the decapitation. The presence of anaemia in the population was indicated by the finding of several cases of cribra orbitalia, while two individuals may have suffered from one of the major infectious diseases of the past, tuberculosis. Not surprisingly, osteoarthritis was the commonest disease recorded for the adults.

Despite poor preservation, therefore, the skeletons from this church at Thetford represent an interesting addition to other groups excavated in the area.

Methodology
(microfiche)

List of Human Skeletal Material
(microfiche)

Number	Sex	Age (yrs)	Stature
F13		1-3	
16		1-2	
22		<1¼	
27		9-12	
35		1-3	
37		Infant	
42		1-3	
44	?F	45+	1.55 m
57		5-8	
59		4-6	
60		16-18	
62	M	45+	1.63 m
63	F	35-45	1.54 m
64	M	35-45	1.72 m
75	M	35-45	1.78 m
76	?M	Adult	
77		5-7	
78		3-6	
79	M	25-35	1.68 m
80		<1	
83		2-4	
84A		1-2	
84B		<1	
85		<1¼	
92	F	35-45	
97		7-10	
98		<1¼	
99A	F	45+	
99B		<1	
100	F	25-35	1.58 m
102		4-6	
103		1-2	
104	M	25-35	1.73 m
107	M	35-45	1.63 m
108	?M	25-35	1.69 m
109	?F	35-45	1.54 m
110	M	45+	1.68 m
112		4-7	
125	M	35-45	1.71 m
133	F	25-35	1.53 m
139		Adult	
151		2-4	
153	M	45+	1.66 m
160	M	20-25	1.73 m
165		6-10	
169		1-3	
170	F	35-45	1.62 m
172		7-11	
177		14-18	
183		Infant	
210	F	25-35	1.54 m
229	M	35-45	1.82 m
230		Infant	
232	F	25-35	1.45 m
233		4-6	
234	?F	Adult	
235		5-8	
236		4-10	
237		3-5	
239	F	35-45	1.62 m
247	F	25-35	1.55 m
248	?F	35-45	1.66 m
249	M	35-45	1.72 m
259		Infant	
260		7-9	
264	M	35-45	1.65 m
265	?F	45+	1.61 m
266		13-16	
267	M	35-45	1.73 m
269	?F	20-25	1.61 m
272	?F	20-25	1.64 m
277	M	45+	1.66 m
278	?F	Adult	
281		2-3	
298	M	35-45	1.74 m
331		16-20	
347	?M	20-25	1.70 m
367	?F	45+	1.55 m

Table 28. Summary of articulated skeletons

II. Animal and Bird Bone

by Gillian Jones

Summary
Bone of Early Saxon to early sixteenth-century date from Brandon Road was studied, the main quantity being tenth to twelfth century. Summary of the bone by zone and fragment count gives information on differences in survival, deposition and the proportions of the main species. The scattered and varying character of the bone is related to the use of different areas of the site. Bone density was greater in the eleventh to twelfth centuries than in the tenth century.

The order of importance of the three main domesticates was sheep, cattle, then pig in the number of animals slaughtered, and cattle, sheep then pig in the number of bone fragments and also the quantity of meat produced. Sheep increased in importance relative to cattle through the tenth to sixteenth centuries, and pig remained steady, probably declining in numbers in the fifteenth/early sixteenth century.

In cattle, dental and epiphysial fusion data show variation in the mortality pattern over time and the slaughter of some adults at a moderately young age. Definition of the later wear stages of the lower third molar is discussed. There is evidence of sexual dimorphism in metacarpal bones from the Thetford sites, of the specialisation of hornworking in one area of the town, and of a slight decrease in the size of cattle since the Middle Saxon period.

The age structure of the sheep found indicates slaughter of some sheep in their second year during the main periods of the Brandon Road site but the keeping of both sexes into maturity in the later medieval period. Adult sheep were increasingly kept to a greater age. Wear-rates at all times were faster than on modern sheep and this may relate to folding and overgrazing of winter pasture. Some very small sheep were present in the fifteenth to early sixteenth centuries.

With pigs, changes in the age structure in the tenth to twelfth centuries suggest an increasing preference for fattening young pigs fairly late, but by the latest phases remains of piglets became more frequent. In the fifteenth and early sixteenth centuries there were a few extremely large pigs which may be from the large, long-legged pigs described as the old type of English pig at the time of the eighteenth-century agricultural improvements.

Other species are shown on Tables 35 and 44 (wild bird). Horse remains were few, though scattered, and general carting was probably done with oxen. Somewhat larger horses were present in the later medieval phases. Higher numbers and frequency (the percentage occurrence of a species in the total of features) of dog, cat and fowl bones coincides with areas of domestic occupation. There was little hunting or fowling, and even fragments of antler were not found in the tenth to fourteenth-century samples. Black rat was present in the eleventh–twelfth century. Rabbit was frequent by the fifteenth century; bones tended to come from one area, where was also found a ferret skull, and this is a likely site for a Late Medieval rabbit warren. Fowl bones showed two size groupings, interpreted as sexual dimorphism. Bones from the wing of geese were common, and goose wings may have been traded for feathers or for making bone flutes. Wild birds included red kite, crane and chough, all now absent from the area.

Descriptions of dental and bone pathology and brief notes on butchery marks are given.

Archive

The bones are stored by the Norfolk Museums Service, mainly in grid-square order. Well-preserved cattle and sheep horncores, mandibles, pelves and metapodials were separated and are stored together, as are the pathological specimens, and bird and miscellaneous bones of interest. There are photographs, sketches, notes and some radiographs of the pathological bones, and sketches and identifications of the worked bone finds.

Introduction

A large quantity of bone (over 21,000 fragments) was recovered from the excavations in 1964–6. Bone was collected by hand and although no sieving was done the policy was to collect all bone whether complete or fragmentary. Most was from the large number of pits. The main quantity of material was from the Late Saxon (tenth century, Period III) and early medieval (eleventh to twelfth centuries, Period IV) periods, when the town was at the height of its importance. Exact separation of these two phases was not possible, for reasons of residuality and dating of the pottery (see main text). Occasionally there is also a possibility of the intrusion of later material into upper layers of Period III pits. Some of the pits were not fully excavated, so some primary deposits are missing. The bones were moderately well-preserved.

There is a small amount of early Saxon (Period II) bone, all in a very eroded condition. The bone from the late twelfth to fourteenth-century period (Period V) was considerable in quantity but was from features with residual earlier pottery, and a less detailed record of this material was made. On Table 35 the Period V bone is shown in two columns, the first where features contain-

	II ES	III 10thC			IV 11th-12thC			V I 12th-14thC			VI I 14th-15thC		VII I 15th-e16th	
		BN	%	MN	BN	%	MN	BN	%	BN*	BN	%	BN	%
Cattle	33	1427	*44*	40	1757	*39*	30	229	*30*	(1051)	117	*31*	243	*35*
Sheep/Goat	13	1045	*33*	43	1574	*35*	59	381	*50*	(1065)	151	*40*	298	*43*
Goat		5			3			1		(1)				
Pig	4	483	*15*	23	687	*15*	37	104	*14*	(411)	56	*15*	66	*10*
Horse	3	49	*1.5*		43	*1*		7	*0.9*	(21)	13	*3.4*	19	*2.7*
Dog		22	*0.7*		75+1sk	*1.7*		6	*0.8*	(18)			2	
Cat		27+2sk	*0.9*		74	*1.7*		7	*0.9*	(14)	1			
Hedgehog						1								
Rabbit		1*			1*						8+3sk	*2.9*	26	*3.8*
Hare					1			1		(4)				
Rat					1									
Fox					2					(1)				
Ferret													1	
Red deer					1					(1)	2a			
Fallow		1*												
Roe		1												
Fowl		100	*3.1*		166	*3.7*		18	*2.3*	(98)	13		19	
Goose *cf.*Dom.		35	*1.1*		69	*1.5*		7	*0.9*	(33)	8		11	
Duck *cf.*Mallard		15			8			1		(5)	1		3	
Wild bird					6			4		(2)	5		4	
Total identified 11397	53	2313			4470			766		(2725)	378		692	
Total bone 21458	109	5842			7785			1150		(4799)	629		1144	

Notes: BN = number of bones; MN = minimum number (see text); * = dating uncertain (see text); a = antler

Table 35. Summary of Mammal and Bird Bones

ed less than 50% residual pottery by sherd count and the second, in parentheses, where there was more than 50%. Rather less severe problems of residuality apply to the smaller quantities of bone from later periods (VI and VII, late fourteenth to fifteenth century and late fifteenth to early sixteenth century). The situation and geology of Thetford is referred to in the general introduction and discussion.

Method

The total number of bones (BN) consists of all identified to species level including shaft fragments and fairly complete vertebrae but excluding ribs and fragmentary vertebrae. The figure gives a measure of the bone quantities studied. Bones were recorded on two lists: a 'zone' and a fragments lists. On the zone list were recorded complete bones or pieces as follows:

Skull – substantial pieces of horncore, frontal, lacrimal, malar, parietal, squamous temporal, occipital, premaxilla;
– upper jaw and mandible with at least one tooth present;
– loose teeth.

Long bones – where more than half the proximal end, shaft or distal end was present (and see note below on cattle and on shaft pieces). Where an immature bone was found with its epiphysis this was counted as one bone but otherwise both metaphyses and epiphyses were counted.

Other bones – more than half the following bones or bone elements: vertebra; scapula – the distal end; ulna – the proximal articulation; pelvis – the iliac, ischial and/or pubic part of the acetabulum; patella; astragalus; calcaneum – the articulation; phalanges.

With cattle, substantial pieces even if less than half complete were included since these large bones are normally more fragmented than with sheep and pig and important epiphysial fusion data would be lost if such pieces were not recorded in detail. But if, for example, two pieces of proximal tibia came from one layer and could be from the same individual, only one was allotted to the zone list.

With long bone shafts the zone count includes all where more than half the bone shaft was present and in addition the following smaller areas of bone: the distal posterior part of the humerus, the proximal ulnar groove of the radius and the supracondylar fossa of the femur. Ideally these counts should be kept separate but for brevity's sake they have been combined. (Note that proximal, shaft and distal ends in the zone list cannot be added to arrive at the number of bones present, since one complete bone will figure in all three.)

Many bone elements occur uniquely in the skeleton, *e.g.* atlas vertebra, left proximal radius, and these are underlined and suggest the minimum number of individuals represented by that bone element.

Small pieces of bone were recorded on the fragments list as a simple count of each bone in the skeleton; *i.e.* they do not appear on the zone list.

Both in recording and presenting the data there is a conflict in the need for information on fragmentation, preservation, epiphysial fusion and minimum numbers, and inevitably there is a conflict between brevity and detail. The present case by no means achieves a solution, but the degree of detail provides a good deal more information than a simple tally of the numbers of each bone in the skeleton (Watson 1979).

Discussion of the skeletal analyses of bone from Periods III and IV

The record made of the bones is an end result of study, recovery, survival, deposition, household management, the slaughtered animals and the live flocks and herds (see Rackham 1983). From the summary of the bones shown on Tables 36 and 37 various observations, often of a rather circumstantial nature, can be made on these stages. Clearly it is the later stages listed above which are of interest, but some of the numerical differences may be explained by the effect of earlier stages with consequent effects on interpretation of species importance and the bone deposits in this area of the town. Examples are taken from Period III (Table 36) except where stated. The analysis for Period IV is Table 37.

