A GLOSSARY OF SHOE TERMS

(For use when describing early shoes; some modern terms are not included. 'Shoe' also includes 'boot' unless otherwise stated.)

BOTTOM: the underpart of a shoe comprising one or more of the following sections: sole, insole, middle, welt, heel, and possibly other minor sections.

BRACING: when an upper is lasted on to an insole, the lasting margins have to be held in position until welt or sole is attached. This can be done by nails or by bracing thread criss-crossing and pulling the margins inwards. Although the thread may not survive in buried shoes, the imprint of it is often visible.

BUTTED SEAM: the edges of adjoining upper sections are butted together and joined by a seam, often an edge/flesh one (qv), invisible on the reverse side.

CHANNEL: a row of stitching holes, sometimes set in a groove.

CLOSED (or CLOSE) SEAM: two upper sections are stitched together face to face along an edge and then opened out and flattened.

CLOSING: stitching upper sections together.

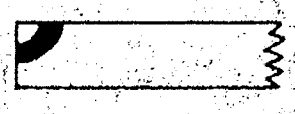
CLUMP (or CLUMP SOLE): a half-sole added to a shoe, usually as a repair.

CONSTRUCTION: the shoemaking term for a method by which upper and bottom are joined together (see NAILED, TURNSHOE, WELTED).

DELAMINATION: the condition of leather which has separated during burial into grain and flesh layers; due to the incomplete penetration of the tan liquor when it was made.

'EARED' SHOE: in the 16th century following a long period of pointed shoes, toes became very square and wide; for a short time, c 1535-55, the corners of the toe were extended sideways resembling ears.

EDGE/FLESH SEAM: the stitching holes are pierced from the edge of the section (usually the sole) to the flesh side; commonly used in the majority of medieval turnshoes (qv).



FLESH: the inner surface of a piece of leather originally next to the animal's body; the loose fibres are usually prominent (see GRAIN).

FOREPART: the front of the shoe (or sole or insole).

GRAIN: the outer surface of a piece of leather originally bearing the hair, fur, wool, etc. Each animal has a characteristic grain pattern and the surface is normally

smooth. Soles usually have the grain side downwards resting on the ground; insoles usually have the grain side upwards so that the foot rests on it. Uppers normally have the grain side outwards except for suedes.

HEEL: a component added to the rear (or seat) end of the sole, originally for utility but then as fashion. May consist of separate 'lifts' ('built heel') or be a block of wood covered with leather or other material. In either case the bottom section which rests on the ground is called the 'top-piece'.

INSOLE: the inside bottom part of the shoe on which the foot rests, sometimes referred to as 'the foundation of the shoe'. In a turnshoe (qv) there is no separate insole, the foot resting on the inner flesh surface of the sole which also acts as an insole.

INSTEP: a rather imprecise area on top of the foot between the rear of the toes and the ankle joint. The name is also incorrectly used for the arch or waist of the foot underneath.

LAPPED SEAM: two upper sections are overlapped and stitched together right through the full substance of both sections.

LAST: a wooden block on which the shoe is made roughly corresponding to the shape of the foot but with certain differences due to fashion and shoemaking requirement. The

backseam, the inside and outside quarters forming a continuous section.

RAND: a long narrow strip of leather of roughly triangular cross-section included in an upper/bottom seam (or elsewhere) to make it more waterproof or decorative. Some early turnshoes have such a rand and if this is wide enough, an additional sole (possibly a repair one) can be stitched to it (see TURN-WELT).

SANDAL: essentially a sole (single or multi-layer) held on to the foot by straps varying in complexity.

SEAT (or HEEL-SEAT): the rear end of insole or sole on which the heel of the foot rests.

SHANK: a reinforcement placed centrally between the lasting margins (qv) or the waist (qv) of a shoe and between sole and insole. Its purpose is to prevent the shoe from bending in the waist, particularly when a heel is used.

SOLE: the part of the shoe which is in contact with the ground. If the shoe has a separate heel (qv) the bottom section of this next to the ground is called the 'top-piece'.

STIFFENER (or HEEL-STIFFENER): a reinforcement placed inside the back of the quarters. In early shoes the top edge is often stitched to the quarters by a type of hemstitch (or overseam or whipped seam) which produces a scalloped effect along this edge: the bottom edge is lasted in with the upper.

STITCH LENGTH: the distance between the centres of stitches of stitch holes in a row.

THROAT: the central portion of the rear end of the vamp resting on the instep of the foot.

TIE-HOLES: the holes in quarters, latchets, or tongues through which a string ribbon or thong is passed to hold the shoe on the foot.

TOE PUFF: a reinforcement under the toe-end of the vamp.

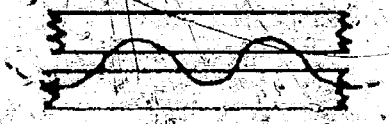
TONGUE: a backwards extension from the vamp throat (qv) resting on the instep of the foot. Latchet ties (qv) may pass over or under it and sometimes there is a pair of holes through which the tie string passes.

TOP-BAND: a narrow strip of leather or other material stitched to the top edge of the quarters (or legs of a boot) for decorative purposes.

TOP-PIECE: the bottom of a heel which actually rests on the ground.

TREAD: the widest part of a sole forepart in closest contact with the ground.

TUNNEL STITCH: a seam used in repairing to attach a new piece of leather, eg a clump sole (qv) on top of an old one. The holes enter the surface of each piece, pass for a short distance through the substance (between grain and flesh) and then reappear on the same side. Sometimes called a 'caterpillar' stitch.



TURNSHOE CONSTRUCTION: the shoe is made inside out (normally with the flesh side outwards) by sewing the lasting margin (qv) of the upper to the edge of a single sole which also acts as an insole. The shoe is then turned the right way round so that the grain side of the leather is on the outside of the shoe and the upper/sole seam is now inside. It was apparently introduced to this country by the Saxons.

TURN-WELT: a turnshoe which has an extra-wide rand (qv) included in the seam so that this becomes a welt to which a first sole, and later a repair one, can be stitched. It is the intermediate stage between a turnshoe and a welted shoe, appearing c 1500.

VAMP: the front section of a shoe upper covering the toes and part of the instep.

VAMP WINGS: the sides of the vamp extending backwards either side of the throat to join the quarters.

WAIST: the narrow part of a shoe sole or insole under the arch of the foot (also called the waist).

WELT: a narrow strip of leather sewn round the lasting margin (qv) of the upper and joining it either to the insole edge or to a 'rib' raised on the flesh side of the insole near the edge. The sole is then attached to this welt by a second seam. It appears to have been developed from the rand (qv) and the two names are sometimes confused with each other (see WELTED CONSTRUCTION).

WELTED CONSTRUCTION: a method of shoe construction introduced to this country c 1500 and still used (although mechanized). It takes place in three stages:

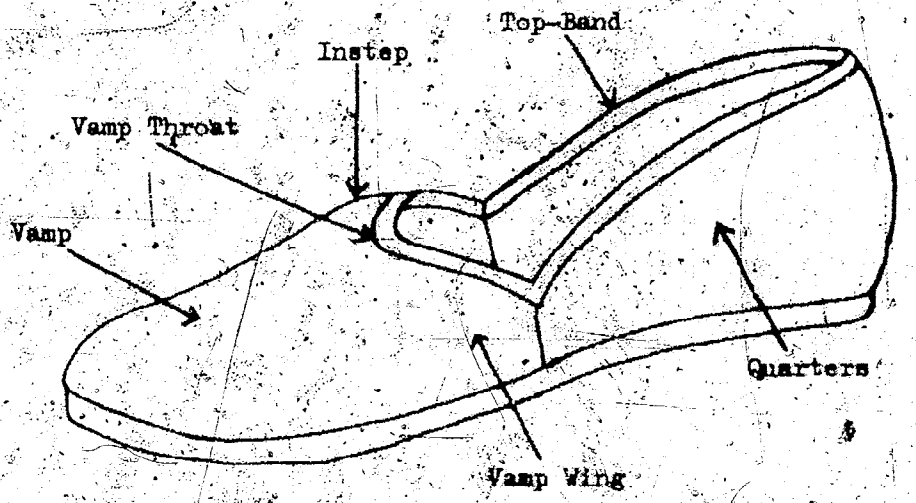
(1) the upper is lasted and held in position by nails or bracing thread (qv);

(2) the lasted upper is sewn together with a welt (qv) to the edge of the insole (early examples use the actual edge itself with an edge/flesh seam (qv) but later ones use an upstanding rib set in a short distance from the edge);

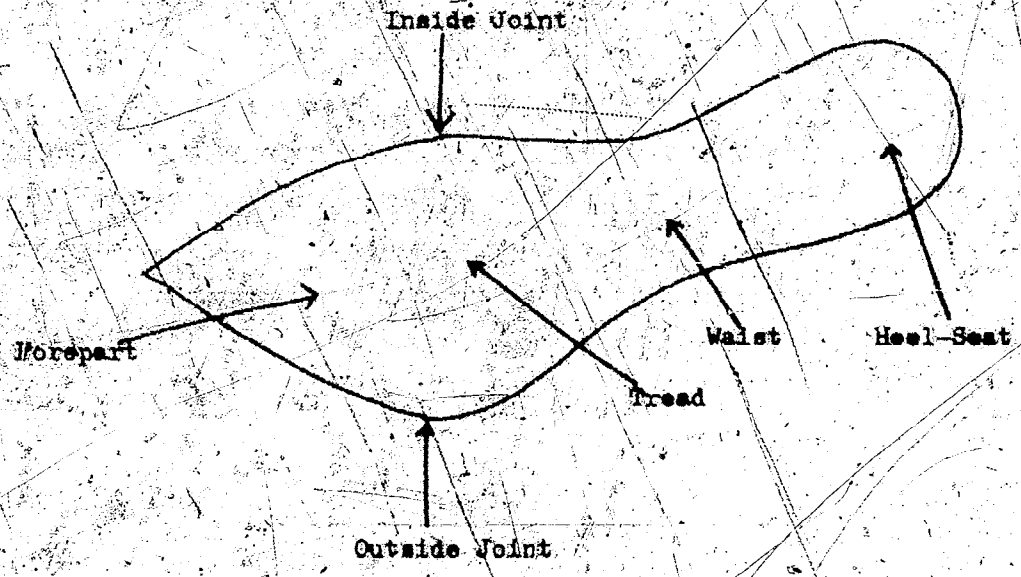
(3) the sole is then stitched to this welt.

A fuller description of some of the above terms and also an account of the origin and development of shoes will be found in Textbook of footwear manufacture edited by J H Thornton (3rd edition 1964, reprinted 1971, Butterworth & Company, London).

SHOE UPPER



SHOE SOLE



THE HUMAN BONES

Ann Stirland

The burials described below are divided into four groups according to where they were found:

Group 1. The chapter-house. Phase 7C
Group 2. The east cloister alley. Phase 3E
Group 3. The cloister garth. Phase 3C
Group 4. South of the church. Phase 7C

A small amount of extra, anomalous bone occurred with some of the burials. Each burial will be briefly described and a summary and conclusions are set out in the main text.

Key to dental formula
1 = medial incisor
2 = lateral incisor
3 = canine
4 = anterior premolar
5 = posterior premolar
6 = first or most anterior molar
7 = second molar
8 = third molar, or wisdom tooth
C = caries
E = exposure of the pulp cavity
$\not{0}$ = a tooth lost post-mortem
X = a tooth lost ante-mortem
(3) = an unerupted tooth
③ = a tooth erupting
NP = a tooth that is not present
a-e = milk teeth

GROUP 1. THE CHAPTER-HOUSE. PHASE 7C

GRAVE 1

Unsexed. Immature: 8-10 years

The maturity of a child's or adolescent's skeleton may be determined in two ways:

a) by the eruption pattern of the teeth

b) by the condition of the edges and/or ends of many of the bones.

As the skeleton grows, these edges or ends remain free from the main part of the bone, gradually uniting with the bone during the slow process of maturation. These unions occur at specific times and can therefore be used to 'age' an immature skeleton. The free ends of the bones are known as 'epiphyses'.

This skeleton is small and delicate in structure, and the epiphyses remain free. There is also mixed dentition, with both milk and permanent teeth present in both jaws, thus:

R (8) 7 ∅ ∅ ∅ (3) 2 1	1 2 (3) ∅ ∅ 6 7 (8) L
(8) (7) 6 (5) (4) (3) 2 1	1 2 (3) (4) (5) ∅ (7) (8)

* Brothwell 1972, 47, 59

There is no decay or tartar on these teeth. With the skull there are also some loose teeth, namely four incisors, three canines, three premolars, and two molars, plus three probable adult molars, all worn and one very decayed.

The state of the teeth and the condition of the epiphyses, plus the general build, indicate a child of about 8-10 years. The skeleton is fairly complete. Four wormian bones are present in the rear lambdoid suture of the skull.

GRAVE 2

~~Unsexed, although a possible female. Immature: 10 years~~

Although most of this skull is present, it is fragmented, apart from the face which is fairly complete, including both eye sockets. The upper borders of both of these are rather sharp, a female characteristic. Also, both the mastoids are poorly developed, again indicating a female. There are wormian bones present in the lambdoid suture of the skull. Both jaws survive, and show the state of the teeth to have been:

R															L
	(8)	(7)	6	5	~~4~~	(3)	2	1	1	2	(3)	~~4~~	5	6	(7)	(8)	
	(8)	(7)	6	5	(4)	(3)	2	1	1	2	(3)	4	5	6	(7)	(8)	

There is no decay on these teeth, although $\overline{1}$ and $\overline{2}$ are broken, and only a small amount of tartar.

The post-cranial skeleton is fairly complete, apart from a missing left arm.

Pathology

There is a partially healed elongated hole 35mm long by 5mm wide on the rear surface of the foot end of the left tibia. This is a curious wound, occurring as it does on the side of the bone which is buried in muscle. As there is no evidence of disease in this skeleton, some kind of ante-mortem accident, possibly involving the lower-leg tendons, is postulated. However, since the healing of this wound would appear to be only partial, post-mortem damage, or accident shortly before death, cannot be ruled out.

The delicate build of this skeleton, plus the state of both the epiphyses and the teeth, would indicate another child, possibly a female and aged about 10.

GRAVE 3

Adult. Male. Age: 23 years

Most of this skull is present, although fragmented. It is strong and thick, with well developed mastoids. There are small wormian bones present in two sutures, the lambdoidal and the sagittal, along the centre of the skull. A small metopic suture 12mm long is retained in the front of the skull, between the eye sockets. This suture usually disappears in early childhood, and indeed was not present in the first two children's skulls. In some individuals it is, however, retained into adult life, and this may be a genetic trait.

Both jaws survive, and show the state of the teeth to have been:

			C												C	
R	8	7	6	5	4	3	2	1	X	2	3	4	5	6	7	8 L
	8	7	6 C	5	4	3	2	1	1	2	3	4	5	6 C	7	8

Both the lower first molars and the upper second molars have lateral neck caries at the gum line. There is one loose canine, probably $\overline{3}$. There is a small amount of calculus or tartar present. The age, based on the wear of the molars, falls within the range 17-25 years.

The post-cranial skeleton is fairly complete and in good condition. Epiphyseal union is just completed on the major long bones, indicating an age of 23 years. The stature, based on the right femoral measurement, is about 5'10".

GRAVE 4

Adolescent. Probably male. Age: 13-15 years

Most of this skull survives, although the face is smashed. Skull measurements were possible, and the Cephalic Index (CI) proved to be 62.1. This is a very dolichocephalic

or long-headed reading, and is obtained by the formula (Brothwell 1972, 88):

$$\frac{\text{Maximum skull breadth} \times 100}{\text{Maximum skull length}}$$

Both jaws survive, and show the state of the teeth to have been:

R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	

Both the presence of the unerupted wisdom teeth (M3), and the fact that the basilar suture in the base of the skull is still open, show this individual to be less than 21 years of age. The age, based on the dentition, is 15. There is no decay, and only a small amount of tartar.

