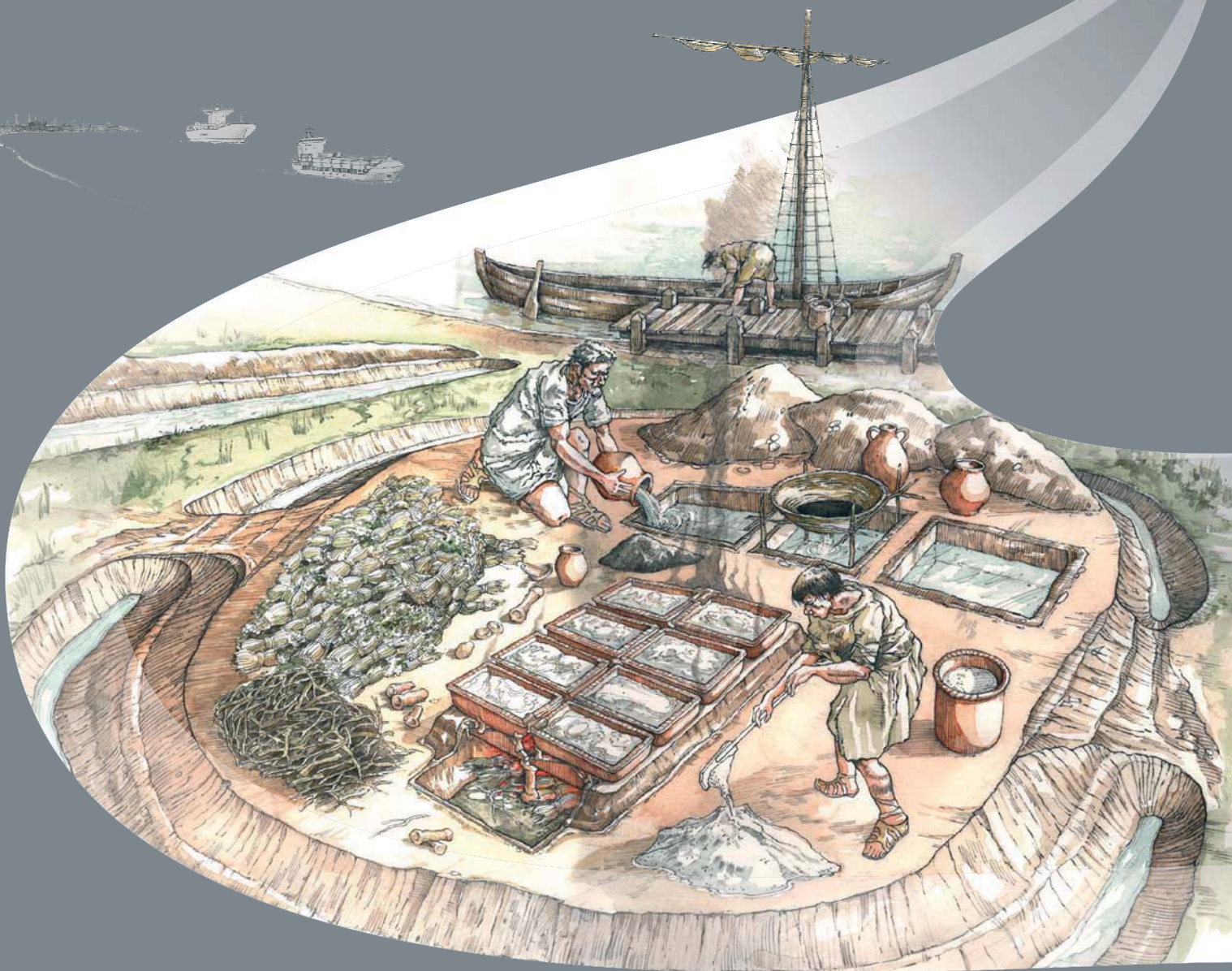


LONDON GATEWAY

IRON AGE AND ROMAN SALT MAKING IN THE THAMES ESTUARY

EXCAVATION AT STANFORD WHARF
NATURE RESERVE, ESSEX



SPECIALIST REPORT 15

ANIMAL BONE

BY LENA STRID

Specialist Report 15

Animal Bone

by Lena Strid

Introduction

The animal bone assemblage from Stanford Wharf Nature Reserve comprises 3842 refitted fragments from archaeological features and naturally deposited layers (Table 15.1). The bones from the sieved soil samples consisted mainly of small fragments of little analytical value. Only the greater than 10mm fraction contained a significant number of speciable bones from large or medium-sized animals. Further, the features and layers were not sealed by heavy clays, indicating a risk of intrusion from burrowing animals, such as rodents and amphibians. For these reasons, only the largest fraction from the sieved soil samples was included in the analysis. A full record of the assemblage, documented in a Microsoft Access database, can be found in the site archive.