With cattle the number of distal tibiae, calcanea and astragali (the two largest bones of the hock joint at the lower end of the hind leg) were found in similar numbers, whereas in sheep very few calcanea or astragali were found – only three astragali against twenty-three left and twenty-six right distal tibiae. It is possible sheep astragali were removed for other uses (*e.g.* as gaming pieces) but lack of recovery of these fairly small bones is more likely. Similarly, there were few phalangeal bones and no caudal vertebrae of sheep or pig.

None of the soil was sieved and it is therefore expected that small bones and bones of small species are under-represented, as was demonstrated by comparison of the sieved and hand collected samples of fish bones at Site 1092, Thetford (A.K.G. Jones 1984).

Generally the bones of cattle were more fragmented that those of sheep or pig. The proportion of bone recorded on the zone list gives a rough indication of fragmentation and it is, as expected, lower for cattle (67%) than for sheep (76%) or pig (84%). Taking the tibia as an example, for sheep and pig numbers of shaft and distal ends more-than-half-complete are quite close, whereas with cattle the long tibia shaft was usually found broken into pieces and the zone shaft figure is therefore much lower than for the distal end. The number of sheep radii represented by the shaft is high: the total left plus right shafts is seventy-one with a total of ninety-seven radius bones, which compares with fourteen and sixty-six for cattle, *i.e.* sheep bones are far more likely to be in a fairly complete state. Chopmarks on cattle bones show that this is a real depositional difference but it may be exaggerated as a result of survival and recovery.

Comparison of the number of elements of the left and right side is interesting in that it is usually, presumably, a random effect and demonstrates the extent to which variation can be expected from this cause alone. In general, sidedness does appear to be random. However, it is curious that in the Period III cattle bones the right cannon bone is much more frequent than the left, both for the metacarpal and the metatarsal. The difference is unlikely to have arisen by chance (it is significant at the 0.01 level) and some difference in disposal seems likely. The difference does not extend to the hock bones or upper hind limb bones, but for the upper fore limb the right side is somewhat more frequent than the left (significant at the 0.05 level). It could be that in the distribution system one side was more often allocated or sold to this area of the town. The greater difference in the metapodials may mean, for example, a preference for one side in bone-working, or the retention of one side with the hide. Of the worked metapodia, all three from Period III and all four from Period IV were from the right side. It is possible, then, that some of the unworked metapodia (many of them complete bones) are unused bone-working material.

	Cattle					Sheep/Goat					Pig					Total	
	No.of Bones		Zone L	Zone R	BN		Zone L	Zone R	BN		Zone L	Zone R					
horncore	19		*8*	*7*	18	sh	5	*11*									hc
					3	gt	1	2									
skull	146		75		73		60		45		36						sk
maxilla	31		*19*	*12*	20		*7*	*11*	32		*16*	*20*					mx
mandible	127		*31*	*34*	112		*43*	*37*	60		*15*	*23*					md
loose teeth	63		54		41		37		33		27						t
Head	386		(225)		264		(212)		170		(132)					820	
vert.,atlas			*15*				*12*				*12*						at
axis			7				*10*				*1*ax						
other cerv.			33				18				4						cv
thoracic			34				10				14						th
lumbar			28				28				10						lu
sacrum			10				1				–						sa
caudal			9				–				–						cd
sub-total	141		136		79		79		42		41						vt
scapula	117	d	*12*	*20*	79	d	*13*	*19*	39	d	*12*	*12*					sc
humerus	69	p	*5*	*4*	57	p	*2*	*1*	43	p	*1*	*2*					hu
		s	*10*	*14*		s	*15*	*16*		s	*19*	*18*					
		d	*10*	*12*		d	*6*	*13*		d	*9*	*5*					
radius	66	p	*9*	*21*	97	p	*24*	*17*	21	p	*7*	*5*					ra
		s	*6*	*8*		s	*35*	*36*		s	*5*	*9*					
		d	*9*	*11*		d	*12*	*12*		d	*2*	*2*					
ulna	24	p	*10*	*13*	18	p	*13*	*9*	25	p	*13*	*12*					ul
pelvis	80	il	*16*	*15*	71	il	*13*	*15*	26	il	*4*	*6*					pe
		is	*11*	*14*		is	*18*	*13*		is	*6*	*6*					
		pu	*6*	*13*		pu	*9*	*5*		pu	–	4					
femur	73	p	*8*	*5*	59	p	*3*	*3*	17	p	*1*	*1*					fe
		s	*15*	*13*		s	*19*	*10*		s	7	*5*					
		d	*7*	*7*		d	*9*	*4*		*d*	*1*	*2*					
patella	8		8						fib.7								
tibia	106	p	*9*	*9*	135	p	*1*	*6*	36	p	*5*	*3*					ti
		s	*7*	*12*		s	*31*	*35*		s	*8*	*12*					
		d	*21*	*19*		d	*23*	*26*		d	*9*	*6*					
Body	684		(444)		595		(435)		256		(218)					1535	
calcaneum			*22*	*17*			*11*	*2*			*1*	*6*					ca
astragalus			*17*	*11*			*2*	*1*			*2*	*1*					as
carpal/tars.	199		17						10								c/t
metacarpal	77	p	*13* mc	*40*	60	p	*14*	*18*	15		III IV III IV						
		s	*15*	*33*		s	*14*	*23*		p	*3* – *5* *6*						
		d	*12*	*30*		d	*9*	*11*		d	*2* – *6* *6*						
metatarsal	78	p	*15*	*26*	95	p	*25*	*22*	12	p	*2* *3* *2* *5*						mt
		s	*14*	*29*		s	*33*	*33*	d		*2* *1* *2* *4*						
		d	*13*	*20*		d	*12*	*8*									
metapodial	5								abax 14 (mp+ph)								
phalanx	98	1st	63		16	1st	13		6		6						ph
		2nd	18			2nd	3			2nd	–						
		3rd	17			3rd	–			3rd	–						
Foot	357		(291)		186		(154)		57		(57)					600	
TOTAL	1427		(960)		1050		(801)		483		(407)					2960	

Unidentified	C/h-size	S/p-size	Small	Bird
vertebra	157	58	–	–
rib	643	740	1	5
other	623	374	5	23
Total 2629	1423	1172	6	28

Zone – see text; p – proximal; s – shaft; d – distal; il/is/pu – iliac/ischial/pubic part of acetabulum; C/h – cattle/horse; S/p – sheep/pig

Table 36. Skeletal Analysis of Main Species, Period III

	Cattle					Sheep/Goat					Pig				
	No.of Bones		Zone L	Zone R	BN		Zone L	Zone R	BN		Zone L	Zone R	
horncore	30		*16*	*8*	43	sh	*22*	*15*					hc
					2	gt	*1*	*1*					
skull	174		84		116		97		65		55		sk
maxilla	33		*16*	*10*	25		*10*	*15*	46		*20*	*25*	mx
mandible	130		*20*	*27*	165		*48*	*59*	85		*29*	*37*	md
loose teeth	78		70		75		69		46		42		t
Head111	445		(249)		424		(329)		242		(202)		
vert.,atlas			*13*				*26*				*8*		at
axis			*10*				*23*				*1*		ax
other cerv.			38				33				22		cv
thoracic			38				15				8		th
lumbar			20				28				19		lu
sacrum			6				4				–		sa
caudal			2				1				2		cd
sub-total	140		127		131		130		60		60		vt
scapula	125	d	*23*	*18*	107	d	*30*	*27*	33	d	*9*	*13*	sc
humerus	95	p	*3*	*5*	85	p	*5*	*6*	47	p	*2*	*2*	hu
		s	*13*	*16*		s	*30*	*29*		s	*16*	*19*	
		d	*15*	*15*		d	*19*	*20*		d	*15*	*8*	
radius	93	p	*18*	*27*	133	p	*25*	*19*	33	p	*8*	*11*	ra
		s	*15*	*15*		s	*43*	*37*		s	*12*	*11*	
		d	*9*	*15*		d	*8*	*16*		d	*1*	*1*	
ulna	53	p	*22*	*20*	25	p	*9*	*12*	35	p	*11*	*18*	ul
pelvis	105	il	*12*	*12*	97	il	*22*	*22*	23	il	*6*	*2*	pe
		is	*20*	*11*		is	*23*	*25*		is	*4*	*2*	
		pu	*9*	*6*		pu	*9*	*18*		pu	*3*	–	
femur	115	p	*10*	*8*	82	p	*4*	*3*	28	p	–	*3*	fe
		s	*26*	*22*		s	*25*	*14*		s	*8*	*8*	
		d	*7*	*7*		d	*7*	*10*		d	–	*3*	
patella	7		7		1		1		fib.20				
tibia	99	p	*9*	*9*	185	p	*6*	*7*	52	p	*2*	*6*	ti
		s	*5*	*7*		s	*41*	*45*		s	*12*	*19*	
		d	*15*	*18*		d	*33*	*43*		d	*10*	*15*	
Body 2009	832		(513)		846		(651)		331		(278)		
calcaneum			*29*	*30*			*8*	*9*			*5*	*6*	ca
astragalus			*22*	*20*			*3*	*6*			*3*	*3*	as
carpal/tars.	133		*27*				*17*						c/t
metacarpal	103	p	*26*	*23*	107	p	29	29	24				mc
											III	IV	III	IV	
		s	*26*	*27*		s	*37*	*27*		p	*6*	*4*	*10*	*3*	
		d	*26*	*25*		d	*20*	*15*		d	*6*	*4*	*9*	*2*	
metatarsal	102	p	*23*	*25*	154	p	*41*	*27*	29	p	*10*	*8*	*6*	*4*	mt
		s	*20*	*27*		s	*46*	*32*		d	*8*	*7*	*4*	*3*	
		d	*17*	*20*		d	*15*	*10*							
metapodial	6								abax 34 (mp+ph)						
phalanx	136	1st	76		19	1st	18		9	1st	7		ph
		2nd	25			2nd	1			2nd	1		
		3rd	35			3rd				3rd	1		
Foot 901	480		(387)		307		(237)		144		(111)		
TOTAL 4021	1757		(1149)		1577		(1217)		687		(591)		

Unidentified	C/h-size	S/p-size	Small	Bird
vertebra	204	108	–	–
rib	842	766	2	7
other	753	593	4	36
Total 3315	1799	1467	6	43

Notes as Table 36

Table 37. Skeletal Analysis of Main Species, Period IV

Numbers of the proximal humerus, proximal and distal femur and proximal tibia are fairly low, which is an expected effect of survival, these parts of the skeleton being formed of cancellous bone with a thin bone cortex. The distal radius is less affected except in the case of pig.

The underlined figures give a precise minimum number of that element for sheep and pigs and give an approximate but probably quite reliable minimum number for cattle (see Method section). Taking the highest zone figure for each main bone of the body (scapula, humerus, radius, ulna, pelvis, femur and tibia) the average figure is 17.1 for cattle, 22.3 for sheep and 11.1 for pig (or 34%, 44% and 22%) for Period III and 21.7, 30.0 and 13.6 (33%, 46% and 21%) for Period IV, both of which suggest a relatively higher value for sheep and pig in relation to cattle than the total bone count. The most numerous element was, for sheep and pig, the mandible. For cattle it was the proximal metacarpal in Period III, and (rather unusually) the calcaneum in Period IV. Proportions from the mandible are 34%, 43% and 23% (Period III) and 22%, 48% and 30% (Period IV). Proportions based on the most numerous element are 38, 40 and 22% (III) and 24, 47 and 29% (IV).