The post-cranial skeleton is fairly complete apart from a missing left foot, which proved to be included with burial 5. The bones generally are robust and strong, with good muscle-markings. The three bones of the pelvis are beginning to unite, indicating a pubescent age of 12-14 years.

The evidence would therefore indicate a very long-headed male of 13-15 years with good teeth.

There is also a piece of unidentified animal (?) pelvis in with this burial.

GRAVE 5:

Adult. Male. Age: 24 years

Most of the calvarium or upper casing of this skull is present, though incomplete. The cranial sutures still appear fresh, and there are small wormian bones in three of them. The heavy mastoids, eyebrow ridges, and nuchal crest on the rear of the skull would indicate a male.

Both jaws survive, and show the state of the teeth to have been:

			C E	C E										C E		
R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	

In the lower jaw, there is crowding of the second incisors 2] and [2, and rotation of 3]. There is no decay in this jaw, but heavy tartar. In the upper jaw there is also heavy tartar, plus a lot of molar decay. [6 is a rotted stump and 6] and 5] both have heavy decay of the pulp cavity; all three have exposure of this cavity. The age, based on tooth attrition or wear, falls within the range 17-25 years.

The post-cranial skeleton is fairly complete and in a good condition. Although all the epiphyses are united, their lines are still apparent, especially on the humerus heads and the crests of the pelvis, indicating a probable age of about 24 years. The long bones are not heavily muscled, but there are small exostoses or bony growths on both tibia, laterally on the left and medially on the right, and on the backs of both at the proximal or head end. These are often the result of compensatory bone growth in the case of muscle or ligament damage or overuse. This skeleton does not show any other evidence of heavy work, however, and two others in the group show signs of these exostoses, so there may be some genetic trait displayed here.

The pelvic measurements give a very small angle, again suggesting a male, and the height, based on a femoral (femor = thigh bone) measurement, is 5'10½".

GRAVE 16

This burial is represented only by some pieces of an immature lower jaw, probably that of a 10-year-old, together with some pieces of thin delicate cranium which

are probably the child's skull. These skull bones have small wormian bones in a suture.

GROUP 2. THE EAST CLOISTER ALLEY. PHASE 3E

GRAVE 6

Adult. Probably female. Age: 30-35 years

There are several problems associated with this burial. In the first place, there is no skull present. Since, however, there are two with burial 8, one of these has been fairly easily matched with this burial.

This skull is complete, and has most of the sutures obliterated on the outer table. Both jaws survive, and show the state of the teeth to have been:

R	8	7	6	5	4	3	2	0	0	2	3	4	5	6	7	8	L
	X	7	6 C E	5	4	3	2	1	1	2	3	4	5 C	X	7 C E	8	

Both jaws show anomalies. There are no first incisors in the upper jaw, and in the lower both the first and second molars on each side are very small and underdeveloped. They have only a small single crown like a worn incisor, and all have some decay. $\overline{7}$ has no proper roots, only a closed end to the pulp cavity, and this may apply to the others as well. There is a small amount of tartar. The age, based on attrition (molar wear, see Brothwell 1972, 69) is 25-35.

This skull gives a CI of 80.4 and is therefore brachycephalic, or round-headed, with a slight sagittal (central) keel.

The post-cranial skeleton is fairly complete, and this is generally a small gracile skeleton. The long bones have strong muscle-markings, and there is an exostosis on the end of the right collar bone where it articulates with the

shoulder blade, probably produced by tearing and damage to the ligaments of the shoulder joint. Both femurs lack the fovae or depressions for the ligaments on their heads. There is osteoarthritic lipping on all lumbar vertebrae, except number two, particularly on L4 where it is extensive and involves the superior articular processes. There is also some osteoarthritis on some thoracic vertebrae. There is a distinctive green stain on the vertebrae of the sacrum.

The height of this individual, based on femoral value, is about 5'2". This stature, coupled with the sciatic notch value of 62°, a sub-pubic angle of nearly 90°, and the general gracility, suggests a female, although the good muscle-markings suggest a robust build.

Intrusive in this burial is a cow's tooth, and there are also some fragments of very small bone. Similar bones also occur with burials 8 and 9. They are the hyoid bones of the skull, bones which are often lost during burial or excavation, and which serve in life to support the tongue.

This probable female was short and robust, with curious teeth and arthritis of the spine. She was aged 30-35 years.

GRAVE 7

Young adult. Male. Age: 21 years

The skull is fairly complete, although fragmented. The sutures are still unfused. The mastoids and nuchal crest are well developed.

Both jaws are present, and show the state of the teeth to have been:

R	(8)	7	6	5	4	3	2	1		1	2	3	4	5	6	7	(8)	L
	8	7	6	5	4	3	2	X		1	2	3	4	5	6	7	8	
																C		

There is a small amount of tartar, and no decay except on 7. The teeth are robust and healthy, with good enamel, and little wear. The age, based on eruption and attrition, is 17-25.

The post-cranial skeleton is complete and in a good condition. The age, based on the fusion of various epiphyseal centres, including the pelvis and long bones, is 21 years. There are no heavy muscle-markings, but there are small exostoses on the lateral backs of both tibia, as in burial 5. The height, based on tibial measurement, is about 6'1", and two of the lumbar vertebrae are green-stained.

GRAVE 8

Adult. Unsexed. Age: 25-35 years

This skull is reasonably complete, but fragmented. There are well-marked eyebrow ridges, well-developed mastoids, and large teeth, indicating a male. There are some very small wormian bones in the suture at the front of the skull. Both jaws survive and show the state of the teeth to have been:

R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	L
	8	7	X	5	4	3	2	1	1	2	3	4	5	6	7	8	

There is resorption (or recession) of the lower jaw bone around the missing X, and all the canines are a little rotated. There is no decay, and a small amount of tartar. Four loose teeth are also present, two incisors and two premolars. There is considerable thickening of one incisor where the crown meets the root. The age based on tooth attrition is 25-35.

The post-cranial skeleton is incomplete and smashed, particularly on the left side. The pelvis is almost non-existent, thus making sexing difficult. There are

strong muscle-markings on the surviving long bones, and both collar-bones are well-developed, especially on the right side, thus indicating possible right-handedness.

The stature, based on the femoral length is 5'10", and this, together with the general robustness, would indicate a male.

GRAVE 9[redacted]
Adult. Probable male. Age: about 30-35 years

The calvarium or cranial vault of this skull is present, the face and skull base are missing, and there is slight sagittal keeling, as with burial 6. The cranial sutures are well obliterated, and there are well marked mastoids, eyebrow ridges, and nuchal crest. There is some 'bunning' of the occiput at the rear of the skull. The CI gives a value of 78.0, which is mesocephalic or medium-headed.

Both jaws survive, and show the state of the teeth to have been:

R 8	7	6	5	4	3	2	1	1	2	3	4	5	X	7	8 L
8	7	6	5 C E	4	3	2	1	1	2	3	4	5	6	7	8

There is considerable tartar at the jaw line and the beginnings of periodontal disease, plus decay on $\overline{5}$, which is rotted, exposing the pulp cavity. There is resorption of the jaw around $\underline{X}$. One loose incisor and one loose canine are also present. The age, based on attrition, is 25-35, probably nearer to 35. There is thickening of the lower incisors, as in burial 8.

The post-cranial skeleton is fairly complete, apart from the right hand and left scapula, although damaged. The

bone of this skeleton is also fairly stained and marked. There is osteoarthritic lipping on the lumbar and thoracic vertebrae, particularly on the left side. There are good muscle-markings on the leg bones. The height, based on femoral length, is about 5'10½".

There are pieces of metal, probably iron, from the areas of both arms, the pelvis, the left leg, and both feet. That with the left arm was embedded in the humerus head until cleaning. These may be coffin nails.

GRAVE 10

Unsexed. Immature. Age: 12 years

This skeleton is fairly complete, although fragmented, especially the skull and pelvis. The skull bone is thin, and the skull itself is small and delicate. Many of the sutures are still free.

Both the jaws survive, and show the state of the teeth to have been:

R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	

There is no decay, and only a small amount of tartar on these teeth. Loose teeth are 1 incisor, 2 premolars, and 1 molar. Age based on tooth eruption is 12-15 years.

There is little to be said about the post-cranial skeleton except that the bones are healthy, with no obvious damage or disease. Age based on the fusion of the pelvis is 12-13 years, and on the foot epiphyses 12 years.

GRAVE 11

Adult. Male? Age: 35-45 years

This skull is complete, including a broken lower jaw. The nuchal crest and mastoid processes are fairly small, but the

eyebrow ridges are marked. The cranial sutures are obliterated, and the skull is similar in shape to that of burial 9, rising in height towards the back. There are the remains of a metopic suture 16mm long. The CI gives a value of 83.04, and this skull is therefore brachycephalic.

Both jaws survive, and show the state of the teeth to have been:

R									area missing								L
	8	7	X	5	4	3	2	1	1	2	3	4	5	6	7	X	
														*			

The upper jaw is almost devoid of teeth. Only 6] survives, and most of the rest of the bone is completely resorbed, implying ante-mortem extraction or loss. Of these, the latter is most likely, due to periodontal disease (pyorrhoea). Both 6] and [6 (*) show the same anomaly of form as in burial 6, and this may imply a possible relationship. There is a lot of tooth wear on the lower jaw, and a lot of tartar, although no decay. Whatever disease or mishap struck this individual seems to have largely affected the upper teeth. Age based on attrition is 35-45.

The bone of the post-cranial skeleton is thin and very damaged, probably by the conditions of burial. The long bones are light and appear to be short and gracile, and there are small squatting facets present on the tibia. There is some osteoarthritis on the lumbar vertebrae, although these are very damaged by burial. Height, based on femoral length, is 5'7".

GRAVE 12

Immature. Probable female. Age: 15-16 years

This burial is incomplete, lacking the skull, humeri, and most of the spine.

The age, based on surviving epiphyses, is 15-16 years. A shadow tracing of the sciatic notch of the pelvis gives an angle of 52° and equal chords, indicating a possible female. There is also present an anomalous adult right femur, probably from another grave.

GRAVE 13
Adult. Incomplete

This burial consists of a complete pelvis, the right femur lacking the knee end, the lower legs and feet, which were almost complete, both radii, and six lumbar vertebrae. There are very strong muscle-markings on the femur, suggesting a male, and this is supported by the sciatic notch angle of 39°. There is considerable osteoarthritic lipping on the pelvis, sacrum, and lumbar vertebrae, suggesting an age in the late 30s or early 40s. There are bony exostoses at the knee ends of both tibia where the ligaments for the muscles join. This is probably caused by continual strain due to heavy work. At the foot end of the right tibia there is a very large exostosis positioned medially. This may well be compensatory growth for a severely damaged muscle earlier in life. There are some arthritic growths on the bones of the right foot, again supporting the idea of earlier injury.

GRAVE 14
Mixed. Fragments of two immature individuals of different ages -

a) Consists of damaged legs, plus the feet and one hand. Age, based on epiphyseal fusion, is 21-22 years.

b) Consists of the pelvis, the head end of the left femur, and the epiphyses of both heads, plus sundry bits. Age, based on pelvic fusion, is 12-13 years. Sex, possibly male, based on the sciatic notch angle of 37°. There is green staining on one half of the pelvis.

GRAVE 15

The position of this burial was recorded during the excavation but the skeleton was not recovered.

GROUP 3. THE CLOISTER GARTH. PHASE 3C

GRAVE 17

Adult. Male. Age: 23-25 years?

This skeleton is incomplete and fragmented. The skull bones in particular are very sparse, lacking both the face, the jaws, and any teeth. There are no lower legs or feet. From the condition of the epiphyses this individual is an adult. The age arrived at is based on changes at the pubic symphysis. The stature, based on femoral and humerus measurements, is 5'10". There is no evidence of damage or of heavy work. There is green staining on the right wing of the pelvis.

GRAVE 18

Adult. Male?

This burial is extremely fragmented and incomplete consisting literally of a few bits and pieces. The fragments that do survive are rather heavy and large, particularly those of the skull, implying a male.

GROUP 4. SOUTH OF THE CHURCH. PHASE 7C

GRAVE A

Male. Age: 21-30, probably 23

Most of the post-cranial skeleton is in reasonable condition, including the vertebral column. The skull is present, complete and fairly robust, with well marked supra-orbitals (brow-ridges), nuchal crest (on back of

skull), and mastoid bones. At the back of the skull there is 'bunning', or a protrusion of the occiput, which is more pronounced on the left side. There are several extra paired wormian bones in the rear or lambdoid suture. There is some retention of the metopic suture in the frontal bone, between the eye sockets.

Both jaws survive, and show the state of the teeth to have been:

			C		C											
R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8 L
	8	7	8	8	4	3	2	1	1	2	3	4	5	6	7	8

There were four loose incisors and three canines, out of the jaws. There is decay on two of the upper teeth, 3| and 6|, and a small amount of tartar is present.

The stature of this individual was calculated using the length of the left tibia. This corresponds to a stature of about 5'11".

Pathology

Although the spinal column is in a good condition, with no arthritic lipping, lumbar 4 (L4) appears to have suffered some damage and regrowth on the outer edge of the upper curved surface. This would suggest either a fall from a height onto feet or head, causing jarring (Gray, 253), or some abnormality of cartilage growth (Wells 1964, 261 and pl 2).

The cranial index (CI) is 70.2, indicating that this individual was dolichocephalic, or long-headed.

GRAVE B
Male. Age: 26-30

The post-cranial skeleton is almost complete and in a good condition. All bones have very heavy muscle-markings,

especially the long bones, pelves, and sacrum. The skull is complete and has strong supra-orbitals, nuchal crest, and mastoids. There is considerable 'bunning' and heavy muscle-markings on the occiput, which also appears to have a polished area or eburnation on the left side. This may, however, be a condition induced by conditions of burial or excavation. There are several wormian bones in the lambdoid suture, and two others present in the coronal suture in the front of the skull.

Both jaws survive, and show the state of the teeth to have been:

R																L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
					C											

There is no tartar, but caries on 4. All molars were removed well before death, and there is considerable resorption of both jaws.

Stature was based on the length of the right humerus and corresponds to a stature of about 5'10½".

Pathology

It is obvious from the extent and degree of the muscle-markings that this individual was engaged in a lot of hard physical work. Possibly in connection with this, he at some time broke his right arm. The right radius has a simple fracture which was apparently unsplinted, since the bone healed with the upper half twisted round in relation to the lower half. At the site of the injury is a small exostosis or bony growth, and there is a similar but smaller one on the ulna or inner bone at the same level. These exostoses indicate that the bone became inflamed as a result of the injury, thus causing the growth. This damaged radius is 10mm shorter than the other one, but the ulna is 10mm longer than the undamaged one. The left scapula (shoulder-blade) has slightly heavier markings than

the other one, and the left humerus has a slightly bigger shaft. It is possible that, after the injury to his right arm, this hardworking man had to resort to greater use of his left, possibly for the rest of his life.

There is osteoarthritic lipping on the upper and lower edges of several lumbar vertebrae, and a little on some of the thoracic or middle ones. The upper or cervical ones are very grossly deformed, with collapse of some of the lower bodies. This may well have been initiated by some kind of injury.

The CI is 70.7, another dolichocephalic man.

GRAVE C
?Male. Age: 17-25

This burial consists of a complete skull with both jaws surviving and some vertebrae. The skull has strong occipital markings, with a well marked nuchal crest plus good brow ridges. These skull markings suggest a male. CI is 80.2, which is brachycephalic, or round-headed.
Teeth:

R	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	

There is no decay or tartar. 7 has slightly impacted roots and there is some destruction of the bone around 8, the actual tooth being loose from the socket. There is also some resorption, or regrowth of the bone, round all molars, caused by pyorrhoea.