The excavation area was divided into four sites: A, B, C and D. The majority of the assemblage came from site A, followed by site B. Sites C and D were subjected to minor archaeological intervention and the assemblages were consequently almost entirely absent of faunal remains.

The Stanford Wharf Nature Reserve site was used as a salt extraction site in the Iron Age and Roman period, and was never a permanent dwelling place. The people who worked here had their main settlement elsewhere in the area and the animal bones found at Stanford Wharf Nature Reserve therefore do not necessarily give an accurate presentation of species ratios and slaughter ages for local livestock as a whole. Despite this limitation, the assemblage is valuable as an indicator of diet choices for temporary industrial settlements and other animal related industrial activities on site.

Methodology

The bones were identified using a comparative skeletal reference collection, in addition to osteological identification manuals. All animal remains were counted and weighed, and where possible identified to species, element, side and zone. An attempt

was made to identify sheep and goat to species using Boessneck *et al.* (1964) and Prummel and Frisch (1986), but no secure identification could be made and the ovicaprine remains were instead classified as 'sheep/goat'. However, as goats are generally rare in relation to sheep in Iron Age and Roman assemblages in south-eastern England, the sheep/goat bones from the Stanford Wharf Nature Reserve site are likely to be sheep. Ribs and vertebrae, with the exception of atlas and axis, were classified by size: 'large mammal', representing cattle, horse and deer; 'medium mammal' representing sheep/goat, pig and large dog; and 'small mammal' representing small dog, cat and hare.

The condition of the bone was graded on a 6-point system (0-5), grade 0 equating to very well preserved bone, and grade 5 indicating that the bone had suffered such structural and attritional damage as to make it unrecognisable.

The minimum number of individuals (MNI) was calculated on the most frequently occurring bone for each species, using Serjeantson's (1996) zoning guide for the post-cranial skeleton and Worley's mandible zoning guide (Table 15.2), and taking into account left and right sides. For the calculation of the number of identified fragments per species (NISP), all identifiable fragments were counted, although bones with modern breaks were refitted. The weight of bone fragments has been recorded in order to give an idea of their size and to facilitate an alternative means of quantification.

For ageing, Habermehl's (1975) data on epiphyseal fusion was used. Tooth wear was recorded using Grant's tooth wear stages (Grant 1982), and correlated with tooth eruption (Habermehl 1975). In order to estimate an age for the animals, the methods of Halstead (1985), Payne (1973) and O'Connor (1988) were used for cattle, sheep/goat and pig respectively. Sex estimation was carried out on cattle pelvises, pig and horse canine teeth, using data from Schmid (1972) and Vretemark (1997).

Measurements were taken according to von den Driesch (1976) using digital callipers with an accuracy of 0.01 mm. Large bones were measured using an osteometric board, with an accuracy of 1 mm. Withers' height of horse was calculated using May (1985).

Overview of assemblages

The preservation level varies greatly (Table 15.3), suggesting that the assemblages

consist both of bones that were deposited rapidly and bones that were lying scattered on the ground for some time prior to deposition. Gnaw marks from carnivores are not very common (Table 15.4), which, since bones were clearly being used as landfill and therefore were available for scavengers, implies that dogs were not common animals on the site, and/or that they were not able to range freely over the site. Gnaw marks from rodents were absent. Burnt bones were rather common in some periods, such as the middle Iron Age (Table 15.4). It is, however, possible that this reflects bone preservation bias rather than deliberate waste management strategies.