These proportions from mandibles and from the main body bones are similar for Period III, but in Period IV the mandible gives a much lower percentage for cattle. There may be depositional reasons why heads of cattle were less frequent in this area of the town, connected with high numbers of horncores found at Site 1092 (G.G. Jones 1984), (see Table 45 (in microfiche) and Horncores, below) and mandibles may not be a reliable bone on which to base species proportions.

Comparison of cattle with sheep remains a problem (O'Connor 1984, 6) as is seen above in the slight differences in method adopted. Comparison of the bones of the pelvis provides a useful measure. The element is a zone in Watson's strict sense (1979) (the iliac, ischial and/or pubic part of the acetabulum), the bone survives fairly well (being a strong loadbearing part of the skeleton) and it is also a bone less likely than many to be affected by bone/horn-working, marrow or glue extraction and gnawing by dogs. Proportions based solely on the pelvis typify the general pattern of sheep being somewhat the commoner by minimum number and cattle the commoner by fragment count.

The fairly detailed anatomical analysis is valuable in showing different patterns of survival and recovery between the three species. Using the total of identified bones, the following percentages result:

	Period III			*Period IV*		
	N	C,	S/g,P	N	C,	S/g,P
Total Bone	2960	48,	35, 16	3817	44,	39, 17
Head	820	47,	32, 21	1111	40,	38, 22
Body	1535	45,	39, 17	2009	41,	42, 16
Foot	600	59,	31, 9.5	901	53,	34, 13

Pig foot-bones are relatively much less common than sheep and especially cattle even without compensating for the fact that a pig has twice as many metapodia and phalanges than cattle and sheep. The high cattle figure is explainable simply by recovery of 199 carpals and tarsals and ninety-eight phalanges, against seventeen and sixteen for sheep and six and ten for pig. But the difference between sheep and pig seems significant. The highest zone figure for sheep foot-bones is thirty-three and for pig only six (forty-six and ten in Period IV). A possible explanation is that pig trotters may have been boiled-up, and the bones tended not to survive either because they were thrown to dogs or the weakening of the bone through long boiling caused the bones to decay. If the feet of sheep were used similarly, probably only the lower part of the foot would be used: this might explain the much lower number of distal than proximal metapodia, but butchery marks indicating such a practice were not observed.

The extent to which pig bones do decay more easily, and that pig may be consequently under-estimated, is uncertain. Some bone elements come close to or exceed numerically cattle and sheep, viz. the very strong upper jaw, the relatively massive ulna (the atlas vertebra and scapula in Period III only), and the humerus and tibia shafts. Lower jaws (N183 left plus right mandibles with at least one tooth from the three species giving 36, 44 and 21%) and loose teeth (N118: 46, 31 and 23%) suggest pig formed about a fifth of the animals by head count. Pig also comes up to a fifth on the total number of bones recorded on the zone list (Period III N2168: 44, 37, 19% and Period IV N2957: 39, 41, 20%). That is, fewer fragments of pig were recorded. It is not known whether this may be an effect of survival and recovery or a difference in the ease of identifying small fragments of pig bones (see Watson 1972).

If pig bones are adversely affected by decay, one might predict that the percentages based on teeth, the most durable part of the skeleton, would be relatively higher for pig. The proportion of mandibles with at least one tooth present plus the loose teeth is indeed a little higher for pig than for sheep (2–4% difference) which is a fairly small difference. Also, the pig bones found appeared to be in a similar state of preservation to the rest of the material. It is not therefore considered that pig is under-represented to a very great extent.

Variation across the site

(Table 38, microfiche)

Some of the Period III features containing bone fell into recognisable groups, for example the boundary ditches and some groups of pits, which may be within the same property. The bones from these are summarised on Table 38 (microfiche). The summary uses the total number of fragments, and the biases noted above need to be borne in mind.

The quantity of bone found is rather small given the very large size of most of the pits. For example, in the area by the enclosure gullies in the pits centred on grid square M21 (9 on Table 38) there were eighteen pits containing bone, many of them very large yet the average number of bone pieces found in them is only twenty-seven. The overall number of bones per feature is thirty-seven (twenty-one identified).

Rarely were bones found as articulated partial skeletons or joints. The great majority occur as isolated pieces. This is true of the cattle, sheep and pig bones where, for example, phalanges which appeared to be pairs, or pig metapodia with their epiphyses, were not found at all. And it is also true of most of the dog and fowl bones where at most sites it is usual to find several bones likely to be from the same individual. The bone appears to have been deposited in small quantities and may often be an accidental deposition as pits were gradually filled.

The main quantity is from the pit groups situated on each side of the north-to-south road and north of the east-to-west road (including as far north-west as those in L21/M22/N22) (9–16 on Table 38). With all these pit groups the most numerous bones are those of cattle and sheep, their relative numbers varying somewhat, with pig always in third place but present in significant numbers. The bones confirm the general interpretation of this area as domestic occupation.

The quantity of bone from pits near the western part of the east-to-west road (Table 38, 6–8) was lower but the character was similar. Worked bones were not concentrated in a single area but scattered among these pits. They consisted of discarded artefacts. No associated bone-working waste like that from Site 1092 (G.G. Jones 1984, pl.XXII) was found.

The features in the north-western part of the site, the pits in O21, N19 and O19, the kiln and the north-west to south-east boundary gullies (the first, and third to fifth groups on Table 38) may be rather different from the pit groups already discussed. Pig bones were very few; cattle were a good deal more numerous than sheep; and bones of dog and/or cats, present in nearly all the other pit groups, were not found. In the three pits in O21 (Table 38, 4) north of the kiln and some distance from the roads, there was a high proportion of cattle bones, nearly all of them skull and foot bones. This was the case also with pit F28 in O19. The bone finds agree with other archaeological evidence in showing that this area was used differently from the main areas of domestic occupation.

Very little bone came from any feature-type other than pits. A few were from gullies but the small numbers involved precludes comparison.

Less of the Period IV bone could be assigned to groups of pits than with Period III (Table 38, microfiche). The greatest quantities of bone were from pits east of the road junction. A few pits contained 200 or more fragments and these are striking for the range of bones found, including skull, body and foot bones; immature and mature bones; and usually a minimum number of three to six cattle, sheep and pig, but with little evidence that bones belong together, *e.g.* matching upper and lower jaws or tibiae with the adjacent astragalus. That is, the deposits seem to have built up gradually and are not from a single event, in contrast to medieval pits at Netherton (Sadler forthcoming) where articulated remains were found and the actual number of individuals could be inferred with some confidence.

There was less bone, in comparison with Period III, in the area immediately west of the north-to-south road. There was also a good deal more in the western part (grid squares N17–19 and M18–21), and the character of the bone in this area suggests domestic occupation, with cat, dog and fowl bones quite common.

The quantity of bone found per pit was higher in Period IV, on average fifty-seven pieces and thirty-three pieces identified. Many processes may have contributed to this effect of which a greater consumption of meat or a greater population density might be inferred.

Cattle

A detailed record of the cattle mandibles is given on Table 39, microfiche, showing a histogram of the eruption stages (*cf.* Bourdillon and Coy 1980) related to the individual tooth-wear stages (Grant 1982). The Period III mandibles comprised no young calves, only one under about eighteen months (using modern figures), 26% about two or three years old (stage 3), 14% sub-adult (stage 4) and 57% adult. Period IV, similarly, included no young calves, two under about eighteen months, fewer 18–36 months old (16%) and again the majority were sub-adult or adult (20% and 56%).

In general terms the epiphysial fusion information is comparable (Table 40, microfiche). Very few early-fusing bone elements were unfused, though there were a few perinatal bone fragments (also shown on Table 40). These may all have been calf losses, and doubtless the vellum from these would have been a valuable commodity. The difference observed in stage 3 mandibles is not reflected in the intermediate-fusing bone elements which show no difference between Periods III and IV. So the suggestion based on the mandibles, that fewer immature cattle may have been marketed in the Early Medieval period than the Late Saxon, remains tentative.

Looking at the late-fusing long bone elements, 45% and 47% were fused (*i.e.* came from skeletally mature animals). This is lower than the percentage of adult mandibles (with M_3 at stage g or beyond) (57% and 56%). If it is assumed that the samples are typical of the animals deposited, it appears that some long bone epiphysial fusion continued to take place after the third molar had reached the mature-wear stage (g). Fusion of the vertebral centra appears to be delayed to an even greater extent, with only 26% and 35% fused; (only the vertebral body was counted, not loose vertebral epiphyses). Vertebral fusion can be a very late event, especially in castrated animals (Noddle, pers. comm.) and it is certainly to be expected that many of the cattle were in fact castrated oxen used for ploughing and carting.

On Table 39 the mandibles which were certainly from fairly old beasts were grouped as stage 5B. In these, M_3 was beyond stage g, the tooth was well worn and often the root arch, or at least the cement-enamel junction, was visible above the alveolar border. Stage 5A includes mandibles where M_3 was lost but from the alveoli it could be seen that the tooth was fully in occlusion; plus the younger-adult, stage g jaws. The data on these stage g cases is confused by the fact that the bovine pillar (on which the later stages are defined) is sometimes absent. This occurred in four cases, but in none of these was the tooth very low-crowned, *i.e.* very worn.

In terms of husbandry, it seems ill-advised to slaughter as young adults cattle that have been trained for work (note their absence from later medieval Period V), yet their age seems excessive if they have been raised purely for their carcase. Perhaps they are culls due to barrenness or bad character, or beasts sold for individual economic reasons (*e.g.* for tithe or rent).

Numbers of mandibles from later periods were low. They included a few calves: a medieval and post-medieval increase in juvenile remains was seen at North Elmham (Noddle 1980). In all the adult mandibles from Period V the third molar was well worn (stage j and beyond) suggesting that adult cattle were generally being kept to a greater age before slaughter.

An attempt was made to study sexual dimorphism in the cattle, based on horncores, pelves and metacarpals. It was not possible to make definitive conclusions but some tentative observations were made.

Using the shape of the acetabulum of the pelvis (see Grigson 1982), about equal numbers of each sex appear to be present (ten cows and nine males in Period III, and six and five in Period IV). This is as would be expected given that about equal numbers are born and that few beasts died at an age before the acetabulum fuses. There is no suggestion here that supplies to Thetford were predominantly of milch cows nor of surplus oxen but a combination of the two.

The site produced a moderately large collection of complete metapodia. The size variation evident in the metacarpal was expected to include a component of sexual dimorphism due to the heavier fore-quarters of bulls in comparison with cows. Effects may also be expected due to differences in nutrition and perhaps type, and individual variation. Dimorphism is greatest in the width not the length of the bone (Higham and Message 1969). Histograms of distal width and, more strikingly, proximal width showed distinct groups of measurements (Fig.166), and these may be interpreted as showing cows, oxen (castrates) and a few bulls. Scattergrams of overall length against width measurements (Fig.166) proved less informative with no clear groupings as was found at Middle Saxon Hamwih (Bourdillon and Coy 1980). Possibly the Thetford cattle were of a type with smaller sexual dimorphism. On Fig.166 (proximal breadth) the probable cows are those with Bp less than 52 mm, the castrates 52–61 mm and the solitary very large bone is probably from a bull. The very great overlap in length measurement is consistent with data from the Kalmyk cattle quoted by Higham and Message (1969). Probable ratios based on Fig.166 (proximal breadth) are fourteen cows, six castrates and two ?bulls in Period III (with two small broken specimens which may be immature) and seven cows, eleven castrates and one bull in Period IV.