Pathology

There are only three surviving vertebrae, and they are all cervical ones. They are C2, 3, and 4 and they all have

severe growths on the left side, so much so that 2 and 3 are completely ankylosed, or fused, on this side. These kinds of growths may be caused by injury or by an infection such as tuberculosis.

At the front of the skull there are the remains of a metopic suture, and at the back, in the occiput, there is the indication of an Inca, or completely extra bone.

GRAVE E
Male. Age: 30

The post-cranial skeleton is damaged and incomplete, so that estimation of stature is not possible. However, enough survives for sexing and ageing purposes. Most of the skull survives including the jaws. The cranial sutures are very fresh-looking. Teeth:

	NP					(3)								NP	
R	8	7	6	5	4	c	2	1	1	2	3	4	5	6	7	8	L
	8	7	6	5	4	3	2	1	1	2	----------						
											missing						

There are no upper third molars or wisdom teeth. An upper milk canine has been retained into adult life, and the permanent canine, or eye tooth, has developed but stayed in the jaw. There are several paired wormian bones in the lambdoidal suture.

Pathology

The sternal end of the left clavicle, or collar-bone, which articulates with the sternum, or breast bone, has strong arthritic lipping. The left side of the upper part of the sternum also shows matching lipping. The lumbar vertebrae have very roughened and pitted bodies, and there are Schmorl's nodes of varying sizes in the centres,

appearing as spinous growths on the upper surfaces. The lower lumbar vertebrae show lipping and compaction. There is a small amount of lipping of the sternal end of the right clavicle, but less than with the left.

GRAVE F
Male. Age: 21-25

Most of the post-cranial skeleton is present and in good condition. The skull has strong brow-ridges, nuchal crest, and mastoids. Teeth:

R	missing								X	X	3	4	5	6	X	8 L
	8	7	X	5	4	3	2	1	1	2	3	4	5	6	7	8

No decay is present, there is a medium amount of tartar, and some resorption of the bone due to gum disease or pyorrhoea.

Stature, based on humerus length, corresponds to a height of nearly 6'.

Pathology

There is lipping of the sternal end of the left collar bone plus some bony outgrowths or exostoses where the ligament attaches. There are equal exostoses on the breast bone, where the collar bone articulates with it.

The CI is 70.5 and this skull is again dolichocephalic.

GRAVE G
Male. Age: 40-45

These remains appear rather smaller and more gracile than the others. The lower end of the breast bone (xiphoid process) is united with the rest of it, a condition which

does not usually occur until the age of at least 40. The skull has again got well marked brow-ridges, and there are some small wormian bones along the lambdoid suture. It is, however, too damaged to allow the CI to be calculated. Teeth:

				E C												
R	~~8~~	7	6	5	4	3	2	1	1	2	3	4	5	6	7	~~8~~ L
	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8

The upper jaw is in three pieces. There is very uneven wear between the left and right sides of the jaws, with much heavier wear occurring on the left. Both the upper wisdom teeth are missing, and look as if they could have been extracted since the bone has regrown very neatly. There is one loose molar with impacted roots.

Stature, based on humerus length, is about 5'6½".

Pathology

There is a small amount of lipping of the lumbar vertebrae and some destruction of the top, rear edge of L4, probably due either to disc trouble or to some kind of injury.

GRAVE H
Male. Age: 17-18

The post-cranial skeleton is fairly complete, but there is no skull. There are no apparent pathologies with this material.

Stature, based on right femur, is about 5'8".

GRAVE J
Male. Age: 35-45

These remains appear older than the others. Although most of the post-cranial skeleton survives, the bone is very

damaged and rather destroyed, suggesting that soil or other conditions where this body was buried may have been a little different from those for the others. The skull has smaller brow-ridges than the others, but both the mastoids and the nuchal crest are heavy. The sagittal suture along the top of the skull is almost obliterated, a condition which occurs with ageing. As with most of the others, there are a few small wormian bones in the lambdoid suture at the back of the skull. Teeth:

	C	A				C								
R	X	7	X	5	4	3	2	1	1	2	3	4	5	6	7	X	L
	X	7	X	5	4	3	2	1	1	2	3	4	5	X	X	X	

There is decay on both 2| and 7|, and an abscess around the missing 6|. There is some resorption or regrowth of the bone around the missing teeth, and it is possible that all the wisdom teeth had been extracted.

Stature, based on humerus length, is about 5'10".

Pathology

There is a great deal of osteoarthritic lipping, some of it very heavy, on many of these bones. The whole of one side of the heads of both femurs (the greater trochanter side) is covered with these growths, which also surround the margin of the head and frill the fovea, or opening, for the ligament into the head. Pieces of the shaft are mineralizing. Other long bones have lipping at both ends, and there are growths on ribs and some foot bones. The sacrum at the base of the spine is also lipped, and there is both lipping and damage in the column, especially in the lumbar region, where some vertebrae have also suffered collapse.

The CI is 78.3 and this individual is therefore mesocephalic or medium-headed.

METHOD

Skull and bone measurement, dental attrition, and related ageing rates are based on those suggested by Brothwell (1972). Stature is estimated using the formulae of Trotter and Gleser (1952).

Ageing based on changes at the pubic symphyses is based on McKern and Stewart's (1957) components.

Other age changes are those stated in Gray.

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THE ENVIRONMENTAL EVIDENCE

Maureen Girling

APPENDIX

Species list of plants, molluscs, and insects from Austin Friars

Those species denoted in the tables by an asterisk (*) indicate identifications made by Dr J G Evans, Dr J H Mathias, and Professor H P Moon from additional material processed independently from the samples investigated by Dr Girling.

Numbers for each taxon represent a minimum based upon commonly recorded remains.

Key for plant remains:

- a achene
- f fruit
- fs fruit segment
- fa fruit achene
- g grain
- m mericarp
- n nutlet
- s seed
- t stone

	SOUTH DITCH/DRAIN					NORTH DITCH			
	2D	3F	9A	9B	10C	5A	9A	10F	Total
FLORA									
CUPRESSACEAE									
Thuja ? plicata Lam.	-	-	1f	-	-	-	-	-	1
RANUNCULACEAE									
Ranunculus repens L.	-	12a	-	-	-	-	-	100a	112
R. bulbosus L.	5a	2a	-	-	1a	11a	12a	48a	79
R. hederaceus L.	2a	-	-	-	-	-	-	-	2
Ranunculus sp.	4a	-	1a	1a	-	-	-	-	6
PAPAVARACEAE									
Papaver rhoas L.	1s	1s	-	-	2s	-	4s	7s	15
CRUCIFERAE									
Brassica nigra L. Koch	-	7s	3s	-	-	1s	6s	-	17
Brassica sp.	1s	-	-	-	-	-	2f	-	3
Sinapsis arvensis L.	1s	-	-	-	-	-	-	-	1
Capsella bursa-pastoris (L.) Medoc	2s	3s	-	-	-	-	-	-	5
Rorippa nasturtium-aquaticum L. Hayek	1s	-	-	-	-	-	-	-	1
Sisymbrium officinale (L.) Scap.	1s	-	-	-	-	-	-	1s	2
CARYOPHILLACEAE									
Lychnis flos-cuculi L.	-	1s	1s	-	1s	-	-	1s	4
Agrostemma githago L.	-	-	-	-	-	-	2s	-	2
Cerastium sp.	3s	1s	5s	-	-	2s	1s	4s	16
Stellaria media (L.) Villa	5s	15s	3s	-	11s	6s	2s	2s	44
S. graminae L.	-	1s	-	-	-	-	-	-	1
Stellaria sp.	-	-	-	-	-	-	1s	-	1
? *Arenaria* sp.	1s	2s	6s	-	-	-	-	1s	10
CHENOPODIACEAE									
Chenopodium album L.	1s	1s	7s	-	2s	-	12s	15s	38
Atriplex patula L.	2s	-	-	-	-	-	-	-	2

	2D	3F	9A	9B	10C	5A	9A	10F	Total
MALVACEAE									
Malva sylvestris L.	?1s	-	2fs	-	2fs	1s	1f	-	6
GERANIACEAE									
? Geranium dissectum L.	2s	-	-	-	-	-	-	-	2
ROSACEAE									
Rubus fruiticosus agg.	-	-	3s	-	-	-	-	1p	4
Potentilla sp.	-	-	1a	-	1fa	-	2a	5a	9
Prunus spinosus L.	-	-	-	-	-	-	-	1t	1
P. ? arium (L.) L.	1t	-	-	-	-	-	-	-	1
ONOGRACEAE									
Epilobium sp.	1s	1s	-	-	-	-	-	1s	3
UMBELLIFERAE									
Torilis nodosa (L.) Gaertn.	-	-	-	-	-	-	-	4m	4
Aegopodium podagarra L.	-	-	-	-	-	-	11m	-	11
Aethusa cynapium L.	-	3m	-	-	-	-	-	-	3
Heracleum spondyleum L.	1m	-	-	-	-	-	1m	-	2
Umbelliferae indet.	-	-	-	1m	1m	-	-	-	2
POLYGONACEAE									
Polygonum aviculare L.	1a	-	9a	-	1a	?1p	4a	35a	50
P. persicaria L.	-	-	-	-	-	-	3a	-	3
P. convolvulus L.	-	1a	1a	-	-	-	1a	6a	9
Rumex acetosella L.	1a	-	-	-	-	-	16a	-	17
R. crispus L.	4f	2a	-	-	-	-	43a	4a	54
R. obtusifolius L.	-	-	1a	-	-	1a	5a	-	7
Rumex sp.	-	-	2a	-	-	-	2a	-	4
URTICACEAE									
Urtica urens L.	-	15a	7a	-	-	-	3a	-	25
U. dioica L.	119a	490a	-	-	-	6a	25a	29a	669
Urtica sp.	-	-	-	-	1fa	-	-	-	1
PRIMULACEAE									
Anagallis arvensis L.	1s	-	-	-	-	-	4s	-	5

	2D	3F	9A	9B	10C	5A	9A	10F	Total
BORIGINACEAE									
Lithospernum arvense L.	2n	-	-	-	-	-	-	-	2
LABIATAE									
Mentha aquatica L.	-	1n	-	-	-	-	-	-	1
Prunella vulgaris L.	-	1n	-	-	-	-	2n	6n	9
? *Stachys* sp.	-	-	-	-	-	1n	-	-	1
Ballota nigra L.	-	1n	1n	-	2n	-	-	6n	10
Lamium ? *album* L.	-	1n	-	-	-	-	-	-	1
L. pupureum L.	2n	-	-	-	-	-	-	-	2
Galeopsis tetrahit L.	-	-	-	-	-	-	6n	-	6
Labiatae *indet.*	-	-	-	-	4n	-	2n	-	6
PLANTAGINACEAE									
Plantago major L.	2s	1s	-	-	-	-	-	-	3
RUBIACEAE									
Galium sp.	-	-	-	-	-	-	-	1m	1
CAPRIFOLIACEAE									
Sambucus nigra L.	-	2s	1s	-	2s	-	-	5s	10
VALERIANACEAE									
? *Vallerianella dentata* (L.) Poll.	-	-	-	-	-	1s	-	-	1
DISPACACEAE									
Dispacus fullonum L. spp. *fullonum*	-	-	-	-	-	-	-	1f	1
COMPOSITAE									
Anthemus cotula L.	3a	4a	2a	-	1a	1a	20a	-	31
Chrysanthemum segetum L.	-	-	1a	-	1a	-	9a	-	11
Arcticum lappa L.	1a	-	3a	-	-	-	6a	1a	11
Carduus sp.	-	-	-	-	-	-	1a	1a	2
Cirsium sp.	-	-	1a	-	-	-	3a	-	4
Centaurea scabiosa L.	-	-	3a	-	-	-	-	-	3
Picris echinoides L.	-	-	-	-	-	-	-	1a	1
Sonchus arvensis L.	-	-	-	-	-	-	1a	-	1

	2D	3F	9A	9B	10C	5A	9A	10F	Total
S. asper (L.) Hill.	-	-	-	-	-	-	2a	-	2
Crepis sp.	2a	3a	1a	-	-	-	-	-	6
Taraxacum officinale Weber	1a	-	2a	-	-	-	-	1a	4
Compositae *indet.*	-	-	-	-	-	2a	1a	-	3
ALISMATACEAE									
Alisma plantago-aquatica L.	-	1s	6s	-	-	-	-	5s	12
JUNCACEAE									
Juncus sp.	2s	-	-	-	-	-	-	-	2
CYPERACEAE									
Carex flava agg.	-	-	1f	-	-	-	-	-	1
C. riparia Curt.	2f	-	-	-	-	-	-	-	2
C. ? *pendula* Huds.	-	-	-	-	-	-	1a	-	1
C. ? *nigra* Reich.	-	-	1a	-	-	-	-	-	1
Carex spp.	1a	-	5a	-	-	-	-	1p	7
GRAMINEAE									
Triticum sp.	1g	-	-	-	-	-	-	-	1
FAUNA									
MOLLUSCA									
MARINE									
Mytilus edulis (L.)	-	*	1	-	*	5	*	-	6
Modiolus modiolus (L.)	-	-	2	-	-	1	-	-	3
Ostrea edulis L.	-	*	3	-	*	-	*	-	3
Gerastoderma edule (L.)	-	*	3	-	-	-	*	-	3
Trichotropis borealis	-	-	1	-	-	-	-	-	1
Buccinum undatum (L.)	-	-	*	-	*	-	*	-	
Littorina sp.	-	-	*	-	-	-	-	-	

	2D	3F	9A	9B	10C	5A	9A	10F	Total
Balanus sp.	-	-	*	-	-	-	-	-	
Aporrhais pes-pelicana (L.)	-	-	*	-	-	-	-	-	
FRESHWATER AND TERRESTIAL GASTROPODA									
Theodoxus fluviatalis (L.)	1	-	-	-	*	-	9	-	10
Bythnia tentaculata (L.)	1	*	32	2	1	*	13	6	55
B. leachii (Shep.)	-	-	12	-	*	-	3	-	15
Bythnia sp.	-	-	-	-	-	-	*	-	
Viviparus viviparus (L.)	-	-	-	-	-	-	4	-	4
Viviparus sp.	-	*	*	-	-	-	-	-	
Valvata piscinalis (Müll.)	2	*	30	54	*	5	50	5	146
V. macrostoma Mörch	-	-	-	-	-	*	-	-	
V. cristata Müll.	-	-	13	-	-	*	-	-	13
Carychium minutum Müll.	-	-	-	-	-	-	*	-	
Physa fontinalis (L.)	-	-	*	-	-	-	-	-	
Limnea stagnalis (L.)	-	-	*	-	-	*	*	-	
L. palustris (Müll.)	1	-	*	-	*	-	*	-	1
L. peregra (Müll.)	2	1	6	2	*	1	22	4	38
L. auricularia (L.)	-	-	22	-	-	-	6	3	31
Ancylastrum fluviatale (Müll.)	-	-	5	-	*	-	1	-	6
Ancylus lacustris (L.)	1	-	*	-	-	-	-	11	12
Planorbis corneus (L.)	-	-	*	-	-	-	-	-	
P. planorbis (L.)	-	*	1	-	-	*	*	2	3
P. carinatus Müll.	-	-	*	-	-	-	*	-	
P. planorbis/carinatus	-	*	-	-	*	-	-	-	
P. vortex (L.)	-	*	1	-	-	-	*	-	1
P. leucostoma Millet	-	1	*	-	-	*	-	-	1
P. albus Müll.	1	*	9	1	-	-	-	-	11
P. contortus (L.)	-	*	3	-	*	*	*	-	3
P. crista (L.)	-	-	*	-	-	-	-	-	
Planorbis spp.	8	1	14	-	8	-	8	13	52