Area A

Assemblage from geological units

The bones from the geologically deposited layers belong to four phases: G42 (Interglacial/Devensian), G3 (Neolithic), G4 (Bronze Age) and G5 (Roman to Post-Medieval) (Table 15.5). Close to 85% of the G5 bones came from Roman or late Roman layers. Finds of sheep/goat in G42 layer (6349) and of ?domestic fowl in G3 layer (1213) suggest that these layers have been subjected to intrusions during later periods, as these species were not introduced to Britain until the Neolithic and late Iron Age respectively.

The species represented in the geological layers, cattle, sheep/goat, pig, horse and ?domestic fowl, are commonly found in occupational assemblages from prehistoric and Roman sites. Most animal remains were sub-adult or adult, although three calf bones were found in G3 layer (1284). The G5 layers included bones with butchery marks whose location and form suggest skinning, disarticulation of the hock joint and portioning of limb bones. Due to the above-mentioned strong likelihood for contamination, the faunal remains from the geological layers are not discussed further.

Archaeological assemblage

In most phases, the majority of the archaeological assemblages derive from layers deposited over the site. The layers may have been partially deliberately deposited as a way to create drier surfaces and the bones probably originally came from local waste dumps. The fills of the ditches, channels and pits mostly suggest butchery or kitchen waste. Only a few bones were associated with structures, such as roundhouse (9501) and boathouse (9500), and consequently the faunal remains cannot be used to interpret

the function of these structures. Discrete deposits were noted in one late Roman phase 1 (LR1) pit (1249), and in two late Roman phase 2 (LR2) channels (8512, 8551). These will be discussed further below.

Of the total 3582 bones, 618 (17.3%) could be identified to species (Table 15.6). Speciable bones are more common in the late Roman assemblages (LR1, LR2 and LR) and the analysis will focus on this period.

Cattle dominate in all phases, followed by sheep/goat. Other domestic species present include pig, horse and dog. Cattle are generally the most common animal on Roman sites in Essex and in north Kent (Grimm and Worley 2011; Johnstone and Albarella 2002; Luff 1993; Albarella 2003) where the coastal pastures would be very suitable for cattle grazing (Davis 1995, 181). The presence of bones from all body parts of cattle, sheep/goat, pig and horse suggest that the animals were slaughtered on site.

Wild mammals are only present in the middle Roman and late Roman phases, where small numbers of antler and deer bones were found. The scarcity of evidence for hunting is consistent with assemblages from contemporary rural settlements (Grant 1989, 144) and suggests that venison was a rare addition to the diet. Chop marks on one red deer skull fragment from the late Roman phase suggest that the antlers had been removed, possibly an indication of antler working. This is, however, no clear indication of antler working at the site, since the antlers may have been sold as raw material.

A large whale bone, probably a vertebra, from layer (1536), displayed chop marks from several directions (Fig. 15.1). Whale bones are occasionally found on Roman sites (Bendrey 2008, 254; Jones *et al.* 1985, 172; Marvell and Owen-John 1997; Powell 2010), and it has been suggested that these probably represent utilisation of stranded individuals rather than off shore hunting (Jones *et al.* 1985, 172). It is unclear whether the chop marks derive from meat removal or from shaping the bone for working. If the bone came from a stranded dead whale, the meat would have been spoiled, but if the whale were still alive when stranded, then the meat could have been eaten.

The skeletal element distribution (Tables 15.7-9) shows an over-representation of cattle scapulae (MNI: 7) and metatarsals (MNI: 7). The high number of mandible fragments (MNI: 4) is mostly due to fragmentation rather than over-representation. The case is less clear for metacarpals, which despite a high element count only

amounted to a minimum of four individuals. The metacarpals were not more fragmented than the metatarsals and the discrepancy may be due to chance in connection to siding. Similar element distribution has been observed at the Roman baths at Caerleon (O'Connor 1986, 230) and in Roman York (O'Connor 1988, 82-84). Over-representation and/or dumps of cattle scapulae are usually interpreted as waste from specialised preparation of smoked or salted shoulder of beef for consumers. The scapulae from Stanford Wharf Nature Reserve and from York had been roughly filleted with cleavers. Several of them have perforation through the scapula blade, probably from hanging them on hooks during smoking or storing (Fig. 15.1).