Metacarpal distal widths are shown for all the Thetford sites, including Periods III and IV of this site, Site 1092 (G.G. Jones 1984)

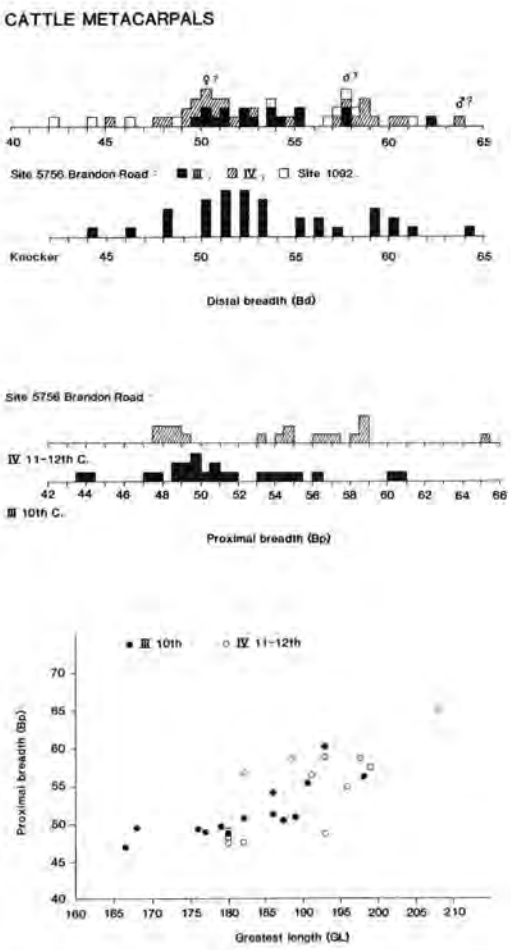


Figure 166 Brandon Road. Cattle metacarpals.

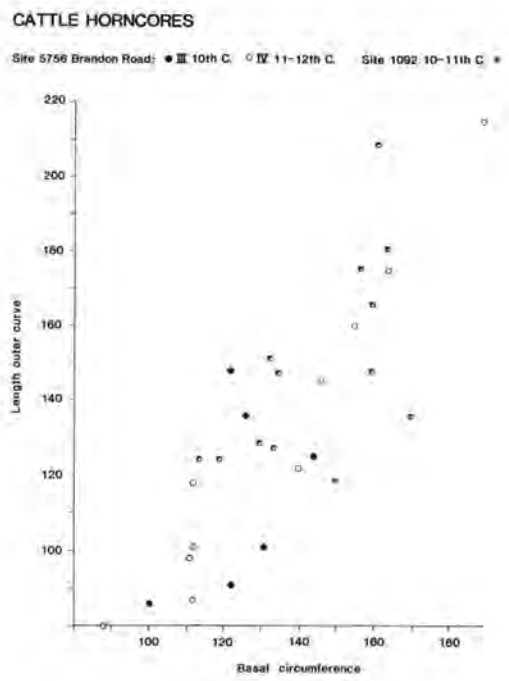


Figure 167 Brandon Road. Cattle horncores.

and the excavations by Knocker (data quoted in Clutton-Brock 1976, fig.9.2). There are a few small records, a large peak presumably of cows merging with a wider spread of probable castrates with a few ?bulls. The cattle are smaller than those from Middle Saxon North Elmham (Noddle 1980).

If the groupings are correct, it would mean that the greater size of many of the Period IV metacarpals is due to the presence of more males, not a real increase in size in the later period. This point is relevant in relation to the horncores (Fig.167) where the few Period III specimens fall in the lower left part of the graph and the Period IV examples show a great range of size and shape, *i.e.* the tenth-century group may be entirely from cows, with castrates and bulls also present in the eleventh to twelfth-century group.

Horncores from Site 1092 (tenth to eleventh century) are also plotted and these – from an area of horn and bone-working – fall in the middle and upper right of the graph. Horncores used for horn objects may, then, have been predominantly those from oxen (in the sense of castrated males) and bulls. Numbers of horncores found at Brandon Road Site 5756 were lower than expected (see Tables 36 and 37) and of those found, although many were chopped at the base, none were sawn in the manner observed frequently at Site 1092 (G.G. Jones 1984, pl.XX). Table 45 shows the numbers of horncores from the two sites. There could have been trade across the town in horncores from cattle, and also those from goat and, to a lesser extent, sheep.

Separation of the sexes on the basis of size was confirmed in the more upward direction of growth in the small horncores and the more outward and downwards curve of the larger ones. Basal shape, however, proved unhelpful: small specimens varied from 68%–82% and large ones 68%–90% (minimum/maximum basal diameter by 100).

Using measurements of the hind limb, which show lower sexual dimorphism (Higham and Message 1969), the distal tibia and astragalus show little variation over Periods III, IV and V, and confirm the slightly smaller size of tenth to twelfth-century Thetford cattle in comparison with Middle Saxon Elmham and Hamwih. Comparison of metatarsal lengths is much more variable, with Period IV specimens showing a very wide range and lower mean. Selection of bones for skates may have biased the results. Period V included one extremely large specimen (235 mm long).

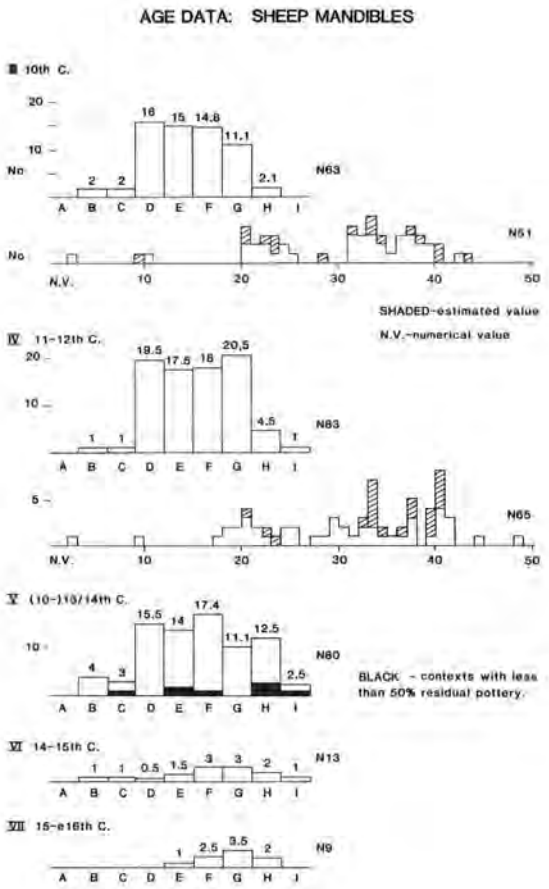
Withers heights estimates based on metapodials are 1.02–1.21 m (N30, Mean 1.14 m) for Period III (tenth century) and 1.01–1.27 m (N31, Mean 1.12 m) for Period IV (eleventh to twelfth century) (method of Fock in von den Driesch and Boessneck 1974).

The position of the nutrient foramen at the supracondylar fossa of the femur was as follows: Period III three cases within the fossa and five outside; Period IV – fourteen within and five outside; and Period V - two within and three outside.

Sheep and goat

The evidence suggests that few goats were kept. Most horncores were from sheep (see Tables 36 and 37); and goat horncores were absent from the Period V–VII bone groups. Horncores, although easy to identify, are problematic in the sense that they can be dispersed due to trade in horn, as was found at Thetford Site 1092, and at Dorestad (Prummel 1983).

Study of the mandibles with deciduous premolars present produced the following observations in using Payne's morphological distinctions were made (Payne 1985). The metaconids of dp_3 were sheep-like but the character was difficult to assess on the mostly very worn specimens. The mesial (anterior) parts of these worn dp_3's were well-developed and sheep-like. The mesio-buccal ridge was strongly sheep-like in twenty-one cases, and goat-like in one. In the dp_4's no interlobal pillars were observed (twenty-six cases); most of these observations were made without extracting the teeth, the cement-enamel junction being above the alveolar border. The angle of the distal cement-enamel junction was difficult to assess. The one probable goat (III, 2671) scored: *Ovis* 1 (½ + ½) (no interlobal pillar but one small irregularity at this point, intermediate enamel margin): *Capra* 3 (metaconid, bucco-mesial ridge, and the two intermediate characters); and the crown height index is within the range given for *Capra* (2.1, Stage d), *i.e.* the tooth is lowcrowned and goat-like. In all, twenty-six mandibles scored as sheep



Method of Payne (1973) and Grant (1982)

A m_3 unworn
B m_3 in wear, M_1 unworn
C M_1 in wear, M_2 unworn
D M_2 in wear, M_3 unworn
E M_3 in wear, 3rd unit unworn
F M_3 in wear on all cusps, pre □□-
G M_3 □□- , M_2 □□
H M_3 □□- , M_2 after □□
I M_3 after □□-

Figure 168 Brandon Road. Age data: sheep mandibles.

on at least two characters (and up to six characters) and seven scored as sheep on one character (all Periods).

There was no sign from other bones to contradict this predominance of sheep over goat. In the *Domesday* return for Norfolk, goat formed 6.1% (3020 goats, 46,458 sheep). None are mentioned for Thetford itself. In one older mandible P_4 and the anterior part of M_3 are both partially erupted and almost equally advanced (Period IV, and one similar case in V). This is unusual in sheep, where M_3 is normally in advance of P_4, but it is common in goats (Deniz and Payne 1982, fig.24). One Period III radius plus ulna was identified as goat using Boessneck's criteria (Boessneck *et al.* 1964). Scattergrams of metacarpal length against distal width (GL by BFd) and Payne's distal metacarpal ratio (1969) gave moderately homogeneous groupings suggesting that all were sheep. (The line which separates the Verroia sheep and goats would class all the Thetford Period III and IV metacarpals as sheep: Payne ibid, figs 6 and 7.)

Sheep

Interpretation of the age of the sheep which reached Thetford, and the results shown on Fig.168, raises questions about the supply and marketing of animals. There were ecclesiastical rights to sheep pasture within the town itself (see below, Documentary Evidence). Individual

land ownership and pasture rights by burgesses and by the church might tend towards a self-sufficiency in meat for some households, which would mean that the age structure found would relate fairly closely to the general culling practice. However, the presence of a large population would have affected sheep-keeping over a wide area, and many of the remains may be of sheep from quite distant villages where the age of sheep sent to market may be selective.

The general pattern of slaughter-age at Thetford suggests that during the tenth to twelfth centuries sheep were not normally killed during their first year. Surplus young animals were slaughtered during their second year. Thereafter there was a range of slaughter-age up to perhaps six or seven years old. The proportion of adult mandibles found, and within these adults the numbers in the latest age-stages, increases slowly through the thirteenth/fourteenth centuries. The Phase VI and VII samples suggest that a decreasing proportion of sheep were being slaughtered before two to three years old. (Ages are based on modern Soay, Shetland, Scottish Blackface and other sheep: Jones, work in progress.)