	2D	3F	9A	9B	10C	5A	9A	10F	Total
Segmentia complanata (L.)	-	-	10	-	-	-	-	-	10
Succinea pfeifferi Ross.	-	-	3	-	1	-	-	2	6
S. putris (L.)	-	-	-	1	-	-	-	1	2
Succinea spp.	-	*	3	-	*	-	-	-	3
Pupilla muscorum (L.)	-	-	2	1	9	-	-	-	12
Lauria cylindrica Da Costa	-	-	*	-	-	-	-	-	
Vallonia pulchella (Müll.)	-	-	-	4	9	-	-	-	13
V. excentrica Sterki	-	-	-	-	4	-	-	3	7
Caecilioides acicula (Müll.)	-	-	2	15	30	-	-	3	50
Cochlicopa lubrica (Müll.)	-	-	1	2	2	-	-	-	5
Cochlicopa sp.	-	-	-	-	*	-	-	-	
Punctum pygmaeum (Drap.)	-	-	2	-	-	-	-	-	2
Discus rotundatus (Müll.)	-	-	1	-	1	-	-	-	2
Hygromia hispida (L.)	-	-	1	-	6	-	-	6	13
Monacha granulata (Alder)	1	-	-	-	-	-	-	1	2
Helix aspersa Müll.	-	-	1	-	1	-	*	1	3
Helix sp.	-	-	*	-	-	*	-	-	
Zonitoides excavatus (Bean)	-	-	1	-	-	-	-	-	1
Z. nitidus (Müll.)	-	1	1	-	-	*	-	-	2
Retinella radiatula (Alder)	-	-	-	-	2	-	-	-	2
Oxychilus alliarius (Miller)	-	-	-	-	1	-	-	-	1
O. cellarius (Müll.)	-	-	-	-	1	-	-	-	1
Oxychilus sp. ?spp.	-	-	1	-	1	-	-	-	2
Vitrea contracta (West)	-	-	1	-	-	-	-	-	1
BIVALVIA									
Margaritifera margaritifera (L.)	-	1	2	-	-	-	-	-	3
Sphaerium corneum (L.)	-	-	1	-	*	1	1	-	3
S.lacustre	-	-	*	-	*	-	-	-	
Sphaerium sp.	-	-	*	-	-	*	*	-	
Pisidium amnicum (Müll.)	-	-	*	-	*	-	-	-	
P. henslowanuon (Shep.)	-	-	-	-	*	-	-	-	

	2D	3F	9A	9B	10C	5A	9A	10B	Total
P. nitidum Jen.	-	-	*	-	-	-	-	-	
Pisidium spp.	2	2	11	6	1	5	13	22	62
Unio tumidus Phil.	-	-	*	-	*	-	*	-	
Unio sp.	-	-	*	-	*	-	-	-	
Anadonta cygnaea (L.)	-	-	-	-	*	-	-	-	
A. anatina (L.)	-	-	*	-	*	-	-	-	
Anadonta sp.	-	-	-	-	*	-	*	-	
Unioniaceae indet.	-	-	-	-	-	-	3	3	6
INSECTA									
COLEOPTERA									
CARABIDAE									
Patrobus atrorufus (Strom.)	1	-	-	-	-	-	1	-	2
Clivina collaris	1	-	-	-	-	-	-	-	1
Bembidion gilvipes (Sturm)	2	-	-	-	-	-	-	-	2
B. harpaloides Ser.	1	-	-	-	-	-	-	-	1
B. biguttatum (F.)	2	-	-	-	-	-	1	-	3
B. guttula (F.)	1	-	-	-	-	-	-	-	1
Stomis pumicatus (Panz.)	1	-	-	-	-	-	-	-	1
Pterostichus diligens (Sturm)	2	-	-	1	-	-	-	-	3
P. madidus (F.)	-	-	1	1	-	-	-	-	2
P. nigrita (Payk.)	1	-	1	-	-	-	-	-	2
P. vernalis (Panz.)	1	-	1	-	-	-	1	-	3
P. (Poecilus) sp.	-	1	-	-	-	1	1	-	3
Agonum muelleri (Herbst)	2	-	-	-	-	-	-	-	2
Amara familiaris (Dufts.)	1	-	-	-	-	-	-	-	1
Badister sodalis (Dufts.)	-	-	-	-	-	-	1	-	1
HALIPLIDAE									
Haliplus sp.	1	1	1	-	-	-	1	2	6

	2D	3F	9A	9B	10C	5A	9A	10F	Total
DYTISCIDAE									
Hydroporus sp.	2	-	-	-	-	-	-	1	3
Potamonectes depressus (F.) ss. *elegans* (Panz.)	-	-	-	-	-	-	1	-	1
Stictotarsus duodecimpunctatus (F.)	-	-	-	-	-	-	1	-	1
Agabus bipustulatus (L.)	1	-	-	-	-	-	-	1	2
Colymbetes fuscus (L.)	-	2	1	-	1	-	-	-	4
GYRINIDAE									
**Gyrinus strigulosus* Reg.	-	-	-	-	-	-	1	-	1
G. marinus Gyll.	-	-	-	-	-	1	-	-	1
Gyrinus sp.	-	-	1	-	-	-	-	-	1
HYDROPHILIDAE									
Helophorus grandis Ill.	2	-	3	-	-	-	1	2	8
H. nubilus F.	1	-	-	-	-	-	1	-	2
Helophorus spp.	28	3	4	1	-	-	3	11	50
Coelostoma orbiculare (F.)	-	-	-	-	-	-	2	-	2
Sphaeridium scarabaeoides (L.)	-	-	1	-	-	-	-	-	1
Cercyon spp.	10	-	5	5	-	-	6	4	30
Chaetarthria seminulum (Herbst)	-	-	-	-	-	-	-	2	2
HYDRAENIDAE									
Ochthebius minimus (F.)	2	2	-	-	-	-	-	1	5
Ochthebius spp.	3	-	-	1	-	-	-	-	4
Limnebius sp.	2	1	-	-	-	1	-	-	4
Hydraena testacea	1	-	-	-	-	-	-	-	1
LEIODIDAE									
Choleva or *Catops* sp.	-	-	-	-	-	-	-	1	1
SILPHIDAE									
Silpha atrata L.	-	-	1	-	-	-	-	-	1
STAPHYLINIDAE									
Lesteva heeri Fauv.	2	-	-	-	-	-	-	-	2

	2D	3F	9A	9B	10C	5A	9A	10F	Total
L. longcelytrata (Goeze)	15	-	1	-	-	1	2	3	22
Lesteva sp.	1	1	2	-	-	-	-	-	4
Omalium sp.	-	-	1	-	-	1	-	-	2
Coprophilus striatulus (F.)	2	-	-	1	-	-	1	-	4
Carpelimus sp.	4	-	1	-	-	-	-	-	5
Platystethus arenarius (Fourc.)	2	-	1	-	-	1	1	-	5
Anotylus complanatus (Er.)	2	-	-	-	-	-	1	-	3
A. nitidulus (Grav.)	5	-	-	-	-	-	-	-	5
A. rugosus (F.)	14	2	4	3	-	1	2	2	28
A. ?tetracarinatus	1	-	-	-	-	-	-	-	1
Anotylus spp.	-	1	1	1	-	-	1	-	4
Stenus spp.	10	1	2	1	-	-	2	2	18
Lathrobium spp.	2	-	-	2	-	-	-	-	4
Xantholinus linearis (Ol.) or longiventris Heer	6	-	2	1	-	-	-	-	9
Xantholinus sp.	1	1	-	-	-	1	1	1	5
Philonthus spp.	6	-	1	3	-	-	-	-	10
Staphylinus fortunatorum (Woll.)	-	-	1	-	-	-	-	-	1
Quedius spp.	-	-	1	2	-	-	1	1	5
Tachinus sp.	2	-	-	1	-	1	-	-	4
Tachyporinae indet.	7	3	4	1	-	-	-	4	19
Aleochara sp.	1	-	-	-	-	-	-	1	2
Aleocharinae indet.	21	3	8	3	-	2	-	4	41
TROGIDAE									
Trox scaber (L.)	-	-	-	-	-	-	1	-	1
GEOTRUPIDAE									
Geotrupes sp.	-	-	-	-	-	-	1	-	1
SCARABAEIDAE									
Aphodius quadrimaculatus (L.)	-	-	1	-	-	-	-	-	1
A. rufipes L.	-	-	1	-	-	-	-	-	1
Aphodius spp.	7	2	10	8	1	-	5	11	44

	2D	3F	9A	9B	10C	5A	9A	10F	Total
Onthophagus *fracticornis (Preys.) or similis (Scriba)	-	-	-	-	-	-	1	-	1
SCIRTIDAE									
Gen. et spp. indet.	4	-	2	-	-	-	-	1	7
BYRRHIDAE									
Simplocaria semistriata (F.)	-	-	1	-	-	-	-	-	1
DRYOPIDAE									
Dryops sp.	2	-	-	-	-	-	3	-	5
ELMIDAE									
Oulimnius troglodytes (Gyll.)	1	-	5	-	-	-	3	-	9
ELATERIDAE									
Agrypnus (= Adalocera) murinus (L.)	-	-	1	-	-	-	-	1	2
Larvae indet.	-	-	-	-	-	-	-	3	3
CANTHARIDAE									
Cantharis rustica Fall.	-	-	-	-	-	-	1	-	1
Cantharis sp.	1	-	-	-	-	-	1	-	2
ANOBIIDAE									
Grynobius planus (F.)	-	-	1	-	-	-	-	-	1
Xestobium rufovillosum (Deg.)	-	-	-	-	-	-	2	1	3
Anobium punctatum (Deg.)	15	1	2	-	-	-	3	-	21
PTINIDAE									
Tipnus unicolor (Pill. and Mitt.)	5	-	2	-	-	-	3	-	10
Ptinus spp.	3	2	1	-	-	-	1	-	7
LYCTIDAE									
Lyctus linearis (Goeze)	1	1	-	-	-	-	-	-	2
NITIDULIDAE									
Meligethes spp.	4	-	2	-	-	-	-	-	6
SILVANIDAE									
Oryzaephilus surinamensis (L.)	38	2	-	-	-	5	1	-	46
CRYPTOPHAGIDAE									
Gen. et spp. indet.	1	-	-	-	-	-	1	-	2

	2D	3F	9A	9B	10C	5A	9A	10F	Total
PHALACRIDAE									
Phalacrus corruscus (Panz.)	-	-	1	-	-	-	4	-	5
COCCINELLIDAE									
Adalia decempunctata (L.)	-	-	2	-	-	-	-	-	2
Coccinella septempunctata (L.)	-	-	-	-	-	-	1	-	1
ENDOMYCHIDAE									
Mycetaea hirta (Marsh.)	10	-	2	-	-	-	-	-	12
LATHRIDIIDAE									
Corticorina spp.	6	-	6	-	-	-	3	1	16
COLYDIIDAE									
Aglenus brunneus (Gyll.)	-	-	-	-	-	-	1	-	1
ANTHICIDAE									
Anthicus sp.	-	-	-	-	-	-	1	-	1
BRUCHIDAE									
Bruchus rufimanus Boh.	1	-	-	-	-	-	2	-	3
CHRYSOMELIDAE									
Donacia sp.	1	-	-	-	-	-	1	-	2
Chrysolina staphylaea (L.)	-	-	-	-	-	-	1	-	1
Gastrophysa viridula (Deg.)	1	-	-	-	-	-	-	-	1
Phaedon sp.	-	-	-	-	-	-	1	-	1
Hydrothassa glabra (Herbst)	1	-	-	-	-	-	1	-	2
Prasocuris phellandrii (L.)	1	-	2	-	-	-	1	-	4
Phyllodecta vulgatissima (L.)	2	-	-	-	-	-	-	-	2
Phyllotreta exclamationis (Thun.)	-	-	-	-	-	-	1	-	1
P. undulata Kuts.	2	2	-	-	-	1	-	-	5
Phyllotreta spp.	5	-	-	-	-	-	3	-	8
Longitarsus spp.	16	1	4	-	-	-	9	5	35
Chaetocnema concinna (Marsh.)	4	-	3	-	-	-	-	-	7
Psylliodes cuprea (Koch.)	1	-	-	-	-	-	-	-	1

	2D	3F	9A	9B	10C	5A	9A	10F	Total
APIONIDAE									
Apion aeneum (F.)	3	-	-	-	-	-	1	-	4
A. craccae (L.)	2	-	-	-	-	-	-	-	2
Apion spp.	6	1	5	2	-	-	4	2	20
CURCULIONIDAE									
Polydrusus spp.	-	-	-	-	-	-	4	-	4
Barynotus sp.	-	-	-	-	-	-	1	-	1
Sitona striatellus Gyll.	13	-	4	-	-	-	-	-	17
Sitona spp.	3	1	-	-	-	1	4	4	13
Phytonomus punctata (F.)	1	-	-	-	-	-	-	-	1
Phytonomus spp.	1	-	-	-	-	-	-	-	1
Alophus triguttatus (F.)	-	-	1	-	-	1	-	-	2
Sitophilus granarius (L.)	12	-	-	-	-	1	1	-	14
Notaris acridulus (L.)	1	2	-	-	-	1	2	-	6
Ceutorhynchus spp.	27	-	7	2	-	-	2	8	46
SCOLYTIDAE									
Leperisinus varius (F.)	1	-	1	-	-	-	1	-	3
HEMIPTERA									
Gerris sp.	-	-	1	-	-	-	-	1	2
Corixidae indet.	7	-	1	-	-	-	3	1	12
Gen. et spp. indet.	3	-	2	-	-	-	1	-	6
DERMAPTERA									
Forficula auricularia (L.)	3	-	2	-	-	-	1	1	7
HYMENOPTERA									
Parasitica indet.	11	2	-	-	-	-	5	6	24
Formicidae indet.	14	1	14	-	-	-	4	11	44
DIPTERA									
Tipulidae indet.	4	2	7	-	-	5	2	1	21
Gen. et spp. indet.	30	13	10	2	1	-	18	15	89
ARANAEA	6	-	2	-	-	-	2	-	10

Smew (Mergus albellus)	1
Buzzard (Buteo buteo)	2
Red kite (Milvus milvus)	2
Partridge (Perdix perdix)	4
Crane (Grus sp.)	1
Dove (Columba livia)	4
Barn owl (Tyto alba)	1
Raven (Corvus corax)	2
Carrion crow (Corvus corone)	2
Rook (Corvus frugilegus)	1
Jackdaw (Corvus monedula)	1
Thrush (Turdus sp.)	3

Fish

Elasmobranch (shark/skate/ray)	1
Ray (Raja sp.)	1
Sturgeon (Acipenser sturio)	1
Salmon (Salmo sp.)	1
Conger eel (Conger conger)	1
Cod (Gadus morhua)	65
Haddock (Melanogrammus aeglefinus)	19
Ling (Molva molva)	22
Turbot (Scophthalmus maximus)	1
Plaice/flounder (Pleuronectes/platichthys)	15
Halibut (Hippoglossus hippoglossus)	1

The bones were identified from the following collections:
Mammals: Leicestershire Museums
Birds: British Museum (Natural History) Tring,
Leicestershire Museums
Fish: DoE Faunal Remains Project Southampton,
British Museum (Natural History)

Bone material from this site was only partially recovered from some areas, a practice which can affect the diversity of both the species and bones submitted for analysis. Also,