While the over-representation of scapulae would indicate food processing, the over-representation of metapodials is less clear. As metapodials are not covered in flesh, they are therefore not connected to food processing, but rather to slaughter and tannery waste or bone working. Salt is used today for hide preservation, but it is unlikely that it would be used in that manner in the Roman period, as large quantities are needed. There is little evidence for bone working at the site, and the comparative scarcity of phalanges and skull fragments would seem to exclude large-scale cattle slaughter or hide tanning. Perhaps cattle hides were used during the industrial processes at the site and the metapodials were merely an accidental inclusion, possibly used as handles. Neither cattle scapulae nor metapodial over-representation were noted at the salt processing sites at Billingborough (Bronze Age/Iron Age) or at Ower (mid-late Roman) (Coy 1987; Iles 2001). However, pork processing could be evidenced for Ower.

The sheep/goat assemblage is slightly different to the cattle assemblage. In contrast to the earlier periods, the sheep/goat assemblage from the LR2 phase is dominated by metapodials, skull fragments, mandibles and loose teeth (Tables 15.7-9). This element distribution might suggest that the sheep were slaughtered and butchered on site, but that the meat rich body parts were mainly transported elsewhere, perhaps to the main settlement. The scarcity of phalanges could be explained by the small bones being missed during excavation.

While the sample sizes for ageing are not large in any of the phases, cattle are consistently represented by mostly adult animals. A small number of juvenile cattle remains were present in the LR1 and LR2 assemblages, among those a semi-articulated calf deposited in a pit (see below). The scarcity of sub-adult cattle suggests that prime beef cattle were rarely consumed at the site. Dental ageing data for

sheep/goat suggests that they were between two and four years old when slaughtered. Sheep/goat bones with ageable epiphyseal fusion are scarce, but the results do not contradict the dental ageing. Ageable pig bones only occurred in the LR2 assemblage. The scant fusion data give an imprecise age range, although most pigs were probably slaughtered as juveniles or sub-adults, due to their high fecundity and lack of products other than meat. Ageing data for other species is scant: most dog and horse bones were skeletally mature, although one fusing distal metatarsal from a horse indicates an age of death of 1-1.5 years. As horses were not raised for meat, they were mainly killed at the end of their useful working life. Its premature death may have been due to leg fracture, bad temper or illness.

In contemporary rural sites in the region cattle were slaughtered as adults, indicating their use for dairy production and, perhaps more importantly, for traction. Sheep/goat had a consistent widespread age range, typical of a multi-purpose sheep husbandry, where the animals would yield some clips of wool and perhaps up to six lambs, as well as milk and manure, before being slaughtered. Pigs were, as expected, mostly skeletally immature when slaughtered (Grimm and Worley 2011, 45-47; Johnstone and Albarella 2002, 17-18, 26-27, 30). The bone assemblages from the urban sites of Colchester reflect what is probably socio-economic differences: while all sites were dominated by skeletally mature cattle, older cattle were predominantly found in the extra-mural sites and younger cattle representing prime beef were mostly found only at the intra-mural sites (Luff 1993, 55-57).

There were few bones suitable for sexing and measuring in the assemblages and an inter-site comparison is not possible. The data have been summarised in Tables 15.10-11. A withers' height of 140.8cm could be calculated on a single horse radius from LR2 ditch 8512. This is within the normal range of Roman horses from Britain (Johnstone and Albarella 2002, 82). A cattle astragalus from the LR1 assemblage deserves further mention: the greatest lateral and medial length are among the largest of contemporary Roman cattle (University of Southampton 2003; Johnstone and Albarella 2002). It is generally argued that large breeding animals were imported to Britain during the Roman period (Dobney 2001, 38-39). Very large late Roman cattle bones have been found at Great Holts Farm, near Chelmsford, and these may represent imported breeding stock (Albarella 2003, 196-198). The astragalus from Stanford Wharf Nature Reserve could have belonged to a first or second generation crossbred animal.