Looking at the Period III and IV data, no mandibles were found with the deciduous premolars unworn or at early wear stages (tooth-wear stage b or c: Grant 1982). Lamb losses at this age, from birth to over four weeks old, would certainly have occurred, and their absence rather suggests that lambing was not taking place in the immediate vicinity. There were a few stage B mandibles, aged two to three months. And there were a few very immature long bones (Table 40, microfiche), of uncertain age-at-death, some of which could be perinatal. (Bones from very young lambs might occur in urban deposits as a result of trade in lambskins.)

It is thought that most of the stage D mandibles were from sheep which died in their second year. Initial wear on the second molar has been observed at 10 – 13 months in modern Soay sheep; and the third molar was erupted into the mouth cavity (and usually in initial wear) at 21/25 months (sheep of various breeds including Soays and Shetlands). In a few of the Thetford Period III and IV mandibles, M_2 was only recently in wear (stage b) but in most it was at stage c, d or e and with the third molar crown below the alveolar border. These stage D mandibles appear therefore to be from sheep fattened in the summer and autumn of their second year. Presumably most of these were rams or wethers.

Complete, or almost complete, erasure of the infundibula of dp_4 was more frequent in the Thetford stage D mandibles than was observed on modern Soays and Scottish Blackfaces, *i.e.*, the teeth are more worn (two or all three infundibula erased; III 12 of 13; IV 6 of 10; V 1 of 3). Butser Soays are kept on downland grass with supplementary winter feed (hay and nuts) and the Blackfaces observed were kept on the Pentland Hills with extra feed (mostly hay) given only during bad weather (and at lambing). The main factor involved in fast tooth-wear is abrasion due to ingested soil (Healy and Ludwig 1965). So, if the eruption ages observed in Soay and other living sheep are taken to apply also to the early Early Medieval sheep, it may be suggested that ingestion of the sandy Breckland soil was fairly high. This would occur, for example, in pastures which were overgrazed during the winter.

Moderately fast wear-rates might also be expected in sheep folded on bare stubble or fallow ground. The folding of sheep was an essential element in the maintenance of soil fertility. The shepherd's work may have been as described in Aelfric in the tenth century: 'In the early morning I drive my sheep to pasture and stand over them in heat and cold with my dogs, lest wolves devour them. I lead them back to the fold and milk them twice a day, and make butter and cheese. I move the fold, and sleep in the sheepcote, which I keep in repair' (quoted in Ryder 1983, 186). Fold-soke, the customary service of folding sheep on demesne land, is mentioned frequently in the *Domesday* returns for Norfolk (Darby 1952, 145).

Mandibles with the posterior cusp of M_3 in wear (stage F and beyond) may be aged at about three years and over. They formed 44%, 53%, 54%, 69% and 89% of the samples in Periods III to VII. Already by Period IV there is an increase in adults suggesting a larger wether flock than previously. It is unfortunate that the sample sizes of the latest phases were small and that the dating of Period V is imprecise. But it appears that by the fifteenth to sixteenth centuries most sheep slaughtered were adults. Lambs of both sexes were being kept into adulthood, thus optimising the amount of wool produced.

Within the adult age stages, the proportions at the latest stages, H and I, also increases in the later periods. Stages G, H and I are defined by increasing wear, all cheek teeth being erupted. The finding of sheep with heavily worn teeth may indicate fast wear-rates or older sheep. Numbers of stage D mandibles in Periods VI and VII were not available for comparison but it may be noted that Period III teeth were relatively more worn than Period IV (or V) (see above discussion of stage D). Comparison was made of the stage F mandibles to see if M_3 was more worn in the later-period specimens, yielding the following results: M_3 at the mature-wear stage/anterior infundibulum partly or/fully erased/the posterior infundibulum likewise: III 3/3/2/1; IV 1/1/2/0; V 5/3/2/1; VI 0/1/0/0; VII 0/2/0/0. The case remains open because of the small sample sizes and the possible range of ages of the stage F sheep but it is suggested that wear-rates may have been no faster in the later periods, and that from the thirteenth/fourteenth century onwards, sheep were being kept to a greater age.

An intensification in wool production would coincide with the Late Medieval agricultural changes, for example in the enclosure of common lands for sheep pasture and the sale and export of wool where previously export had been primarily of cloth (Reynolds 1977, 46).

Finds of wool tools are described above and include six spindlewhorls, four made from bone and two from pottery.

The age structure found at nearby, rural North Elmham Park showed, as at Thetford, an increase in the proportion of adults in the medieval period. Differences in methods of recording make direct comparison inexact, but in both Late Saxon and medieval times the proportion of adults may have been higher at Elmham than Thetford. There may well be indirect evidence from this of the movement of younger sheep to market.

The horncores found were varied. They included some as large as those from Site 1092 (although none were so well preserved) and these are presumably from rams. The small and medium-sized cores may be from ewes and wethers, but separation is uncertain and would be influenced by natural variation and the age of the sheep. The form of the cores was similar to those from North Elmham (Noddle 1980). Plots of basal diameter demonstrate the range of size (Fig.169). Possibly the females separate from the males at below 27/40 mm and the rams from the wethers at above 41/55 mm. In comparison with the horncores from Late Saxon and Early Medieval Lincoln (O'Connor 1982), the overall range is similar but at Thetford there was a larger group of the moderately large cores (?wethers).

There was one case of hornlessness from Period III (identified as sheep from the shape of the parietal bone), one case from sheep (or goat) from each of Period IV and V and two (both sheep) from Period VI.

The size of the sheep appears to have remained unchanged through the main periods of the site, from the tenth to twelfth centuries. Measurements of sheep bones from Middle and Late Saxon North Elmham (Noddle 1980) and other sites in Thetford (Clutton-Brock 1976; G.G. Jones 1984) are similar. Detailed measurements of the metapodials were made, and are accessible in the archive. There was considerable variation in the length and robustness of the metacarpals but clear separation into groups was not obvious. Distal metacarpal measurements were more dispersed for Period IV than Period III (note the higher standard deviation).

The most striking aspect of the measurements was the smaller size of the sheep bones from the later periods. In general the Period V (thirteenth/fourteenth century) measurements are similar to Periods III and IV but there is a consistent tendency for a decrease in the lower range, *i.e.* some smaller sheep are present. The bones from Periods VI and VII include some very small, gracile specimens, *e.g.* a metacarpal 95 mm long, 15 mm shorter than any from Periods III to V.

The nutrient foramen of the femur was in the proximal anterior or mid-posterior position, with the latter being commoner (Period III 1,5; Period VI 2,2).

Pig

The proportion of pig bones found at Thetford remains fairly consistent through periods III to VI, at about 15% by fragment count and rather more, about one fifth, by other methods of calculation (see above). Fewer pigs were found at Thetford than at North Elmham and this is in accord with the greater amount of woodland recorded in *Domesday* for the Elmham area, and the generally high numbers of sheep recorded for much of West Norfolk (Darby 1952). No pigs or woodland are recorded in the Thetford *Domesday* return, which records only demesne land. Notwithstanding this, other evidence suggests that pigs were kept in herds depending on woodland pannage for fattening (Trow-Smith 1957; Wiseman 1986). Wiseman suggests that there was a decline in the importance of pigs during the medieval period, based on reductions in the time permitted for pannage. At Thetford a decrease in the proportion of the pig bones is not observed until the fifteenth to early sixteenth century (10%, the small period VII sample). By this time reliance on pannage and swineherding may be in decline with more pigs being raised domestically in sties. On the Peterborough Abbey manors, sty management existed by the fourteenth century, pigs being fed grains and legumes (Biddick 1984).

The mandible data are shown on Fig.170. The method follows that of Bourdillon and Coy (1980). Wear was defined as beginning when wear could be seen on the enamel: the thickness of the enamel in pigs

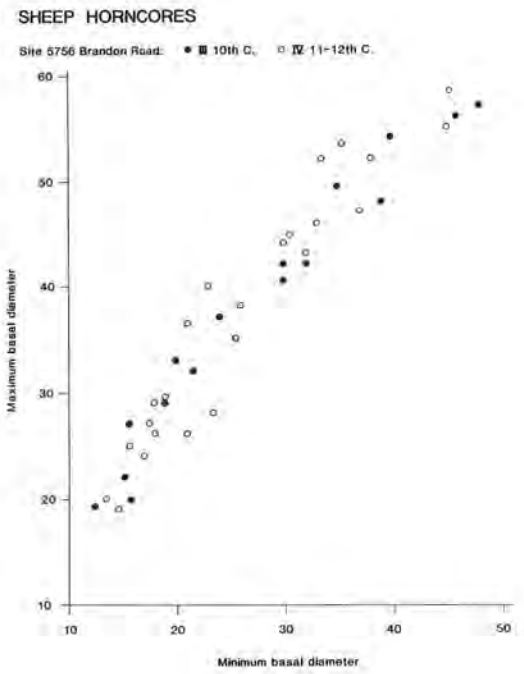
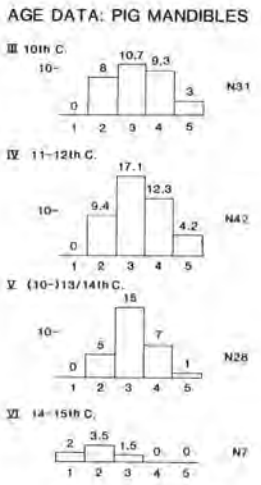


Figure 169 Brandon Road. Sheep horncores.



1 — birth to M_1 erupted, unworn
2 — M_1 in wear, M_2 unworn
3 — M_2 in wear, M_3 unworn
4 — M_3 in partial wear (Grant stages a,b)
5 — M_3 in wear on posterior cusp
in wear — for pigs, wear visible on the enamel.
Vertical axis shows sample number (with incomplete jaws allotted in proportion).

Figure 170 Brandon Road. Age data: pig mandibles.

and the different tooth morphology compared to cattle and sheep means that the enamel-wear-only stage lasts much longer in pigs. Stage 5 begins when wear is evident on the posterior part of M_3, *i.e.* the third molar has completed its long eruption and is fully in occlusion. No stage beyond stage 5 was used. With incomplete mandibles where the stage could be given only as a range of two stages, these were allotted to each stage in the proportion found in the more complete specimens (*cf.* Payne 1973 for sheep).

The mandibles were recorded using Grant's tooth wear stages (1982) and these data and records of the whole tooth row are preserved in the archive. M_3 stage b was taken to end when wear was visible on the enamel of the posterior cusp. Maxillae were also recorded, using the nearest equivalent lower jaw stages.

The tenth-century jaws included no piglets but otherwise showed widely varied slaughter ages with few fully adult pigs. The Period IV mandibles show a greater concentration at stage 3, probably animals mostly in their second year (Bull and Payne 1982), and this is even more marked in the Period V sample. The stage 2 and 3 pigs, although they may include some that have bred, may be considered as the pigs raised for market. The three phases show a continuing decrease in the proportion at stage 2 (about six to twelve months old) suggesting that a larger, more mature carcase was preferred. At the same time, the proportion of young adult plus fully adult pigs at stages 4 and 5 declines, with 40% in Period III, 37% in Period IV and 29% in Period V. A few pigs were elderly, *e.g.* one specimen in Period IV with M_3 very worn (Grant stage k).

The mandibles found, of course, suggest only the slaughter age of pigs eaten at the site, and the links between this and farming practice may be complex.

Comparison with North Elmham Park (Noddle 1980) is interesting, however, in showing a similar reduction in the proportion of adults between the Late Saxon and medieval and post-medieval periods. (Elmham was exceptional in the finding of a very high proportion of adult and aged pigs in the Middle Saxon period.)