Table 27 The mammal bones

PHASE	OX (Bos taurus) F mn1 mn2	SHEEP (Ovis aries) F mn1 mn2	PIG (Sus scrofa)	HORSE (Equus caballus)	FALLOW DEER (Dama dama)	RED DEER (Cervus elaphus)	DOG (Canis familiaris)	CAT (Felis domesticus)	HARE (Lepus europaeus)	RABBIT (Oryctolagus cuniculus)	POLECAT (Putorius putorius)	MOUSE (Apodemus sylvaticus)	TOTAL FRAGMENTS
1	440 (10, 69)	117 (8, 36)	61 (3, 26)	13 (1, 6)	6 (1, 6)		12 (2, 4)	13 (1, 5)	1				665
2A		1 (1, 1)											1
2B	1 (1, 1)												1
2D DRAIN	204 (10, 15)	22 (1, 3)	18 (2, 3)	2 (1, 1)	1 (1, 1)		1				1		249
3A	217 (6, 23)	44 (3, 11)	52 (2, 10)	2 (1, 2)	1 (1, 1)			1					317
3B1	334 (4, 47)	288 (13, 44)	82 (2, 24)	4 (1, 3)	6 (2, 5)	1							715
3B11	13 (1, 4)	12 (1, 4)	4 (1, 1)										29
3C	1 (1, 1)												1
3D	42 (1, 13)	14 (1, 11)	5 (1, 4)	3 (1, 3)			1	2 (1, 2)					67
3E DRAIN	71 (3, 8)	32 (3, 6)	57 (3, 4)	7 (2, 1)									167
4A	241 (6, 27)	72 (4, 15)	40 (2, 12)		2 (1, 2)		1	1					357
4B	247 (9, 36)	63 (4, 22)	78 (5, 22)	7 (1, 5)	5 (1, 4)		1	3 (1, 3)					404
4C DRAIN	11 (1, 2)	1 (1, 1)	2 (1, 2)	2 (1, 1)			1					1	18
5A	32 (1, 6)	4 (1, 2)	7 (1, 4)										43
5A DRAIN	184 (2, 23)	102 (4, 17)	48 (2, 13)	6 (1, 4)	5 (2, 4)		5 (1, 3)	(1, 2)		1			353
5B	23 (1, 4)	6 (1, 4)	10 (2, 4)										39
6A	34 (1, 12)	30 (2, 11)	13 (1, 8)				4 (1, 1)		1				82
6B	29 (1, 16)	14 (1, 8)	11 (1, 5)	2 (1, 2)			1						57
7A	37 (2, 9)	9 (1, 6)	5 (2, 3)	3 (1, 1)				1					55
7A DRAIN	45 (2, 6)	21 (2, 3)	22 (2, 4)	1 (1, 1)			2 (1, 1)						91
7B	17 (1, 4)	1 (1, 1)											18
8B	13 (1, 3)	5 (1, 2)	1 (1, 1)	1 (1, 1)									20
9A DRAIN 'S'	901 (22, 42)	408 (23, 29)	98 (4, 8)	14 (1, 2)	65 (8, 7)		2 (1, 1)	1	2(1,2)	1			1492
'N'	465 (10, 33)	366 (20, 41)	67 (4, 8)	16 (1, 4)	17 (2, 6)		3 (1, 3)	1	1	1			937
9B DRAIN	76 (4, 4)	53 (5, 4)	5 (1, 1)		1 (1, 1)								135
10	70 (4, 20)	52 (5, 16)	25 (1, 7)	17 (1, 1)	1 (1, 1)	1							166
10 DRAIN	140 (6, 24)	188 (31, 59)	6 (2, 5)	178 (6,17)	5 (1, 5)		4 (1, 1)	1					522
DRAIN TOTAL	2097 (60,157)	1193 (90,163)	322(20, 48)	226(14,31)	94(15,24)		16 (7,10)	5 (4, 5)	3(2,3)	3	1	1	3961
OTHER TOTAL	1791 (51,295)	732 (48,195)	395(25,131)	52 (9,26)	21 (6,19)	2	22 (7,11)	21 (6,11)	2				3038
TOTAL	3888(111,452)	1925(138,358)	717(45,179)	278(23,57)	115(21,43)	2	38(14,21)	26(10,16)	5(4,5)	3	1	1	6999

F: the number of fragments recovered
mn1: the minimum number of individuals, method 1
mn2: the minimum number of individuals, method 2

Table 28 The bird bones

PHASE	Domestic Fowl (Gallus gallus)	Domestic Goose (Anser anser)	Mallard (Anas platyrhynchos)	Cormorant (Phalacrocorax carbo)	Heron (Ardea cinerea)	Shag (Margus albellus)	Buzzard (Buteo buteo)	Red Kite (Milvus milvus)	Partridge (Perdix perdix)	Crane (Grus sp.)	Dove (Columba livia)	Barn owl (Tyto alba)	Raven (Corvus corax)	Carrion Crow (Corvus corone)	Rook (Corvus frugilegus)	Jackdaw (Corvus monedula)	Thrush (Turdus sp.)
1	14 (3, 2)	3 (1, 1)	1										1				
2D DRAIN	6 (1, 2)	24 (2, 2)	1														
3A	10 (2, 3)	20 (2, 3)							1								
3B1	54 (6,10)	93 (6,17)	7(1,2)														
3B11	3 (1, 1)	1															
3D		1															
3F DRAIN	9 (3, 1)	4 (1, 1)	1														
4A	21 (3, 4)	15 (2, 8)	1						1								2
4B	14 (2, 4)	13 (2, 6)	2(1,1)					1	1		3						
5A	1																
5A DRAIN	19 (2, 3)	5 (1, 2)	3(1,1)											1			
5B	3 (1, 1)	2 (1, 1)															
6A	3 (1, 1)	2 (1, 1)															1
6B	2 (1, 1)	5 (1, 3)															
7A													1				
7A DRAIN	5 (1, 1)	4 (1, 1)													1		
8B		1															
9A DRAIN 'S'	30 (3, 3)	21 (3, 3)	1		1	1	2		1	1							
'N'	38 (4, 4)	11 (2, 2)		1				1				1				1	
10	10 (1, 1)	4 (1, 1)															
10 DRAIN	5 (1, 2)	2 (1, 1)												1			
TOTAL	246(37,46)	232(32,57)	17(8,9)	1	1	1	2	2	4	1	4	1	2	2	1	1	3

P, mn1, mn2 (as in Table 27)

no sieving was carried out, which will tend to bias the results in favour of the larger species. Payne (1972; 1975) has demonstrated that smaller species are only occasionally recovered from unsieved sites.

The quantity of bones per phase is given in Table 27 (mammals), Table 28 (birds), and Table 31 (fish). In Tables 27 and 28, three values are given per species where numbers are above just one bone. These are:

F: the total number of fragments per species

mn 1: the minimum number of individuals per species using Grant's (1977) method of taking half of the maximum number of longbones per phase

mn 2: the minimum number of individuals per species calculated by matching those longbones which are identical (after Chaplin 1971), but assuming that all the bone-bearing layers were discrete

There are faults in all three methods. Certain parts of the skeleton were more frequent than others for various reasons, such as the degree of fragmentation prior to burial and the survival potential of the fragments (see Grant 1975). 'Mn 1' tends to give an unrealistically low figure because it ignores both the possibility of time lapse between the deposits and any bones that were not identical; 'mn 2' will tend to overestimate for converse reasons. A more accurate 'minimum number' is probably to be found somewhere between the two methods.

Figure 64 displays these proportions diagrammatically, using the Table 27 data to form four phase groups:

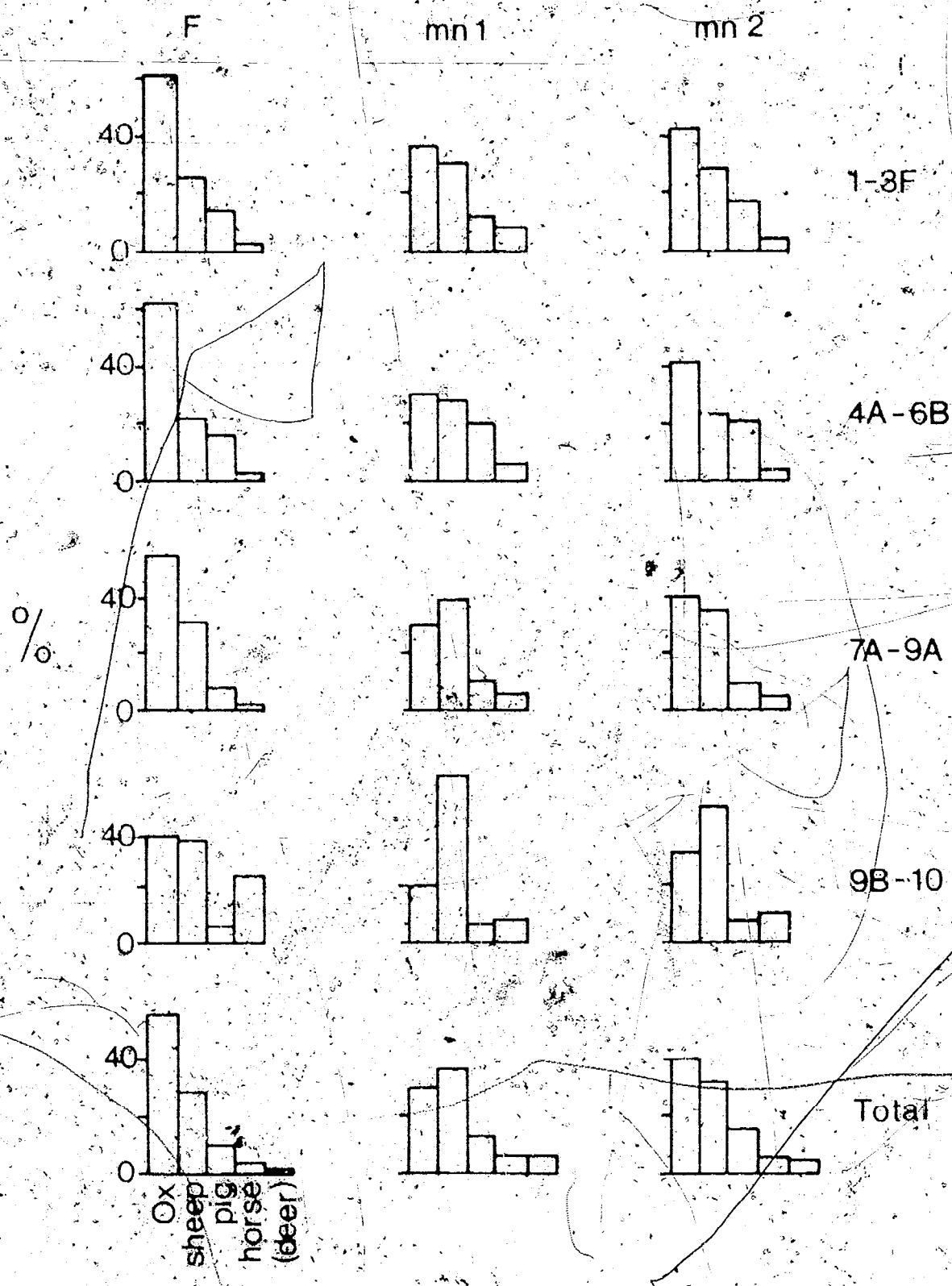
1 - 3F (c AD 1250 - 1400)

4A - 6B (c AD 1350 - 1450)

7A - 9A (c AD 1450 - the friary closure of AD 1538)

9B - 10 (AD 1538 - c 17th century: desertion and destruction levels)

Fig 64 The proportion of mammals per phase group for the three methods used in Table 27



The proportions of each species varied with the method used but, in general, the rank of each species remained the same: 1st, cattle; 2nd, sheep; 3rd, pig; 4th, horse. Sheep bones became apparently more abundant within group 9B - 10; largely because of an accumulation of metapodia within the north drain.

The proportion of pig bones appears to have been consistently low throughout the occupation period, with an apparent decline from phase 7A onwards. This could suggest that pigs played a less important part in the local economy than cattle or sheep, but low numbers could also be due to the general fragility of pig bones.

Horse bones increased in number during phases 9B-10 with the burial of about a dozen entire horses in the north drain after the dissolution of the friary.

The proportions of the bone fragments varied according to the type of deposit from which they originated:

*True ditchfill	47.3%
Early deposits (1)	9.1
*Ditch: destruction layers	6.0
Cloister midden (4B)	5.8
Levelling spreads	4.3
General destruction (including 6A)	3.6
Construction debris, building	2.8
Garden	2.1
*Ditch: construction etc	2.1
Foundations	0.9
Post-holes and their fillings	0.2
Floors, cobbles	0.1
Miscellaneous and unclassified	12.3

*= drain deposits

As a group, the 'true ditchfill' deposits held the most bone. Although each 'non-drain' type of deposit held only a small amount of bone, some of these deposits were used for the

disposal of bone waste before the creation of either ditch. The cloister midden (4B) was apparently more important than the early south ditch, which was then in use, in the receipt of bone waste; the 4B deposits spanned about 50 years, whereas the 2D deposits spanned some 100 years. Also, due to the disturbance of much of the cloister area by the later railway development, the material from the cloister midden was only partially recovered. This midden may therefore have been more important than the data in Tables 27 and 28 suggest.

Deposits associated with building activities (levelling, construction debris, foundations, floors, and post-holes) account for 8.3% of all the fragments, which probably became accidentally incorporated into building materials such as soil fillings derived from earlier deposits on the site.

After the north ditch was cut (phases 4C-5A) it apparently received more bone waste than either the south drain or the non-drain deposits. After the construction of the stone walled south drain (phase 7A), the importance of both north and south drains in the receipt of bone waste grew, until the closure of the site, after which the deposition of bone declined.

Of the bone fragments, 98% came from the ten domestic species, the remaining 20 wild species accounting for only 2%. This ratio is typical of an organized agricultural community, relying almost entirely upon its domestic breeds for food. There will, however, be some amount of bias towards the bones of large species owing to the lack of sieving. Also there are problems of fragmentation associated with the larger animals, whose bones will necessarily become more fragmented during butchery than will those of the smaller species, in order to produce cuts of meat of manageable size. To negotiate this problem, the minimum numbers can be used:

Table 29. The bones recovered (fragments)

Table 29a

PHASES \ BONES	SKULL	HORN	HYOID	MANDIBLE	TEETH	VERTEBRAE: ATLAS	AXIS	CERVICAL	THORACIC	LUMBAR	SACRAL	CAUDAL	STERNUM	RIBS	VERTEBRAE IRR.	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	TARSALS	METATARSALS	METAPODIALS
1	21	1	1	24	127	4	4	14	15	10			1	43		27	8	13	6	3	20	29	17	9		14	9	16	4
2B					1																								
2D DRAIN	51			30	53	2	1	1	3	5				12		3	3		1		7	3	2	5			2	19	3
3A	13	1		7	18	2		3	6	11		1	1	56	1	21	8	4	6		5	10	15	13		5		10	
3B1	26		1	16	25	4	2	12	8	20	5			125	2	16	7	2	4	5	6	13	17	4	2	4	5	2	1
3B11				1	2		1		2					4		2				1									
3C														1															
3D				7	10					2			1	5		5		1	1	1	1	1	2	2			1	2	
3F DRAIN	9			7	6	2	2	2	2	6	1			10		2	2		1		2	3	4	5		5			
4A	7	1	2	7	37	1	1	10	13	16				80		14	11	4	4		1	5	9	4	1	3	3	7	
4B	14		1	12	20	1		5	11	10	1			72		13	17	6	5	2	9	10	11	7		8	4	6	2
4C DRAIN				1	1			1						4				2				1	1						
5A	3			1			1	1	1	3				14		1	1					2	1			2		1	
5A DRAIN	9			14	6	1		3	9	6	2		1	81		7	4	3	3		4	14	10	4		2	1		
5B				1	3									15			1		1				1	1					
6A	4			2	2		1		2	2				14		1	2	1		1				1				1	
6B	3			4			1	1	2	1				8		1	1	1		1		2		2			1		
7A	3			5	4	1			3	1				8		1		3	1	1		1	1				1	3	
7A DRAIN	10		1	5	1			3	2	1				4		1	4		2		1		4	3		1	2		
7B	11				2					2												2							
8B				1						1				6			1	1				1	1			1			
9A DRAIN 'S'	29		4	47	10	5	6	17	64	32	4	1	2	279	2	86	29	12	12	4	33	7	61	65	2	32	13	43	
'N'	15			30	7		4	16	19	7	3		2	232	1	34	20		9		6	4	24	9	1	8	4	4	
9B DRAIN				1		1				2	2			44		2	1	3	1		1		6	7		1	1		
10	1			4	6	1		2	6	2				19		2	3	7		3	1	1	1	2		3	2	3	1
10 DRAIN	9			7	7		1	2	1	4	1			34		15	8	3	4		1	2	11	11		10	1	8	