Butchery marks were most frequent on cattle and occur mainly in the LR1 and LR2 assemblages. Cut marks from skinning were noted on the distal half of three metatarsal shafts. Cut marks on two tarsal bones and proximally on one metatarsal are more ambiguous as they may also occur during disarticulation of the tarsal joint. However, as disarticulation was mostly carried out by heavy cleavers during this period, and indeed, few cut marks from knives were noted in the assemblage, the cut marks on these bones most likely represent skinning. Disarticulation and portioning with a cleaver occurred on the hip joint where the caput had been chopped off the femur, and on the elbow joint where one radius had been chopped off at the metaphysis and three distal humeri had been split axially. Utilisation of head meat is evidenced by one mandible articular process being chopped off and one zygomatic bone displaying two diagonal chop marks. One mandible had deep chop marks on the ventral side at the anterior part of the mandible, suggesting removal of the mouth. Most filleting seem to have been carried out by cleavers, resulting in the typical blade marks seen on many long bones on Roman sites (Maltby 2007, 64). At Stanford Wharf Nature Reserve, these were noted on two humeri and nine scapulae. A total of three scapulae, all from the scapula deposit in channel (8551), had perforations in the blades, possibly from hanging the joint. The axial splitting of a tibia shaft and transverse severing of two metatarsals suggest marrow extraction. One of these metatarsals also had been chopped, diagonally into the proximal metaphysis. This kind of butchery mark also occurred on two other cattle metatarsals, one from geological assemblage (G5). All three chops were unsuccessful in splitting the bone. It is unclear whether the intention was to sever the tendons, which may have succeeded, or whether a second attempt successfully hit the tarsal joint.

Butchery marks on other species include cut marks from filleting on a late Roman horse humerus and several chop marks on a whale bone from LR2. Horse was normally not eaten in Roman Britain and the presence of cut marks bears mentioning. The bone may represent a period of food shortage, or the flesh may have been used to feed dogs.

The pathological conditions observed in the assemblage only affected cattle metapodials and foot bones. In most cases the conditions have been associated with the use of cattle for traction (Albarella and Davis 1996, 42; Bartosiewicz *et al.* 1997, 32-50). The proximal joint surface on two metatarsals displayed pathological bone growth, pitting and bone remodelling, all signs of degenerative joint disease. One of

these metatarsals also had several small abscesses in the pathological bone growth at the anterior side of the proximal metaphysis. Three first phalanges had lipping and exostoses at the joint surfaces and one metacarpal had a medial extension of the distal medial condyle. One cattle metatarsal had a substantial ridge on the medial part of the anterior side of the shaft. The aetiology is unknown but has been linked to muscular stress and ageing in sheep (Thomas and Grimm 2011).

The assemblage contained a small number of discrete deposits of animal bone. Two of these follow the definitions for Associated Bone Groups (cf. Grant 1984; Hill 1995) and may be of a ritual nature. A semi-articulated calf was found in one of the middle fills in LR1 pit 1249. Most of the skeleton is present, only lacking the phalanges and the metacarpals. Other finds from this fill include a leather sole, two complete pots, and a small number of disarticulated animal bones and pot sherds. Deposits of entire carcasses can have a ritual meaning but can also be profane disposal of natural mortalities. While the placement in the middle of the pit would argue against a ritual interpretation, since such deposits are commonly found at the base of pits, the presence of two complete pots would suggest otherwise. However, the analysis of the insect remains from the pit show ubiquitous remains of taxa connected to cess also within the pots (Allison, specialist report 18). This would suggest that the calf represents a profane deposit of an animal not considered suitable for food.

A complete horse skull and a maxillary fragment of another horse skull were found in the single fill of LR1 channel 8512. The excavated cut was rather large (1.20x3.50m) and it is not clear if the skulls were situated near each other or whether they were placed at the base of the ditch or in the middle of the fill. Due to the lack of details, the interpretation must remain inconclusive.

Of the seven cattle scapulae in LR2 channel 8551, all but one scapula show evidence of butchery from coarse filleting with a cleaver and three have perforations in the blade. As mentioned above, similar deposits of butchered scapulae have been found in other Roman settlements, and have been interpreted as waste from processing of salted or smoked shoulder of beef.

Area B

Geological assemblage

The geological assemblage from Area B comprises four bones from layer (4552). The only bone that could be identified to species is a sheep/goat pelvis fragment.

Archaeological assemblage

The archaeological bones mostly derive from the late Roman phase (Table 15.12). The smaller assemblages from the middle Iron Age, early Roman and the unphased Roman period yielded little information and will therefore not be discussed further.