The gradual changes seen from the tenth to fourteenth centuries suggest, then, the successful rearing of rather larger litters, and an increasing preference for slaughtering immature animals fairly late.

By the fourteenth to fifteenth century the few mandibles found show a marked change, most being piglets and young (stage 2) pigs, and no stage 4 or 5 jaws being found. These very young specimens could demonstrate a taste for sucking pig, which suggests a wealthy household. Or they may be natural deaths from pig-keeping in the immediate vicinity. (Three mandibles from Period VII were at stages 3, 3 and 4.)

The size of the pigs is similar to those from Elmham. Most measurements (Table 48, microfiche) are much smaller than the measurements given for wild boar (Noddle 1980) but as at Elmham a few specimens approach this size, *e.g.* a metacarpal III 89.3 mm long and an unfused abaxial metapodial 54.5 mm long without its epiphysis (both period III).

In the Period VI and VII sample of pig bones, most of which were similar to those from earlier periods, there were a few exceptionally large bones. They included an adult axis and 7th cervical vertebrae (see measurements Table 48, microfiche) and an immature metatarsal 104 mm long without the epiphysis, with an estimated length with epiphysis of *c.* 116. This compares with specimens from phase V of 74, 81 and 81, 73–92 at Elmham (all periods) and 95 from a wild male (Noddle 1980).

The large pigs are either from wild boar or from a new type of large domestic pig. Wild boar are rare in England by this date. References to their status in the Breckland have not been found. Circumstantial evidence is rather against the bones being from wild boar; hunting of other species does not increase, and the bones are chiefly immature.

If domestic, the bones are of some interest. The pig which is described as the old type of English pig at the time of the eighteenth-century improvements and the introduction of Chinese pigs was described as large, long-legged, usually white, with long, 'lop' ears and with no pronounced bristly spine (Wiseman 1986). This contrasts strongly with the small medieval pig with its prick-ears and bristles along the spine, but documentary evidence for its introduction is sparse. The bones found here would corroborate Trow-Smith's surmise that the larger, lop-eared pig was not present before the late Middle Ages. Presence of larger pigs is recorded for the sixteenth century at Exeter (Maltby 1979, 57).

The sex of the canine teeth was recorded and is shown on Table 41 (microfiche). The number of ageable jaws which could be sexed was very small.

Overcrowding of the premolar teeth in pigs was seen occasionally, viz. in three cases in Period III (two mandibles and a maxilla, in one mandible the first premolar also being absent); two cases in Period IV (one mandible and a maxilla where p^2 was rotated through more than a right angle); and one in Period V.

Absence of the lower first premolar was common (32%, N59, Periods III–V) and more frequent in males than females (41%, N17 and 24%, N29), with no noticeable difference through time (Table 42, microfiche). The character seems to be a useful one to record as it may show regional or temporal variation.

Horse

The horse bones were striking by their small number yet their relatively frequent occurrence over the site. They formed only 1.5% and 1% of the bones in Periods III and IV but were found in 15% and 21% of the features containing bone (Table 35; Table 43, microfiche). The finds were scattered and occasional, no horses being found as partial skeletons. Articulated remains occurred just four times, where a few vertebrae probably from one individual were found together (twice in each of Periods III and IV).

Other than one probable chopmark on a third phalanx, no butchering marks were observed on bones from the main phases; chopmarks were seen on a distal tibia from Period VI and a proximal metacarpal from Period VI, both of which may be skinning marks.

The real frequency of use of horses is uncertain. A single horse was recorded in the *Domesday* return for Thetford. The expectation is that the horse was not normally killed unless ailing, and that the carcase was useful only for its hide (Langdon 1982) and occasional use of bones for working (*e.g.* skates). The slaughter or death of a horse would not then have been an everyday event. Normally the carcase appears not to have been buried as a whole (as occurred for example at Aylesbury, Bucks: Jones 1983), but to have been disposed of, presumably to dogs, and perhaps to people too but without the breaking up for marrow which was the usual practice for cattle. One horse carcase might then have become dispersed over a whole neighbourhood. (A single horse bone bore gnaw marks probably from a dog.)

The small number of horse bones applies also to Period V, with a relative increase in the two later periods. In Period V the frequency per feature does increase (to 30%) but although the increase would be consistent with a real change, it may be a result of the re-working of the deposits.

Age data from teeth for Period III suggests at least two adult but not aged horses and three elderly ones. In one of these latter the crown heights of the anterior five maxillary cheek teeth were 15, 15, 16, 13 and 15 mm, *i.e.* extremely worn (Levine 1982, 228). All long bones were fused; in nine of fifteen vertebrae epiphysial fusion was incomplete. Similarly, all tooth data for Period IV indicates adults (at least six); unfused bone epiphyses included only late-fusing elements, *viz.* a single unfused distal femur and four of ten vertebrae incompletely fused. Full fusion of the vertebrae may not be completed until well into adulthood.

Height estimates using the method of Kiesewalter (in von den Driesch and Boessneck 1974) from the few complete long bones are 12 and 13 hands (Period III), 13 hands (IV) and 12 hands (V, 20% residual pottery) (1.24 m, 1.33 m, 1.32 m and 1.19 m). Measurements are given on Table 49 (microfiche) with tooth height and mesio-distal diameter recorded in the archive (defined in Levine 1982, 228). A few minor measurements from Period V contexts seem large (a radius Bp 85.4 and a 1st phalanx GL 82). Measurements of bones from Periods VI and VII include two bones giving height estimates of 13 and 14½ hands (1.35 m and 1.47 m, Period VI) and a scapula from a fairly large individual (Period VII). Remains of horses larger than the usual small horses typical of the Saxo-Norman period were found, then, in Period VI and VII, the Late Medieval and Early Post-Medieval periods, and possibly in Period V also.

Dog

Dog bones were commoner and found in more features (Table 35; Table 43, microfiche) in Period IV than III. With the dog, and also the cat, it was more common than with the horse bones for several bones from a feature to be probably from one individual. One partial skeleton and a probable second one were found in Period IV, but the majority of bones still occurred singly.

Measurements (Table 50, microfiche) suggest medium to large animals, within the size ranges found on the Anglo-Saxon sites studied by Harcourt (1974). Shoulder height estimates were as follows: 49 cm, 54 cm (III); 48 cm, 61 cm, 62 cm (IV); and 49 cm (V). A skull from Period IV (P21, F18, tenth-eleventh century) was smaller than the dog skulls found previously at Thetford (Harcourt 1974, table 12 and G.G. Jones 1984, table 11), though still within Harcourt's Anglo-Saxon range and not from a dog as small as the one whose very small, curved radius bone (GL 89) was found at Thetford Site 1092 (eleventh century).

The Period III bones included a puppy (M_1 unerupted), one less than a year old (unfused distal radius) and two adults (mandibles, one with dentine exposed on the teeth). From the teeth, all the Period IV dogs were mature (seven individuals, in six of which dentine was

exposed), and just four long bones were immature. Period V (all features) included a puppy and two adult mandibles and a maxilla. Immature bones were not so common as at Site 1092 where five out of eleven individuals were immature.

No butchery marks were observed and the bones were not fragmented – all the dog bones were on the zone list (see Method section).

No dog bones were found in Period VI and only two in Period VII.

Two cracked and healed ribs and three vertebrae where the spine was bent over (see Pathology) may be the result of harsh treatment. Injuries on the muzzle of a dog from Site 1092 suggested a similar interpretation, although dog-fighting or bear-baiting could have been involved.

The most likely uses of dogs within the town are as guard dogs, pets and scavengers.

Cat

Although the number of cat and dog bones is small and conclusions need to be drawn with care for that reason alone, it is interesting that the proportions of both are very similar. As with dogs, cats appear to be commoner in Period IV than Period III, less common in Period V and rare in the later Periods. They tend to mirror the general density of occupation.

Period III remains included two partial skeletons from L27 F6 and remains from at least four cats from J26 F34. Assuming that the bones of one cat were not spread among more than one feature, Period III produced ten cats, five of them with immature long bones; and Period IV sixteen, five of them young and two sub-adult (partially fused late-fusing epiphyses). The young cats were not kittens: immature long bones were near to full-size; and early-fusing epiphyses, which fuse at four to seven months (Smith 1969), were all fused (Periods III and IV).

Control of the numbers of cats was not done, apparently, at the kitten stage (or, the kitten bones have not survived and been recovered). This may be deliberate if the cat was valued for its skin, although no skinning marks were observed.

Catskins certainly were used in the Early Medieval period, and had minor status. The Saxon Wulfstan, bishop of Worcester in the eleventh century, was upbraided by his admirers who observed that even if he did not wear sable, beaver or fox as he ought to do, he might at least wear catskins rather than lambskins. 'Believe me,' retorted the Bishop, 'men sigh oftener of the Lamb of God than the cat of God' (quoted in Veale 1966, 4, and for discussion see Jones 1983, 38–9, 43).

The cats were varied in size, including one smaller than any found at Lincoln (O'Connor 1982) (see Measurements, Table 51, microfiche, Period III, individual A). Generally they were of similar size to those at Lincoln, with few as large as those found in fourteenth-century Aylesbury (Jones 1983). None approached the size of a female wild cat in the British Museum (Natural History).

Period V included at least two kittens (distal humerus unfused).

Other mammals

Bones from deer were rare. Period III produced a specimen of roe deer—part of a skull with antler attached (see measurements). A fallow deer humerus (BT 36.3) was found in K20 F10 (1381). The feature contained all Late Saxon pottery (113 sherds) but the feature was only 25 cm deep and the depth of bag 1381 within the feature is not known, *i.e.* it may be the upper layer with the possibility of later intrusion. The context is not sufficiently certain for the find to constitute a definite record of fallow deer in Period III. Single bones of red deer were found in Periods IV (a tibia) and V (high residual pottery, a scapula).

Antler fragments were not found in Periods III to V which is more unusual in a town site, where worked bones are quite common, than the rarity of the eating of venison. It is particularly surprising given the expectation that deer may have been fairly common in the Thetford area, both from the presence of deer in the Breckland in the present day and the generally sparse population shown in *Domesday* (Darby 1952). The lack of hunting evidence would be consistent with extensive use of the area for sheep pasture.

Two antler pieces were found in Period VI (M23 F101, 876, fifteenth-century feature but with residual earlier pottery).

Two fox bones from Period IV were found in grid squares O18 and P21, that is, away from the main areas of domestic occupation. The two bones are mute as to whether they are from hunted foxes killed for their fur or natural deaths of town scavengers. A pelvis from Period III may be from fox or small dog, and one bone of fox came from Period V.

Hare was present in Periods IV and V, with one and five bones (from five features) respectively. Hare may have been trapped or hunted. The bones could also be natural occurrences, with the greater frequency in Period V reflecting the fairly sparse occupation of the site in the thirteenth to fourteenth centuries. If so, the hare may have been displaced by rabbit warrening in the late medieval period, all lagomorph bones from Periods VI and VII being rabbit. No cutmarks were observed on the hare bones.

Hedgehog and black rat occurred in Period IV (both from grid square M19).

The likelihood of later burrowing into features is a problem in studying rabbit. No butchery marks were observed on any rabbit bones, so it is probable that no record can be regarded as dated with certainty. However, the frequency of finds may be a good indicator. A single rabbit bone was found in each of the large bone samples from Periods III and IV, and none was found from Period V.