Table 29b

SHEEP

PHASES	BONES	SKULL	HORN	HYOID	MANDIBLE	TEETH	VERTEBRAE: ATLAS	VERTEBRAE: AXIS	VERTEBRAE: CERVICAL	VERTEBRAE: THORACIC	VERTEBRAE: LUMBAR	VERTEBRAE: SACRAL	VERTEBRAE: CAUDAL	STERNUM	RIBS	VENTRALRIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	TARSALS	METATARSALS	METAPODIALS
1		3			3	24				3	3				9		3	6									16	7	3	
2A																						1								
2D	DRAIN	3*			3				1		1				3		2	2				1		4	1					
3A		1			4	2		1	1	5	2				4		2	4				1		5	1		6	3		
3B1		5			3	3	2	6	7	7	28	2		1	114		19	7	13	3		3		17	11		26	7		
3B1L															5		1	2	2				1		1					
3D				1		2				1	1				1			2	1			1		1				1		
3F	DRAIN	1*			3					3	3				4		3	2	1					3	5				1	
4A		1	1		2	9	2	1	2	4	6				12		6	3	5	2			1	4	2		8	1		
4B			1		1	7			1		3			1	9		6	8	3	2		2		5	3		8	1	2	
4C	DRAIN														1															
5A		1				1												1									1			
5A	DRAIN	2	3		2	2	1				5				32		4	4	7			8	5	7	4			2	6	
5B										1					1				1					1			1		1	
6A					1	1								1	17			3	1					1	2		2	1		
6B						2									6			1	2	1		1					1			
7A																	1	1				1		1	1		2		2	
7A	DRAIN		1		1	1				2	2				4		2		3					4	1					
7B																			1											
8B															3									1			1			
9A	DRAIN 'S'	8	3	1	47	2	1	2	2	11	21	2			116		9	24	21	11		12	1	20	22		46	6	18	
		4	3	1	3		1		2	3	3				148		10	11	20	9		40	6	26	9		29	1	39	
9B	DRAIN														21		2		2	1				2	1		9	1	7	
10		1*			2	2									12		2	1	4	2		10	4	1			1		9	
10	DRAIN		1		10	4		1	3		1				14		3	5	7			52	8	5	1		8	1	64	

* = hornless individuals

Table 29c

FIG ZONES / PHASE	SKULL	MANDIBLE	TEETH	VERTEBRAE: ATLAS	AXIS	CERVICAL	THORACIC	LUMBAR	SACRAL	CAUDAL	STERNUM	RIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	FIBULA	TARSALS	METATARSALS	METAPODIALS	* RATIO OF MALE : FEMALE CANINES: ♂	♀
1	4	5	20						1			2	3	10	1	1		2	4	1	1		2		1	2'	1	8	1
2B DRAIN	3	2					1					1	2	1	1	2		1					2	2				1	1
3A	9	10	7			1						6		3	2	2		1	1	3	4		2			1		4	1
3B1	3	4	2			1	6	1			1	24	7	4	4	2		4	3	3	6		2		2	2	1	1	
3B11	3															1													
3D			1	1							1				1				1										1
3F DRAIN	5	8				1						30	1	3	1	2				1	1		1		2	1		1	4
4A	4	6	9			1	1	1				5	2	3		3					1		2		1'	1		5	1
4B	5	14	16			3	3	1				8	3	7	3	1		2		3			3		2	1		9	8
4C DRAIN			1									1																	
5A	1	2	1									1	1					1											2
5A DRAIN	7	4	3	1			3	2				10	1	2	3			1		1	1				3	2	1	2	1
5B	2	4			1								1							1						1		2	2
6A	2	1	1				1					2	1	1			1			1	1		1						
6B	1						1					2	1	1		1			1	2					1				
7A		1	2										1													1		1	1
7A DRAIN	2	6						1				1	1	1	1	3		1	1		1		2		1			4	2
8B												1																	
9A DRAIN 'S'	6	11	7		1		4		1			32	3	2	1	9		1		2	9		3	1	1	4		6	3
9A DRAIN 'N'	3	2	1				2					27	2	2	1	8		1	1	4	3		7	3				1	2
9B DRAIN		1					2									1													
10	1	2	4									7	1	1	1	2				1	2		2			1		3	
10 DRAIN		1					1					2		2															

Table 29d

HORSE

BONES / PHASES

	SKULL	HYOID	MANDIBLE	TEETH	VERTEBRAE: ATLAS	AXIS	CERVICAL	THORACIC	LUMBAR	SACRAL	CAUDAL	STERNUM	RIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	FIBULA	TARSALS	METATARSALS	METAPODIALS
1				9															1	1				1			1	
2D DRAIN	1		1																									
3A																				1						1		
3B1				2																1						1		
3D				1																						1	1	
4D DRAIN				1											1	1			1								1	
4B				1			1	1											1							1	2	
5D DRAIN				1																								
6A DRAIN				2															1		1						1	
6B																				1								
7A																			1								1	
7A DRAIN																												
8B																1												
9A DRAIN'S'				2			1	1	1				6			1			1	1								
'N'				1	1			1					7							1	2	1					2	
10								3					8															
10 DRAIN	3	1	9	9	2	1	7	13	5	5			62	4	7	8	1	1	4	3	12	7		7		1	6	

Table 29e

FALLOW DEER

	SKULL	ANTLERS	HYOID	MANDIBLE / TEETH	VERTEBRAE: ATLAS	AXIS	CERVICAL	THORACIC	LUMBAR	SACRAL	CAUDAL	RIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	TARSUS	METATARSUS
1		1													1			2	1						1
2D DRAIN		1																							
3A		1																							
3B1				1	1													2		1			1		
4A																			1	1					
4B																							3		2
5A DRAIN		2		1														1		1					
9A DRAIN 'S'		2		5								10		2	3			6	1	3	10		7	2	5
9A DRAIN 'N'	1	1		1								2			1			1	1		1		4	1	1
9B DRAIN																									
10																									
10 DRAIN		2		1										1				1					1		
RED DEER																									
3B1																									
10		1																							

Table 29f

DOG

ZONES / PHASES	SKULL	HYOID	MANDIBLE	TEETH	VERTEBRAE: ATLAS	AXIS	CERVICAL	THORACIC	LUMBAR	SACRAL	CAUDAL	STERNUM	RIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES	PELVIS	FEMUR	PATELLA	TIBIA	FIBULA	TARSALS	METATARSALS	METATARSALS
1			3	3											2	1	1		1								1	
2D DRAIN			1																									
3D																											1	
4A															1													
4B																						1						
4C DRAIN															1													
5A DRAIN														1	1	1	1					1						
6A							1						1						1									
6B																						1						
7A															1	1												
9A DRAIN 'S'	1			1																								
'N'													1				1							1				
10 DRAIN	3		1																									

Table 29g

S CAT

1			1										1		1				2	1	2			2			2	1
3A																								1				
3D															1							1						
4A																						1						
4B															1	1	1											
5A DRAIN									1						1													
7A															1													
9A DRAIN 'S'			1																									
'N'																								1				
10 DRAIN	1																											

mn 1 87.8% domestic, 12.2% wild
mn 2 93.7% domestic, 6.3% wild

The domestic species do not all appear to have been used for food. The bones of cattle, sheep, pigs, chickens, geese, and ducks bear cut marks typical of butchery, which are presumably indicative of human consumption of the meat. Of the wild species, only fallow deer bones appear to have been butchered. Species which had no butchered remains, but which may have been eaten, are partridge, smew, rabbit, and hare. The functions of the other species on the site were probably varied; there is insufficient information to support much speculation on the subject. Possible functions of both domestic and wild species during their lives may have been:

1. Working animals (horse, ox, dog)
2. Suppliers of farm produce, milk, wool, eggs (ox, sheep, fowl, geese, ducks)
3. Pets (cat, dog, raven, dove, polecat)
4. Scavengers (cat, dog, crow family, red kite, polecat, pig)
5. Independent of the friary, but related to the local marsh and wetland habitat (heron, cormorant, smew)

Once dead, the animals could supply raw material to various trades, eg meat and offal to butchers, hides and fleeces to tanners, horns to horners, antlers and bone to boneworkers.

Table 29 shows the types of bone recovered per species per phase from (a) ox, (b) sheep, (c) pig, (d) horse, (e) deer, (f) dog, and (g) cat. Table 30 shows the bird bones.

The other four species of mammal comprised the following bones:

1	:	1 hare calcaneus
2D drain	:	1 polecat skull
4C drain	:	1 woodmouse skull and mandible
5A	:	1 rabbit rib
6A	:	1 hare metatarsus

9A south drain: 1 rabbit fibula, 1 hare tibia, 1 hare metatarsus

9A north drain: 1 rabbit femur, 1 hare radius

Tables 29 and 30 show that in most species the greater the number of fragments per phase, the greater their diversity. Generally, the commonest cattle bones were the ribs (of which each animal has 26, and which also become highly fragmented during butchery) followed by components of the skull (which were often fragmented and which are believed by some authors, eg Grant 1975, to be more durable during burial than other bones).

In both cattle and sheep, there are no especially abundant bones which would reflect any favouritism such as the purchase of meat in joints. The presence of bones from both the head and feet suggests that the animals were either killed on site or were imported as whole carcasses.

Table 29b shows the increasing number of sheep metapodia, which reached a peak during phase 10 in the north drain and which are displayed in Figure 65.

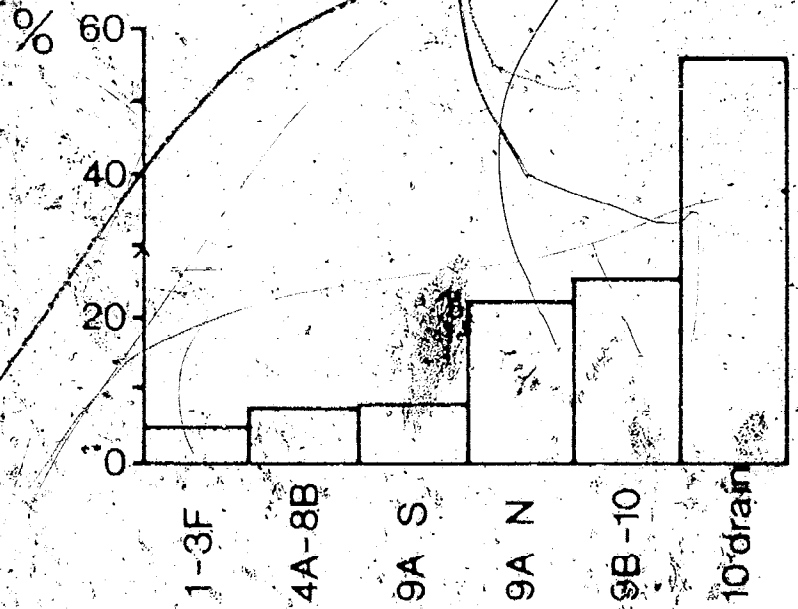


Fig 65

Sheep metapodia as a proportion of the total number of sheep bone fragments per phase group

Table 30a

DOMESTIC FOWL

PHASES	SKULL	MANDIBLE	VERTEBRAE: CERVICAL	VERTEBRAE: THORACIC	VERTEBRAE: SACRAL	VERTEBRAE: CAUDAL	CORACOID	CLAVICLE	STERNUM	RIBS	SCAPULA	HUMERUS	RADIUS	ULNA	CARPALS	METACARPALS	PHALANGES (WING)	PELVIS	FEMUR	TIBIA	FIBULA	METATARSUS	PHALANGES (FOOT)	
1							1					2	5	2					1	2		1		
2D DRAIN								1	1			1							2	1				
3A								1	1		1	1				1			1	1		5		(includes 1♂ metatarsus)
3B1							3	2	1		1	9	6	7		3			6	11		5		
3B11					1								1						1					
3F DRAIN	1							1	3	1				1										
4A					1					1		4	3			1			4	5		1		
4B							1				1	4		1					5	2				
5A																						1		
5A DRAIN				1	3		1	1	1			1	1	3				1		3		3		(includes 2♂ metatarsi)
5B								1				1										1		
6A							1				1									1				
6B			1																		1			
7A DRAIN									3									1				1		
8B												1												
9A DRAIN 'S'							1	5			2	2	2			1		1	5	2		2	7	(includes 1♂ metatarsus)
'N'					1		2	1	1	1	6	5		2				2	7	6		4		(includes 1♂ metatarsus)
10								1			1		1	2					2	2		1		
10 DRAIN							1				1		1	1						1				

Table 30b

GOOSE

1																1			1			1		
2D DRAIN			2		2			1	3			4	1	1		2			3	1			1	
3A		1	1				2		1			1	1			2		1	4	4		1	1	
3B1	2		1		1		5	8	1	10	4	8	11	4		7	3	2	3	10	3	4	6	
3B11		1																						
3D																			1					
3F DRAIN								1					1							1		1		
4A		2	1						2	2		2				1	1			3	1	1		
4B							1	2	1		2	1	2	1										
5A												1												
5A DRAIN									2			2		1										
5B											1					1								
6A																	1	1						
6B							1				2								1			1		
7A DRAIN								1				1		1		1								
8B												1												
9A DRAIN 'S'		1								1	1	3	3	2		2	1			4	1			
'N'								1				3	1			1			1	3		1		
10							1									1			1					
10 DRAIN								1				1												

Table 30c

MALLARD BONES PHASE	CORACOID	STERNUM	SCAPULA	HUMERUS	ULNA	PHALANGES (WING	TIBIA	FIBULA	METATARSUS
1							1		
2D DRAIN			1						
3Bi	1	2					2	1	1
3F DRAIN					1				
4A				1					
4B	1					1			
5A DRAIN					1		2		
9A DRAIN 'S'				1					

Table 30d

SPECIES	PHASE	CORACOID	STERNUM	HUMERUS	RADIUS	ULNA	TIBIA	METATARSUS
CORMORANT	9A DRAIN 'N'					1		
HERON	9A DRAIN 'S'	1						
SMEW	9A DRAIN 'S'					1		
BUZZARD	9A DRAIN 'S'				1	1		
RED KITE	4B					1		
	9A DRAIN 'N'	1						
PARTRIDGE	3A			1				
	4A							1
	4B					1		
	9A DRAIN 'S'							1
CRANE	9A DRAIN 'S'						1	
DOVE	4B			1	1		1	
	5A DRAIN		1					
BARN OWL	9A DRAIN 'N'							1
RAVEN	1							1
	7A						1	
CARRION CROW	5A DRAIN						1	
	10 DRAIN			1				
ROOK	7A DRAIN					1		
JACKDAW	9A DRAIN 'N'							1
THRUSH	4A				1			
	6A					1		1

The reason for this increase is not clear from the bone evidence alone. Some of the metapodia bore small cuts, which might be an indication of skinning activities. Very few sheep phalanges were found in these deposits, but of those recovered, two were cut.

Pig bones were less abundant than those of cattle and sheep, and accordingly showed a lower diversity. The commonest types of bone were components of the skull, particularly those parts bearing the teeth, whose dental structure would probably render them fairly resistant to decay during burial. The majority of the pig bones were of a delicate nature, and would have been more vulnerable to decay and crushing during burial than the denser bones of the other large mammals. Pigs may have been more important in the local economy than their surviving physical remains suggest.