The late Roman assemblage is dominated by cattle, although there is no substantial over-representation of lower limb bones or mandibles as were noticed in the contemporary assemblage from site A (see above). The ageing data are scant; nevertheless, most animals were adult or sub-adult at the time of death. Butchery marks were present on one pig humerus, where chop marks on the distal part of the bone suggest disarticulation of the joint, and on one cattle metatarsal, where cut marks at the proximal joint indicate skinning or disarticulation. A cattle metacarpal had minor pathological bone growth below the proximal joint, possibly deriving from an infection or muscle strain.

Area C

The assemblage from Area C comprised two unidentifiable fragments from geological layer 3035, dated to the early Roman period.

Area D

The only bone from Site D was a horse radius, which was recovered from channel fill 2115, dated to the LR2 phase. The radius was unfused distally, indicating the horse was younger than 3.5 years old when it died.

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Animal Bone Tables

TABLE 15.1: NUMBER OF HAND-COLLECTED AND SIEVED ANIMAL BONE FRAGMENTS FROM ALL PHASES AT THE STANFORD WHARF NATURE RESERVE. ONLY HAND-COLLECTED BONES AND BONES FROM THE GREATER THAN 10 FRACTION WERE INCLUDED IN THE ANALYSIS

Site	Period	Hand-collected fragments	Sieved fragments				Total number of fragments
			>10mm	10-4mm	4-2mm	2-0.5mm	
A	G42	4					4
	G3	133					133
	G4	4		2			6
	G5	169	2	4			175
	IA		1	6			7
	MIA	45	8	34	1		88
	ER	124		16			140
	MR	16					16
	MR-LR	2					2
	LR1	588	36	45	67		736
	LR2	1644	251	181	55	1	2132
	LR	263	41	2			306
	R	27		2			29
IA-LR	224	1	8	2		235	
B	G5	4			4		8
	MIA	10	10	337			347
	ER	34	1	16	9	2	62
	LR	177	6	38	1	6	228
	R	14		5	4		23
	MED	10					10
C	G5	2					2
D	LR2	1					1
TOTAL		3485	357	696	143	9	

TABLE 15.2: FAY WORLEY'S DEFINITIONS FOR MAMMALIAN MANDIBULAR ZONES USED DURING BONE RECORDING

Zone	Mandible
1	Coronoid process
2	Condyle
3	Ascending ramus
4	Goneal angle
5	Molar region of the body
6	Premolar region of the body
7	Diastema with mental foramen
8	Incisor region and mandibular symphysis

TABLE 15.3: PRESERVATION LEVEL FOR BONES FROM ALL PHASES OF THE STANFORD WHARF NATURE RESERVE ASSEMBLAGE

Site	Phase	N	0	1	2	3	4	5
A	G42	4		25.0%	50.0%	25.0%		
	G3	133		94.0%	3.0%	3.0%		
	G4	4		25.0%	25.0%		50.0%	
	G5	171	1.8%	57.3%	30.4%	6.4%	4.1%	
	IA	1		100.0%				
	MIA	53	1.9%	32.1%	49.1%	9.4%	7.5%	
	ER	124		7.3%	85.5%	7.3%		
	MR	16		31.3%	56.3%	6.3%		
	MR-LR	2				100.0%		
	LR1	624	1.0%	27.1%	21.5%	36.9%	4.6%	0.8%
	LR2	1895	1.0%	11.6%	32.3%	50.9%	4.3%	
	LR	304		10.2%	24.3%	53.3%	12.2%	
	R	27	7.4%	18.5%	33.3%	37.0%	3.7%	
IA-LR	225	1.3%	0.4%	0.9%	97.3%			
B	G5	4			25.0%	75.0%		
	MIA	10		90.0%	10.0%			
	ER	35	5.9%	5.9%	14.7%	52.9%	23.5%	
	LR	183	2.3%	11.9%	31.1%	23.2%	35.0%	
	R	14	28.6%			14.3%	57.1%	
	MED	10	20.0%			80.0%		
C	G5	2				100.0%		
D	LR2	1		100.0%				