Rabbit became fairly frequent by Period VI, forming 2.9% of the bone and occurring in three out of eleven features. By Period VII it was common, forming 3.8% of bone count but occurring in eleven out of the twenty-five features. The bones occurred singly, except for three partial skeletons from an oven (L22 F38, Period VI or VII), probably filled after *c.* 1500. No burrows in the feature were observed, but the possibility that they are later intrusions remains.

The rabbit bones came mostly from the five grid squares L22, N23/24, M23/24 (ten of the fourteen Period VI and Period VII features containing rabbit), so it is this area which may have been used as a rabbit warren in the Late Medieval and Early Post-Medieval period.

The rabbit would have been valued for its fur, supplementing skins available from lamb, cat, fox and hare (Veale 1966).

The suggestion that rabbits were being kept in the vicinity of the site in Period VII is strengthened by the find of a ferret (or polecat) skull, in grid square L 24 (F47, 2621), which is near the area where rabbit bones were most frequently found. The skull was identified as ferret (Mustela furo) and probably not polecat (M. putorius) on the basis of the narrow post-orbital constriction (13.6 mm and see Measurements) (Corbet and Southern 1977, 345), and comparison with material kindly provided by Peta Sadler, Bob Wilson and Jennifer Bourdillon.

The association between ferrets and rabbits is well established (Owen 1969). The earliest known reference to ferrets in England is for 1223. During the medieval and Early Post-Medieval period rabbits were confined to purpose-built warrens, often with walls and made-up banks, and the date at which they became feral is uncertain. An early fifteenth-century reference (Owen 1969, 490) mentions that no-one hunts rabbits except furhunters, *i.e.* it is the fur which is the important commodity.

Bird bones

The percentage of fowl bones remained close to 3% in all periods. The bone count shows a small relative increase from Periods III to IV (Late Saxon and Early Medieval) (3.1% to 3.7%). This increase appears to be a real change, as fowl bones were also found more frequently, occurring in 26% of Period III features against 42% and 44% in Periods IV and V. The minimum number based on the most numerous skeletal element is twelve and fourteen for Periods III and IV. Fowl bones were less common than at Site 1092, where they formed 7.2% (169, of 2334).

The bones appeared to have been scattered, rarely being found as partial skeletons as one usually finds.

The anatomical analysis shows an uneven distribution of bones. For example, in Period III no skulls, one carpometacarpus but twenty-seven tibiotarsi were found. Rather similar inequalities were seen for Period IV with the ulna, femur and tibiotarsus being far more common than other bones. These differences are probably mainly the result of survival and recovery and do not show, for example, the separate disposal of feet from the main carcase. Tibiotarsi, which are the bones usually broken if the feet are separated, were more broken than femora: combining the two periods, 67% of femora and 47% of tibiotarsi were found in a complete state. Two tibiotarsi bore knife marks on the distal articulation suggesting separation at the joint, not by breaking the bone.

Few fowl bones were immature. Taking the total of bones with at least one articulation, 5.3% (N95) were immature in Period III with rather more, 12% (N134) in Period IV. Allowing for half of births to be hens, between a tenth and a quarter of males may have been kill-

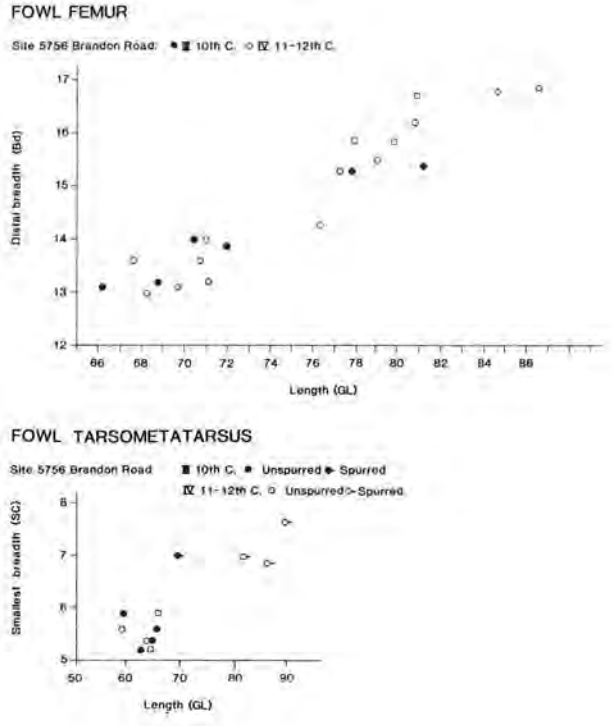


Figure 171 Brandon Road. Fowl: femur and tarsometatarsus.

ed before five to six months of age, with the majority being fattened at a greater age.

The measurements of the fowl bones show that two groups are present. Histograms and scatters of the humerus, ulna, femur and tarsometatarsals all showed a separation with roughly equal numbers of large and small bones. Tarsometatarsals were not numerous (twelve bones) but all the large group were spurred, which suggests that the large bones are from capons and cockerels, the small from hens.

Fowl, goose and duck were present in all periods, always in this order of numerical importance. The goose and duck are probably domestic, though the duck bones are little if any larger than wild mallard. Bones of both were mostly mature (immature bones, Period III: goose 0, duck 1; Period IV: goose 1, duck 0). There were more bones from the wing of geese, than would be expected, this part of the skeleton forming 70% and 80% of the samples from Periods III and IV. It could be that wings of geese were traded for their feathers, and see Fig.161, Nos 15 and 17, the bone flutes made from a goose ulna. (The wing bones of geese are also much larger than the leg bones, which would favour their preservation and recovery.)

A goose skull (IV 2598) bore a triangular hole 9 by 9 by 3 mm on the braincase, suggesting that it had been killed with a sharp instrument (*cf.* the rather larger, similar hole on a sheep skull, Site 1092: G.G. Jones 1984, pl.XXIII).

	Period	IV	V	VI	VII
Barnacle/ White-fronted Goose	*Branta leucopsis/ Anser albifrons*	1			
Red Kite	*Milvus milvus*	2			
Crane	*Megalornis grus*	1	(1)*		
Coot	*Fulicra atra*	1			
Rock/Stock Dove	*Columba livia/oenas*	1		1	1
Chough	*Pyrrhocorax pyrrhocorax*		2(1)*	3	
Jackdaw	*Corvus monedula*	1			
Rook	*C.frugilegus*				1
Rook/Crow	*C.frugilegus/corone*		1	1	2

* = dating uncertain

Table 44. Wild Bird

Remains from wild birds, though few, included red kite, chough and crane, which are absent from the area at the present time. The red kite, formerly a town scavenger, is probably a natural occurrence. Goose, crane, coot and dove may have been shot or trapped. The finds of chough at Thetford, 49 km from the sea, is of note as the bird is characteristically a bird of sea cliffs.

Plate XXXI Cattle rib fracture (Period III). Remodelling of the bone is well advanced but no fusion of the two parts has occurred. Either the condition has stabilised as a false joint or death occurred before fusion was complete.

Plate XXXIII Cattle molar: (Period VI), with a very large bovine pillar, arising from a supernumerary root.

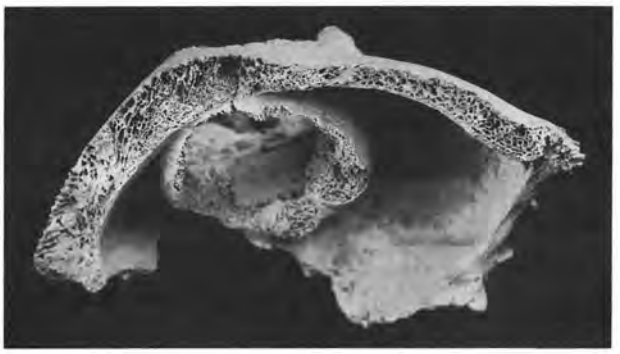


Plate XXXV Sheep skull: (Period V) the right upper part of the skull survives and there is a large abscess cavity at the base of the (missing) horn core 36 by 32mm and extending as much as 17mm into the cranium. The sheep was immature, the frontal suture being unfused and the frontal/parietal partly fused. Infection may have gained access through damage to the horn. The horn core base is quite small suggesting a ewe not a ram.

Plate XXXII Cattle metacarpal: (Period IV) a grossly deformed bone; the medial part of the bone (*i.e.* metacarpal III) is thickened, occupying ⅔ instead of ½ the bone. Most of the bone surface is smooth but there are three knobbly outgrowths on the posterior of the shaft. Radiography reveals that the bone cortex is thickened and less dense than normal (the cortex mid-shaft on the medial side is *c.* 16mm thick) and there is bone growth within the medulla.

Plate XXXIV Sheep elbow joint: (Period III), exostosis on the proximal lateral corner of the radius.

Plate XXXVI Dog lumbar vertebra: (Period III) the tip of the spinous process is bent 6mm out of true to the left and there is an extension of the left cranial articular facet.

Pathology

A record of the pathological bones and various anomalies is on microfiche and detailed records, sketches and photographs are held in the archive.

Pathological bones were not common. In cattle there were a few cases of periodontal disease and of bone changes resulting from injury, *e.g.* a broken rib (Pl.XXXI), stress or age, *e.g.* two phalanges with osteoarthritis, and disease during development, *e.g.* the metacarpal shown in Plate XXXII. Anomalies of form or development include a molar tooth with a very large bovine pillar arising from a supernumerary root (Pl.XXXIII).

In sheep, fairly frequent pathologies were periodontal disease in mandibles and a bony outgrowth on the side of the elbow (Pl.XXXIV). The only pathology almost certain to have been the cause of death was an infection within a cranium (Pl.XXXV).

Post-cranial pathologies in pigs affected metapodia and phalanges, many of them from immature animals, and possibly indicating tethering and confinement indoors. In other species, cases of spondylosis and spavin are testimony to the work done by riding or pack-horses, and in dogs, broken ribs and three cases where the vertebral spine is bent over (Pl.XXXVI) may mean that dogs were beaten. One bird bone was pathological.

Butchery

Butchery marks were recorded, but not in great detail. Cattle skull pieces were rather few. Horncores were often chopped at the base as expected. The occiput of one skull, the atlas and axis were chopped through roughly sagittally, from the ventral side (Period III). Long bones were very fragmented. Many showed heavy chopmarks and some knifemarks. One scapula blade piece showed a hole probably done when fresh, from which the meat may have been hung. Chopmarks were often heavy enough to show separation, *e.g.* behind the skull, and at the elbow and hock. Long bones were often chopped through the diaphysis. 34% of cattle bones were classed as fragments (III and IV). One deposit (III, in 019) contained remains of several broken-up skulls and fairly complete vertebrae, often chopped but not sagittally. Sometimes marks were seen on the distal condyles of metapodials, which may suggest use of the tendons (IV). A few vertebrae from later phases (V – VII) were chopped through sagittally, suggesting that splitting of the carcase occurred but not universally.

With the sheep and pigs, some vertebrae were chopped through sagittally and many long bones were chopped through the diaphysis (shaft), though the bones were less fragmented than with cattle (III – V). Chopping up of the skull was observed, usually breaking sheep skulls roughly along the midline (sagittally), and with pig skulls both sagittally and transversely. Most sheep horncores had been chopped through. Several sheep scapulae were chopped, from the medial side, *i.e.* after dismemberment. Chopmarks were seen on pig mandibles, which greatly reduced the data relating sex (from the canines) to the molar teeth. Male canines were usually broken.