Bones from most parts of the body occurred; pigs may have been killed or butchered on site, like the cattle and sheep, but this was not the case with the horses (Table 29d). In the desertion and destruction layers horses do appear to have been brought whole to the site, but were buried whole and not generally butchered for their meat. Before the desertion of the friary, horse bones do occur, but in low numbers, with a correspondingly low diversity per phase. Throughout the occupation of the site, the occurrence of occasional bones of a species not generally butchered seems anomalous. This may indicate transport of the bones after they had been thrown away, eg by water flow in the drains, dogs carrying bones away, or the use of old deposits in later building activities. This possibility is supported by the fact that no entire cats or dogs were recovered, although this may be partly due to the lack of sieving.

Fallow deer bones occurred from most parts of the body, although hindquarter fragments were slightly more abundant. Most of the bones were butchered, and some antler fragments had been worked. The deer, both fallow and red, could have originated from local deer parks such as Abbey Park,

Table 31 Fish bones (fragments)

PHASE	ELASMOBRANCH	RAY	STURGEON	SALMON	CONGER EEL	COD	HADDOCK	LING	TURBOT	PLAICE/FLOUNDER	HALIBUT	UNIDENTIFIABLE FRAGMENTS
1							C					1
2D DRAIN						V		V				
3A						6V		7V				11
3Bi			C			3C 17V	2C	9V				71
3Bii	V					C						1
3F DRAIN						4V	C 12V	2V		C 12V		122
4A						7C 8V	C 2V					17
4B					V	2V						8
5A						C						
5A DRAIN						V				V		5
6B						V						10
7A				V								
7A DRAIN									d	V		29
9A DRAIN 'S'		d				9C 1V		3C				29
'N'						V					C	23
9B DRAIN												1
10						2V						2
10 DRAIN												40
TOTAL	1	1	1	1	1	65	19	22	1	15	1	370

Key:

c: cranial component

d: skin component

v: vertebra

Beaumont Leys, or Leicester Forest. The Earls of Lancaster, who owned Leicester Forest chase, were benefactors to the friary (information from P Liddle, Leicester Museum). Deer may have been presented as gifts to the friary, possibly as quartered carcasses rather than whole, since more hindquarter fragments occurred.

Table 30 also shows a high diversity associated with the larger numbers of bird bones, especially in the fowl (Table 30a) and geese (Table 30b). Bones from most parts of the body came from the three domestic species, which may be an indication of their having been killed or butchered at the site, rather than bought dressed from the market.

Table 31 shows the species and bones of fish recovered from each phase. Only about a quarter of the fish bone fragments were identified, the remainder consisting of miscellaneous spines and fragmentary crania and vertebrae. Most of the bones identified were from the cranium and backbone, and were mainly from large fish. Had the site sediments been sieved, diagnostic bones of smaller marine and freshwater species might have been recovered. Several points of interest arose from the fish bones:

1. Nine out of the eleven fish species or types shown in Table 31 are marine; sturgeon and salmon spend part of their lives in freshwaters. The absence of true freshwater fish from a site adjacent to a river seems anomalous, and appears to indicate a taste amongst the friars for marine fish. This raises the question of how the fish were transported from the coast to Leicester, which is one of the furthest inland of English towns. Whereas oysters and mussels could have been transported from the coast alive in salt water kegs the fish would probably have been dead upon arrival at the ports and would require either rapid transport or some means of preservation. Henisch (1976) describes the frequent appearance of salted or dried fish on the medieval English lenten menu, when meat was forbidden; salted white herring, salted and smoked red herring, and

salted or dried cod were apparently the commonest.

2. Many of the fish fragments recovered were from large fish, many being considerably larger than most fish caught today. This presumably is an indication of less fishing pressure in the coastal waters in the medieval period than today, allowing the fish to grow to a larger size. Large fish may also have been preferred. Most of the bones were broken so measurements could not be taken. The halibut articular bone (right hand side) from phase 9A (north drain) was complete in its length and was 118mm long (posterior-anterior, greatest length). This is shorter than the same bone from the Southampton DoE Faunal Remains collection, which measured 165mm and was from a 160lb fish. The friary halibut could have been between 100 and 150lb in weight. Although the exact positions in the spinal column were not determined, the cod vertebrae between the head and end of the abdominal cavity ranged between 19 and 23mm across the centrum (medio-lateral), the ling between 16 and 24mm, the salmon 14mm, and the conger eel 15mm. The largest fish from the site were cod, ling, haddock, halibut, and sturgeon.

3. The Salmo sp. vertebra could have been either a trout (brown or sea) or salmon, but its large size suggests that it might have been a salmon. This vertebra had been cut transversely between it and the adjoining vertebra, suggesting that the fish was cut into steaks. Some other fish bones bore cuts, but most fragments were just broken. Four cod bones bore cuts (from phases 3Bi (3) and 9A south drain (1)); three clavicle fragments had lateral or medial cuts and one vertebra had been cut in half longitudinally suggesting filletting.

4. The presence of two skin bones (a ray wing spine from phase 9A, south drain, and a turbot dermal tubercle from phase 7A, drain) suggests that the skins were kept on these fish during all transactions, and that the skin was finally removed by the consumer.

Table 32 Ages at death of the mammal bones (fragments)

PHASE	OX			SHEEP			PIG	
	CALF	PRIME	OLD	LAMB	PRIME	OLD	PIGLET	PRIME
1	3	430	7	5	111	1		61
2A					1			
2B		1						
2D DRAIN	7	194	3		22		2	16
3A	3	214			43	1		52
3B1	35	298	1	2	283	3	8	74
3B11	2	11			12			4
3C		1						
3D	1	41			14			5
3F DRAIN	7	63	1		30	2	37	20
4A	20	216	5		72		1	39
4B	7	236	4		6			78
4C DRAIN		11			1			2
5A		30	2		4			7
5A DRAIN	11	172	1	1	101		2	46
5B	4	19			6		4	6
6A	3	31			30		1	12
6B		28	1		14			11
7A		37			9			5
7A DRAIN	9	35	1		21		2	20
7B		17			1			
8B		13			5			1
9A DRAIN 'S'	82	809	10	8	398	2	23	75
'N'	49	411	5	1	365		2	65
9B DRAIN	2	74		1	52			5
10	2	67	1		52			25
10 DRAIN	3	137		1	186	1		6

Table 32 cont'd

PHASE GROUPS	PROPORTIONS OF EACH AGE GROUP WITHIN THE TOTAL FRAGMENTS PER SPECIES, EXPRESSED AT A %							
1 -3F	4.4	94.7	0.9	1.3	97.4	1.3	16.8	83.2
4A-6B	5.6	92.8	1.6	0.3	99.7		3.8	96.2
7A-9A	9.7	89.2	1.1	1.1	98.6	0.3	14.0	86.0
9B-10	2.4	97.2	0.4	0.7	99.0	0.3		100.0

5. The biology of the fish from the friary could indicate the method by which they were caught. The flat fish (plaice/flounder, turbot, and halibut) live on the sea floor around the coast, the gadoids, (cod, haddock, and ling) and rays inhabit deeper water, the conger eel lives in shallower water, and the sturgeon and salmon live around the coast and estuaries and up rivers. Most of these fish are caught today by lines or trawling. Possibly the two marine molluscs found from this site (described in the environmental reports) were collected by trawling or dredging.

Table 32 shows the age at death of the mammal bones. The bones are divided into three age groups for each species:

juvenile (0-1 years*)
prime (1-5 years ox, 1-3½ years sheep, 1-4 years pig)
old (older than 'prime' for each species)

* These ages are based on epiphyseal fusion and tooth eruption data given by Silver (1969) for modern animals. Problems arise in attempting to demarcate age groups, since most bones can be given only a minimum age at best, based upon modern data derived from animals bred to mature earlier than ancient stock. The three age categories used in this report include all the bones. Juvenile bones are easily distinguished on account of their size and texture. Old age bones are more difficult to differentiate, principally because their diagnostic characters are few; vertebral fusion and toothwear were the characters mainly used. The 'prime' bones fell between these two limits, comprising jaws with erupting teeth and long bones whose epiphyses were still fusing, in addition to all the other fragments which were neither obviously juvenile nor old. The title 'prime' denotes that the meat should have been at its best, after the animals were well grown but before the meat toughened with old age. The domestic animals were probably kept for a few years in order to provide service before their death eg:-

cattle	milk and draught	breeding stock and supply of manure
sheep	wool	
goats	milk	
pigs	foraging	

Of the juvenile bones present, those of piglets formed quite a high proportion of the total pig bone fragments, especially within the groups 1 - 3F and 7A - 9A. Lamb bones were few, possibly because of the small size and fragility, although this could equally apply to pig bones. Perhaps the presence of higher proportions of piglets than lambs was of significance, probably being related to pigs' higher natality. Trow-Smith (1957, 129) in a discussion on medieval mortality rates throws light upon the problem of losses from natural causes, 'litters of pigs...overlain or eaten by their dams'. If they could be extricated from the sows, the dead piglets were probably eaten by medieval people. Lambs and calves were probably less prone to an early death, partly because of being more independent when very young, but possibly because they were reared in the open whilst pigs were penned. That sties were in use in 14th century England is mentioned by Trow-Smith (1957, 118); 'dredge corn was fed, particularly to the nursing sow in the sty'.

Calves and lambs were probably encouraged to live longer before being killed, in order to provide service to the community. Probably calves and lambs were killed only if necessary, for instance if they were weak or sickly. Trow-Smith (1957,130) reports that 'the old cows with bad teeth, and the barren, and the draft of the young avers that do not grow well were culled, fattened and killed' during autumn. It would appear that pigs were fattened off at about 18 months (Trow-Smith 1957, 126) for killing, hence the high proportion of sub-adult bones at the friary. Of the other species a few juvenile bones were recovered:

Plate 1. Mandible with molar worn down to the root.

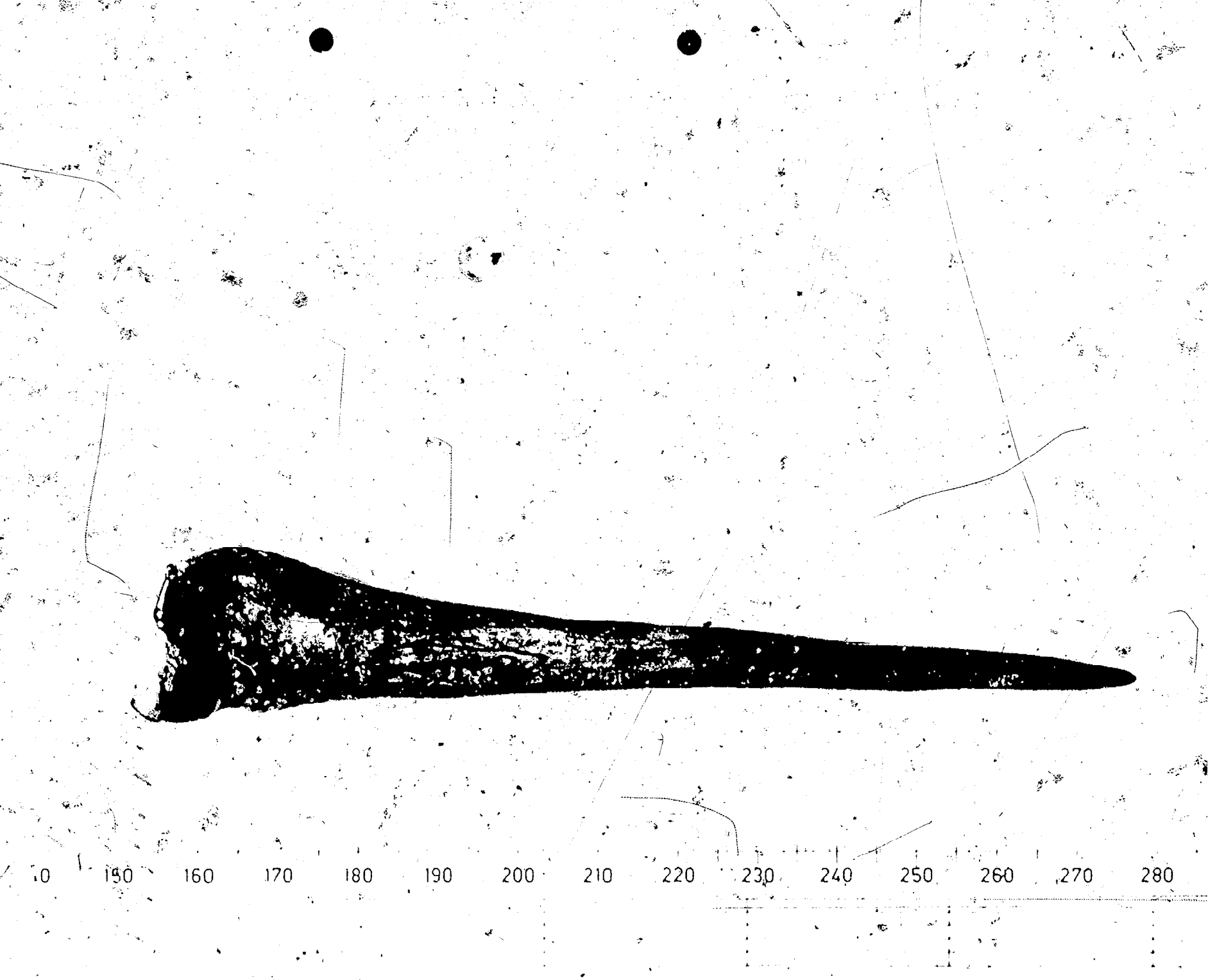

150
160
170
180
190
200
210
220
230
240
250
260
270
280

Table 33 Mammal bone fragments gnawed by dogs

PHASE	OX	SHEEP	PIG	HORSE	DEER	TOTAL GNAWED	% OF TOTAL FRAGMENTS PER PHASE
1	27	22	8		1	58	8.8
2A							
2B							
2D DRAIN	4	1	2			7	2.8
3A	23	4	4	1		32	10.1
3Bi	53	47	18	1	1	120	16.8
3Bii	1	2				3	10.3
3D	3	3				6	9.0
3F DRAIN	4	4	3	6		17	10.2
4A	29	8	9			46	12.9
4B	20	6	5		2	33	8.2
4C DRAIN							
5A	4		2			6	13.6
5A DRAIN	18	13	6		1	38	10.8
5B	1		1			2	5.1
6A	5	2	3			10	12.2
6B	5		3			8	14.0
7A							
7A DRAIN	2	2	1			5	5.6
7B							
8B							
9A DRAIN 'S'	32	24	4	1		61	4.1
'N'	25	48	11		1	85	9.1
9B DRAIN	6	3				9	6.7
10	7	3	1			11	6.5
10 DRAIN	10	17		15		42	8.0
TOTALS	279	209	81	24	6	599	x 8.6