TABLE 15.4: BURNT AND GNAWED BONES FROM ALL PHASES OF THE STANFORD WHARF NATURE RESERVE ASSEMBLAGE

Site	Phase	N	Burnt bone	Burnt bone %	Gnawed bone	Gnawed bone %
A	G42	4				
	G3	133				
	G4	4				
	G5	171	11	6.4%	2	1.2%
	IA	1	1	100.0%		
	MIA	53	10	18.9%		
	ER	124	2	1.6%		
	MR	16				
	MR-LR	2				
	LR1	624	15	2.4%	16	2.6%
	LR2	1895	75	4.0%	21	1.1%
	LR	304	5	1.6%	5	1.6%
	R	27			2	7.4%
IA-LR	225			1	0.4%	
B	G5	4				
	MIA	10	10	100.0%		
	ER	35	3	8.8%	1	2.9%
	LR	183	1	0.5%	6	3.3%
	R	14				
	MED	10				
C	G5	2				
D	LR2	1				

TABLE 15.5: IDENTIFIED SPECIES/PHASE FOR ALL GEOLOGICAL PHASES FROM THE SITE A ASSEMBLAGE AT THE STANFORD WHARF NATURE RESERVE. MNI WITHIN PARENTHESIS.

	G42	G3	G4	G5
Species				
Cattle	1 (1)	3 (1)		27 (2)
Sheep/goat	1 (1)			5 (1)
Pig				5 (1)
Horse				1 (1)
?Domestic fowl		2 (1)		
Medium mammal		1	1	3
Large mammal	1	5	1	42
Indeterminate	1	122	2	87
Total fragment count	4	133	4	170
Total weight (g)	39	232	3	2408

TABLE 15.6: IDENTIFIED SPECIES/PHASE FOR ALL ARCHAEOLOGICAL PHASES FROM THE SITE A ASSEMBLAGE AT THE STANFORD WHARF NATURE RESERVE. MNI WITHIN PARENTHESIS.

***: INCL. ARTICULATED CALF SKELETON (65 FRAGMENTS).**

Species	IA	MIA	ER	MR	MR-LR	LR1	LR2	LR	R	IA-LR
Cattle	1 (1)	5 (1)	9 (1)	5 (2)	1 (1)	168* (5)	209 (8)	57 (2)	4 (1)	3 (1)
Sheep/goat		5 (1)	4 (1)			8 (1)	53 (3)	4 (1)	1 (1)	3 (1)
Pig			2 (1)			4 (1)	22 (1)	3 (1)	1 (1)	1 (1)
Horse		2 (1)				7 (1)	15 (2)	1 (1)		
Deer sp.							18 (1)			
Red deer							1 (1)			
Roe deer				1 (1)						
Dog							1 (1)			
Cetacean						1 (1)				
Indet. bird						2				
Small mammal							1			
Medium mammal		4	1	1		11	47	7		
Large mammal		8	35	4	1	66	297	16	10	
Indeterminate		29	73	5		357	1231	216	11	218
Total fragment count	1	53	124	16	2	624	1895	304	27	225
Total weight (g)	9	195	1114	524	94	10137	22011	2245	259	278

TABLE 15.7: ANATOMICAL DISTRIBUTION OF ALL SPECIES FROM THE LR PHASE AT THE STANFORD WHARF NATURE RESERVE

	Cattle	Sheep/ goat	Pig	Horse	Medium mammal	Large mammal	Indet.
Skull	4						
Mandible	13	1	1				
Loose teeth	18	1	2				
Vertebra						2	
Rib						5	
Scapula	1						
Humerus	2			1			
Radius	2						
Pelvis	1						
Femur	2						
Patella	1						
Tibia	2	2					
Calcaneus	1						
Astragalus	2						
Metatarsal	4						
Phalanx 1	2						
Phalanx 2	2						
Longbone					7	5	
Indet							216
TOTAL	57	4	3	1	7	16	216
Weight (g)	1215	23	52	145	5	160	640

TABLE 15.8: ANATOMICAL DISTRIBUTION OF ALL SPECIES FROM THE LR1 PHASE AT THE STANFORD WHARF NATURE RESERVE. BONES FROM ARTICULATED CALF WITHIN PARENTHESIS