III. Fish Remains

by Andrew K.G. Jones

Brandon Road

(Tables 54 and 55, microfiche)

The fish remains discussed in this report comprise a group of fifty-six bones collected from archaeological deposits excavated in Thetford between 1964 and 1966. At that time samples of urban medieval deposits were rarely sieved and it is not surprising that the present assemblage was collected by simply hand sorting excavated deposits. Sieving work at other sites in Thetford (A.K.G. Jones 1984) has shown that other early medieval deposits in the town do contain a large number of bones of small fishes in addition to the remains of large marine species which dominate the present assemblage. This strongly suggests that this assemblage consists of only a fraction of the fish remains present in the deposits at the time of excavation.

The deposits were assigned to periods, and the number of bones per period is very small. Consequently, few inferences can be drawn from the data.

However, it is clear that large marine fishes were imported into Thetford from the Late Saxon period until the sixteenth century. The presence of head bones and vertebrae in archaeological assemblages is normally used to indicate that whole fresh fish were present. This is at first sight surprising given the distance of Thetford from the coast.

The main value of the assemblage is that it contains remains from later medieval deposits in addition to Late Saxon material. As far as it is possible to judge from the small assemblages, there do not appear to be major changes in the kinds of large fishes brought on to the site from the tenth to the sixteenth centuries, although the tenth-century layers yielded only cod remains while later deposits, although dominated by cod, also produced haddock and ling bones. This result agrees with recent work on deposits from the Alms Lane site, Norwich (Jones and Scott 1985, 223 – 8) where an extensive sieving campaign recovered a host of bones from small and medium sized fishes as well as bones of large fish. This detailed investigation showed little change in the assemblages of fish remains from the twelfth to the eighteenth centuries and suggests that the various fisheries supplying the city were managed successfully for many centuries.

IV. Molluscs

(Tables 56 and 57, microfiche)
by Peter Murphy

Brandon Road

These were counted and then mostly discarded at the time of excavation. Table 56 (microfiche), based on material recorded as originally present, shows general types by quantity and by percentage. No shell was found in Period I, and only two oysters in Period II. In Period III, the largest quantity of oyster found (fifty-nine) was in pit M19 F38 which may belong to the early part of Period IV as it contained a high percentage of SN: The largest quantities of Period III mussel were found in pit K25 F8 (about 101) and in the top of gully O18 F34 (eighty). The largest amounts of shell in Period IV pits were in O22 F32 (forty-six oysters) and to some extent in O22 F2, K25 F16 and K25 F19. In Late Period IV, over forty oysters were found in pit N19 F4, and the total of mussels is inflated by a group of about 185 in the top of pit K25 F23; discounting these, percentages for Late IV are oyster 71%, cockle 18%, mussel 9%, land snails 2%. No large dumps of edible shell are evident from Period V features. In Periods VI – VII quantities increase and a number of pits contained edible shell refuse, particularly L24 F56 (VI?

predominantly oyster) L28 F53 (VI, over forty cockle shells), and the groups of pits in M23/N23 and M25/M26. Notable are M23 F11 (224 oyster, fifty mussel, one whelk), M23 F12 (nearly thirty oyster, some mussel), M25 F71b/M26 F79 (includes fifty-eight mussel) and to some extent M26 F79, M26 F100 which contained predominantly mussel.

Little can be made of the mollusca and the percentages of types are roughly similar for Periods III–IV and V–VII (Table 57, microfiche). The frequency remains oyster greatest, then mussel, cockle and few whelk.

V. Plant Remains

(Tables 58–60, microfiche)
by Peter Murphy

Methods

Samples collected during the excavations of 1964–5 and 1969–70 at sites 5756 and 5759 were received for examination. Most of these samples consist of large plant macrofossils, predominantly charcoal, collected by hand: no on-site sieving or flotation was undertaken.

The charcoal samples were graded into size fractions by dry-sieving before examination. Charcoal fragments larger than 6 mm were identified where possible and the finer fractions were scanned under the microscope, picking out any smaller macrofossils (*e.g.* shoots, seeds and seed capsules) which were present in the sandy matrix adhering to the charcoal. Plant remains were extracted from two small soil samples from Building J (K27 F15) at Site 5756 (Bag nos (2274), (2275)) by manual water flotation using a 0.5 mm collecting mesh.

Brandon Road

(Part II, above)

(a) Building J (K27 F15)

The samples from this cellared building fall into two categories: two small (300 g) soil samples and two charcoal samples from the fill of this feature (Bag nos (2274), (2275), (2260) and (2262)), and charcoal samples from post-holes. The fill samples provide some information on the superstructure of the building and where possible all plant remains in these samples have been identified. The post-hole samples were taken specifically in order to establish the types of timber used for the main vertical elements of the structure. Accordingly only charcoal from mature wood in these samples has been identified. Twigs and small branches of various species are also present, and in some cases make up the bulk of the sample, but these are clearly intrusive in the post-hole fills and consequently have not been examined in detail. Carbonised plant macrofossils in samples from Building J are listed in Table 58.

The soil sample from Bag (2275) was collected from a patch of charred material in the entrance of the cellar. It includes numerous rachis fragments of rye (*Secale cereale*), with some grains of rye, florets of oats (*Avena* sp), cereal and/or grass culm fragments, seeds of arable weeds, fragments of bracken fronds (*Pteridium aquilinum*) and heather shoots (*Calluna vulgaris*). This assemblage seems to represent rye straw from which the more-or-less completely threshed ears and other contaminants had not been removed, mixed with some bracken and heather. The location and composition of the sample suggest that it could represent charred remains of thatch: traditionally rye was considered the best straw for thatching, being both long and strong (Brown 1985, 249). Alternatively the sample could be from plant material strewn on the floor.

The charcoal from this sample includes mature wood of ash and oak (probably fragments of radially-split boards), as well as some hazel twigs, 16 mm in diameter, and unidentified fragments. Unlike the other samples from the cellar, however, Bag 2275 also contains some small worked pieces of wood (Fig.163). These include a lath-like piece of ash (SF764, No.2), about 24 by 5 mm in cross-sectional dimensions, with rounded edges, and a length of unidentified diffuse porous charcoal with a rounded quadrilateral cross-section up to about 20 mm across (SF763, No.1). This wooden object, which was cut from a piece of mature, non-twiggy wood, has a surviving length of about 80 mm, though other fragments in the sample, riddled with insect borings, indicate that it was originally longer.

The other soil sample from the cellar (2274), which came from the burnt layer on the mortar floor, is different in composition. Apart from a few grains and florets of oats (*Avena* sp) and young shoots of *Calluna vulgaris* it consists mainly of charcoal: twigs of hazel, 6–15 mm in diameter, fragments of ?birch and hawthorn-group charcoals, large fragmentary twigs of oak and large fragments of oak and ash wood. These seem to be fragments of radially-split oak boards and tangentially-split ash boards 20–25 mm thick. Similar board fragments of oak were collected by hand from elsewhere in the fill ((2260) and (2262)). The charcoal from the lower levels of the cellar fill thus appears to represent fragments of oak and ash floor-boards mixed with hazel twigs, presumably from wattle panels, and with some charcoal of other diffuse porous species, which were also perhaps structural components of the building.

Even after ignoring the twiggy charcoal from the post-hole fills several samples from these features include more than one species. In most samples oak is the main non-twiggy charcoal but samples (2263), (2264), and (2268) include some ash, and samples (2271), (2272) and (2273) contain some birch. It appears that all three species were used as constructional timber, though the post-hole fills evidently include charcoal introduced when the burning building collapsed. The single sample from a 'strut' (2267) was of mature oak wood with some twig fragments.

(b) Kiln N19 F7

Six small charcoal samples from layers (c) and (e) were collected for identification. The stokehole had been dug away by later pits and thus all samples came from the interior of the kiln. Identifications of fragments larger than 6 mm are given in Table 59.

Compared to the 'kiln-yard' samples, tree charcoals, including oak wood and hazel, oak and ash twigs, are relatively more abundant. Heather charcoal is, however, present in three of the samples.

(c) Pit M22 F48

(Periods IV–V)

This sample from the topmost fill of thirteenth to fourteenth-century date of a Period IV ?pit consists of 130 acorn cotyledons and fragments (*Quercus* sp) and a few small pieces of *Calluna* charcoal. The cotyledons are preserved in a mineralised state. Since only the largest

macrofossils from the deposit were collected interpretation is difficult, but it is possible that the acorns had been collected for their tannin content, for use in tanning leather or for some other industrial activity.

(d) 1966 Kilnyard

Charcoal samples from contexts E16 F33, D16 F46, D16 F61, D16 F97, D16 F115 and D16 F137 were received for identification. Most of the samples came from the stokeholes and interiors of the kilns and represent the remains of fuel, though charred fragments of rods forming the framework for the structure of kilns D16 F97 and D16 F115 were also collected. Identifications of fragments larger than 6 mm are given in Table 60. In addition to the identifications listed, most samples include young shoots of heather (*Calluna vulgaris*) with leaf bases and capsules containing seeds.

The two samples from the centering of the flue arches of kilns D16 F97 and D16 F115 are of hazel and hazel/alder. Charcoal samples from the stokeholes and the interiors of the kilns consist predominantly of heather (*Calluna*) and broom/gorse (*Sarothamnus/Ulex*) with relatively small amounts of hazel, oak and ash twigs and oak wood.

Discussion

The development of the Late Saxon town of Thetford would have resulted in a considerable demand for constructional wood and for fuel, both for domestic purposes and for use in the pottery industry. However, evidence from pollen analysis and other sources (Sims 1978; Bennett 1983) indicates that there were extensive prehistoric woodland clearances in the Breckland and it can be assumed that by the Late Saxon period large heaths existed in this area. The predominance of *Calluna* (heather) and *Sarothamnus/Ulex* (broom/gorse) charcoals in the pottery kiln samples implies that sufficient fuel could not be obtained from local woodlands and indicates that the fuel requirements of the industry were met, at least in part, collecting heather and broom/gorse in heathland areas. Whether the fuel was supplied as wood or as charcoal (produced perhaps in heathland clamps) cannot be determined. This activity would have had ecological effects of greater or lesser magnitude, depending on its scale: removing woody vegetation would have prevented regeneration of scrub on the heaths whilst any disturbance of the soil surface associated with this fuel collection could have resulted in instability and wind-blowing.

Interpreting the charcoal and other carbonised plant remains from the cellared Building J (K27 F15), in terms of their structural functions inevitably raises problems since clearly much of this plant material was not *in situ* but lay where it fell when the building burnt down. The following tentative interpretation may, however, be proposed:

Roofing	Thatch of rye straw, perhaps mixed with some bracken and heather (Sample (2275)).
Walls/partitions	Wattle panels, mainly of hazel (Samples (2260), (2262), (2274), (2275)).
Floor-boards (ceiling of cellar)	Radially and tangentially-split boards of ash and oak (Samples (2260), (2262), (2274), (2275)).
Main vertical posts	Oak, ash and birch (post-hole samples).
Struts/braces	Oak (Sample (2267)).

Abundant rye straw would have been available for thatching. The crop is known to have been widely cultivated in the Breckland from at least Middle Saxon times onwards (Murphy 1983).

Hazel rods were also used as part of the framework for the kilns. The acorns from the thirteenth to fourteenth-century context on top of pit M22 F48 give some indication of the uses of other woodland products.