	Cattle	Sheep/ goat	Pig	Horse	Red deer	Indet. bird	Medium mammal	Large mammal	Indet
Homcore	1								
Skull	7 (1)		1		1				
Mandible	18 (2)		2						
Loose teeth	20	2	1	3					
Axis	1 (1)								
Vertebra	7 (7)							12	
Rib	30 (30)						1	8	
Scapula	8 (2)							3	
Humerus	9 (4)				2			1	
Radius	5 (2)	2							
Carpal bones	1			1					
Metacarpal	7	2							
Pelvis	6 (4)								
Femur	3 (2)								
Tibia	7 (1)	1							
Calcaneus	7 (2)								
Astragalus	4 (2)	1							
Metatarsal	9 (2)								
Phalanx 1	6			1					
Phalanx 2	3								
Phalanx 3	1			1					
Indet. metapodial	5			1				1	
Longbone	3 (3)						10	36	
Indet								3	357
TOTAL	168 (65)	8	4	7	2	1	11	66	357
Weight (g)	7419 (952)	35	112	182	1	41	47	1158	1142

TABLE 15.9: ANATOMICAL DISTRIBUTION OF ALL SPECIES FROM THE LR2 PHASE AT THE STANFORD WHARF NATURE RESERVE

	Cattle	Sheep/ goat	Pig	Horse	Dog	Deer	Cet- acean	Small mammal	Medium mammal	Large mammal	Indet
Antler						18					
Horncore	1										
Skull	1	3	1	2					1		
Mandible	16	8	5		1					2	
Loose teeth	33	23	8	8						2	
Atlas											
Axis											
Vertebra									3	43	
Rib									4	56	
Sacrum										1	
Scapula	16									4	
Humerus	5										
Radius	3		1	1							
Ulna	4		1	1							
Carpal bones	9										
Metacarpal	22	5									
Pelvis	4		1							1	
Femur	5	1								2	
Patella											
Tibia	4	2									
Fibula											
Calcaneus	4										
Astragalus	4										
Tarsal bones	2		1								
Metatarsal	27			1							
Phalanx 1	22		1	1							
Phalanx 2	12										
Phalanx 3	7										
Indet. metapodial	8	1	3								
Longbone				1				1	39	179	
Indet							1			7	1231
TOTAL	209	53	22	15	1	18	1	1	47	297	1231
Weight (g)	11323	406	189	3312	9	27	272	0	109	3921	2385

TABLE 15.10: SEX ESTIMATION OF CATTLE, SHEEP/GOAT AND PIG FROM ALL PHASES AND SITES AT THE STANFORD WHARF NATURE RESERVE

Site	Species	Element	Phase	Female	Male	Castrate
A	Cattle	Pelvis	LR1		1	
			LR2		3	
			R			1?
	Pig	Mandibular canine	LR	1		
			LR1		1	
			LR2	2		
			R		1	
B	Pig	Maxillary canine	LR	1		

TABLE 15.11: GREATEST LENGTH AND GREATEST DISTAL WIDTH OF CATTLE, SHEEP/GOAT AND HORSE BONES FROM ALL PHASES IN SITE A AT THE STANFORD WHARF NATURE RESERVE

Species	Bone	Measurement	Phase	N	Mean	Min	Max
Cattle	Metacarpal	Bd	LR2	3	57.4	56.4	59.1
	Metatarsal	Bd	LR1	1	52.1		
			LR2	2	58.0	51.7	64.3
	Radius	Bd	LR2	1	78.2		
	Tibia	Bd	LR	1	62.4		
			LR1	1	59.0		
LR2			1	57.3			
Sheep/goat	Tibia	Bd	LR	1	27.8		
			LR2	1	27.2		
Horse	Radius	GL	LR2	1	342.5		
		Bd		1	70.8		

TABLE 15.12: IDENTIFIED SPECIES/PHASE FOR ALL ARCHAEOLOGICAL PHASES FROM THE SITE B ASSEMBLAGE AT THE STANFORD WHARF NATURE RESERVE. MNI WITHIN PARENTHESIS.

Species	MIA	ER	LR	R	MED
Cattle		1 (1)	19 (2)	1 (1)	
Sheep/goat	1 (1)	6 (1)	9 (2)	5 (1)	
Pig			5 (1)		1 (1)
Horse			9 (1)		
Dog			2 (1)		
Canid			3 (1)		
Small mammal		3	2		1
Medium mammal	1	5	16		1
Large mammal		1	23		
Indeterminate	8	19	95	8	7
Total fragment count	10	35	183	14	10
Total weight (g)	8	114	2419	34	22



Figure 15.1: Pierced cattle scapulae from ditch 8551 and a whale bone from 5191

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