Table 33 cont'd

PHASE GROUPS	TOTAL BONES GNAWED	% OF TOTAL FRAGMENTS PER GROUP
1-3F	243	11.0
4A-6B	143	10.6
7A-9A	151	5.8
9B-10	62	7.5

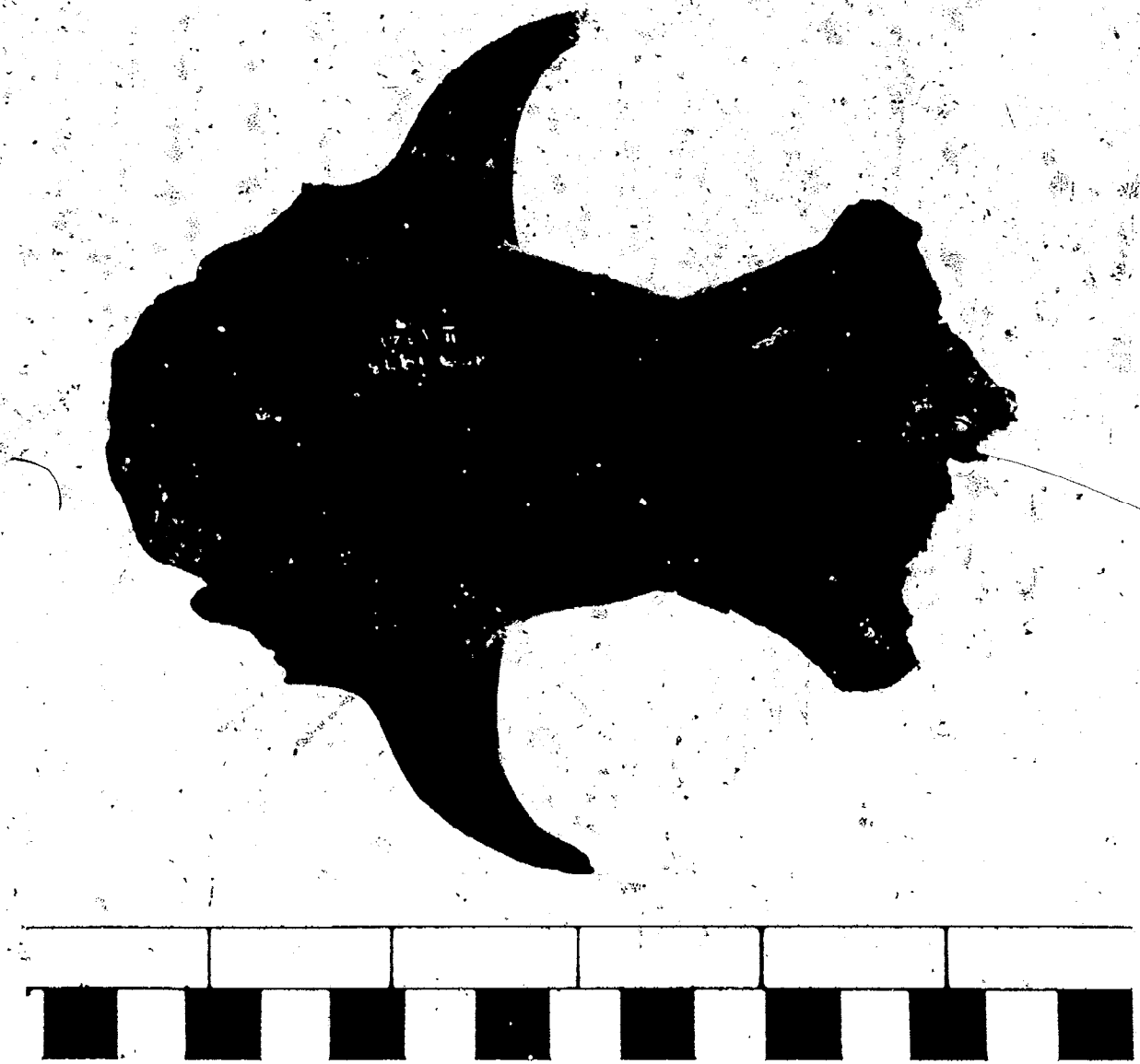
number 20, from the 9A south drain). It looks as though it was worked into a round shape with a tool like a rasp.

Plate 19 shows the remains of a large dog skull from the phase 9A south drain, which has two irregular holes made near the base of the occipital condyle, between the tympanic bullae, with the beginnings of another hole through a nearby foramen. These holes appear to have been made by a rotary motion but by a tool with an irregular cross section. Also the holes are tapered, like those made by a reamer. These holes were made after the animal was dead, and avoided both the mandibles and the atlas, but their purpose is unknown. The dog had at some stage of its life sustained a blow to its right frontal, which had subsequently healed.

The breeds of domestic animals of the period are not exactly known, diagnostic features such as the colour, type of coat or plumage, and yields of meat, milk, wool, or eggs being indeterminable from the bones alone. However, the bones can give an indication, through measurements, of the size and stature of the animals. Tables 36 (mammals) and 37 (birds) give the ranges of measurements of mature bones from all phases within the friary site. These measurements have been standardized to recommendations given by von den Driesch (1976).

The size range of the cattle bones is compatible with those from other medieval sites described by Jewell (1963). In general the friary cattle bone measurements conform to a normal distribution curve with very few either very small or very large bones at the extremities of the range. The variation in size could be due to different breeds, sexual dimorphism, or just individual variation. There were too few metapodials to attempt a statistical test on sexual dimorphism. Since metapodials were the only complete cattle long bones recovered, Zalkin's conversion factors for the estimation

Plate [illegible] skull: a) dorsal surface with healed frontal



Horse : 2 (10 drain)
Fowl : 1 (3A), 1 (5A drain)
Goose : 1 (2D drain), 1 (3A), 1 (3Bi), 1 (9A south drain)

No juvenile cats, dogs, or deer were found. Some bones had unfused epiphyses but fell within the 'prime' category.

One bone of particular interest was that of an old cow from the 9A south drain. Only one tooth remained in the jaw, the other teeth having been lost during burial or excavation but not during the animal's life. The tooth was worn down beyond the enamel leaving just a polished root stump (Plate 17). The meat on the animal would probably have been past its prime, and the animal may well have been beyond lactation age. Perhaps the animal had been kept at the friary as a milking cow and then kept on as a pet. A similar jaw was found at Breedon-on-the-Hill, Leicestershire, possibly originating from the monastery (Thawley, unpublished a).

Two well worn horse teeth came from the phase 10 north drain. One was a very well worn lower P2 which had worn down beyond the enamel of its medial side. The other was a pair of excessively worn upper canines in a skull fragment, whose other teeth indicated that the animal would have been middle-aged rather than old. The canines may have become worn through the use of a bridle with a bit.

Dog remains from the site were few, but their activities at the site have been preserved in the form of gnawed bones, shown in Table 33 (mammals). Only five bird bones were gnawed, from phases 3A and 3Bi.

If a dog is not constrained, it can completely destroy a bone. Dogs can also be responsible for the transport of bones in order to bury them in a safe place for their future use. Hence the data in Table 33 could be interpreted as a minimum indication of dogs' activities at the friary.

Plate 1[illegible] [illegible] skull: b) ventral surface with two drilled holes

In general, the frequency of gnawed bones corresponds loosely to the total number of bone fragments per species per phase, but where the total numbers of fragments is low, the proportion of gnawed bones can be apparently very high. To compensate for the possibility of small sample error and bias, percentages of gnawed bones per phase are given in Table 33. The activities of dogs apparently declined over the occupation period, as did their physical remains. The friary may have supported a small self-contained but fluctuating population of dogs, and was not subjected to appreciable scavenging by town dogs. The small increase of gnawed bones in the period of desertion and destruction may be an indication of extramural scavenging.

A pig mandible fragment from phase 3A bore rodent toothmarks, between mouse and rat size.

Marks left on bones by fire and metallic objects, although of minor proportion, are nonetheless important in the general interpretation of activities on the site. Table 34 shows the types of charred and calcined mammal bones (no burnt bird bones were found).

There are 59 burnt bones (0.5% of the total identified and unidentifiable mammal bone fragments) which suggests that incineration of kitchen wastes was not regularly practised. Although the sample is small, some points of interest arise:

1. the burnt bones from 4B (the cloister midden) were all calcined
2. only burnt sheep bones occurred in the 9A north drain
3. only burnt horse bones occurred in the phase 10 drains

Although the numbers of charred cattle skull fragments were few, the proportion of charred calf frontals within all the calf frontal fragments recovered was 29.4% ~~17.5%~~ of all

Table 36a Mammal long bone measurements (key at end of Table 37)

BONE	GREATEST LENGTH (GL)	GREATEST PROXIMAL BREADTH (Bp)	SMALLEST BREADTH OF DIAPHYSIS (SD)	GREATEST DISTAL BREADTH (Bd)
OX				
HUMERUS		74.4(1)	26.5-40.0(24)	59.2-94.5(23)
RADIUS		66.5-82.5(14)	35.6-42.5(8)	59.9-81.5(11)
ULNA		DPA 46.4-67.0(6)		
METACARPUS	187.0-198.5(3)	48.6-63.2(13)	21.4-35.5(9)	48.0-63.8(16)
PHALANX I	49.6-67.5(47)	24.2-42.0(8)	19.4-33.2(37)	
PHALANX II	32.4-41.1(13)		17.2-26.5(13)	
PHALANX III	DLS 59.8-80.9(9)			
FEMUR		DC 39.7-47.4(5)	32.9-39.2(16)	78.2-97.7(5)
TIBIA		80.6-86.4(2)	29.0-42.3(14)	48.7-66.0(12)
PATELLA	50.4-65.5(4)			
CALCANEUS	111.0-139.9(8)			
ASTRAGALUS	GLl 57.5-69.0(13)			
METATARSUS	201.0-223.0(6)	40.4-51.3(19)	20.7-24.9(7)	45.4-65.4(18)
SCAPULA			SLC 38.0-58.1(22)	GLP 51.0-74.4(10)
SHEEP				
HUMERUS	113.2-133.0(3)	33.0-39.3(5)	12.6-17.3(38)	27.1-33.8(42)
RADIUS	129.0-162.0(28)	26.5-37.5(43)	13.6-18.9(63)	24.4-30.9(37)
ULNA	156.0-172.8(4)	DPA 23.6-28.2(18)		
METACARPUS	106.0-134.0(56)	19.0-24.7(95)	11.1-15.9(95)	20.9-28.6(67)
PHALANX I	31.6-39.4(25)	10.4-11.6(2)	7.7-10.8(18)	
PHALANX II	20.3-23.5(3)		6.8-9.1(3)	
PHALANX III	DLS 24.5-24.8(2)			
FEMUR	171.0(1)	38.5-46.9(3)	13.3-17.8(29)	32.9-39.4(9)
TIBIA	176.0(1)	34.2-41.6(9)	11.1-16.0(74)	21.5-33.6(60)
CALCANEUS	48.3-58.2(11)			
ASTRAGALUS	GLl 25.5-28.6(10)			
METATARSUS	119.0-153.2(57)	16.8-22.3(91)	9.2-13.7(105)	19.8-27.5(72)
SCAPULA	HS 130.0-152.2(7)	Ld 93.7-97.7(2)	SLC 16.3-22.3(30)	GLP 26.0-37.3(24)
PIG				
HUMERUS		Dp 42.0(1)	12.3-16.7(16)	34.6-42.9(8)
RADIUS		26.0-30.1(2)	22.1(1)	
ULNA		DPA 32.1-40.7(6)		
PHALANX I	31.8(1)		12.5(1)	
PHALANX II	17.6-25.2(3)		6.2-13.8(3)	
FEMUR			14.5-19.5(4)	
TIBIA			16.3-21.8(6)	32.0-37.6(2)
CALCANEUS	64.6-64.8(2)			
ASTRAGALUS	GLl 41.4-45.6(2)			
SCAPULA			SLC 17.7-25.6(9)	GLP 32.3(1)

Table 34 Burnt mammal bone fragments

PHASE	CHARRED BONES																				PARTIALLY CALCINED BONES										WHOLLY CALCINED UNIDENTIFIABLE BONES
	CALF			OX									SHEEP					HORSE			OX							SHEEP			
	FRONTAL	OCCIPITAL CONDYLE	MAXILLA	PERIOTICUM	PREMAXILLA (diastema)	MANDIBLE (diastema)	INCISOR	THORACIC VERTEBRA	LUMBAR VERTEBRA	PELVIS	FEMUR	CUBOID	OCCIPITAL CONDYLE	RIB	RADIUS	METACARPUS	METATARSUS	RIB	ULNA	PHALANX I	ZYGOMATIC	CERVICAL VERTEBRA	RIB	ULNA	PHALANX I	PELVIS	FEMUR	RIB	HUMERUS	METATARSUS	
1					2																										
2D DRAIN	1				2	2																									
3A																								1							1
3Bi		1		1									1															1			10
3Bii																															1
3C						1																									2
3F DRAIN	1																								1						
4A							1	1														1									
4B																					1		1			1	1				
5A																															2
5A DRAIN										1																					1
7A DRAIN	3																														
9A DRAIN 'S'			1						1			1	1				1													1	1
'N'														1	1	1	1												1		1
10 DRAIN																		2	1	2											

Table 36a cont'd

BONE	GL	Bp	SD	Bd
HORSE				
HUMERUS	277.0-303.2(5)	89.5-96.5(6)	29.6-35.4(8)	73.7-82.3(7)
RADIUS	313.0-352.0(8)	75.1-86.7(8)	33.8-39.6(9)	62.2-80.9(9)
ULNA	413.2(1)			
METACARPUS III	209.1-267.0(3)	45.5-59.2(4)	29.5-37.8(4)	43.8-57.2(3)
PHALANX I	81.3-88.7(3)	51.9-58.5(4)	32.7-35.0(5)	44.0-46.8(3)
PHALANX III				GB 87.6(1)
FEMUR	365.2-405.3(7)	102.4-125.0(8)	37.8-41.9(7)	87.8-101.7(7)
TIBIA	327.3-359.6(7)	91.4-99.5(6)	36.3-38.3(7)	68.2-74.6(7)
METATARSUS II	202.0(1)			
METATARSUS III	262.0-281.5(6)	44.3-52.0(7)	23.4-32.2(8)	46.1-50.6(7)
METATARSUS IV	181.0(1)			
SCAPULA	HS 351.2(1)		SLC 59.6-65.3(4)	GLP 88.6-96.0(4)
FALLOW DEER				
HUMERUS		51.4(1)	16.4(1)	35.4(1)
RADIUS	174.0-189.3(2)	33.0-36.3(2)	16.4-19.2(3)	31.0-31.2(2)
METACARPUS	176.5-194.5(3)	25.4-29.4(5)	14.0-17.4(4)	26.6-28.1(3)
PHALANX I	39.3-41.7(3)	13.5(1)	10.0-10.7(3)	
PHALANX III	DLS 37.0(1)			
FEMUR			20.5-23.6(7)	51.7(1)
TIBIA	250.2-283.4(2)	46.7-57.8(5)	17.8-24.1(7)	31.1-37.4(6)
CALCANEUS	74.7-82.2(2)			
METATARSUS	201.0-221.3(11)	24.1-27.5(14)	14.0-17.2(14)	27.0-30.4(11)
DOG				
HUMERUS	128.0-142.3(2)	22.5(1)	7.7-12.6(3)	20.2-30.7(3)
RADIUS	161.5(1)	11.4-17.5(2)	6.7-12.5(2)	20.2-24.3(2)
ULNA	187.4(1)	DPA 16.4-25.2(2)		
METACARPUS III	52.1(1)	10.5(1)	6.6(1)	8.8(1)
METACARPUS IV	66.0(1)		5.8(1)	
FEMUR	169.0(1)	29.6-32.9(2)	10.7-12.3(2)	28.0(1)
		DC 14.4(1)		
TIBIA	141.0(1)	25.1(1)	9.4(1)	17.1(1)
METATARSUS II	51.1-56.0(2)			
SCAPULA	HS 126.0(1)		SLC 21.3(1)	
CAT				
HUMERUS			4.8-6.1(3)	13.6-16.3(4)
RADIUS	75.5(1)	6.5(1)	3.9(1)	10.4(1)
ULNA		DPA 9.3(1)		
FEMUR	87.6(1)	17.1(1)	6.7(1)	16.5(1)
TIBIA	102.0(1)	16.6-18.6(3)	6.7(1)	14.8(1)

the adult cattle diastema fragments (mandible and skull) were charred, but, unlike the calf skull charring, this custom prevailed in only the earlier part of the occupation (phases 2D-4B). This phenomenon has been observed from Roman Cirencester, where 21.3% of all the ox diastema fragments had been charred around a rough break in the bone (Thawley, unpublished b). This practice would appear to have been quite widespread, and carried out over a number of centuries, but the reasons behind the practice are unknown.

Perhaps the carcase was hoisted, head downwards, in order to bleed. The removal of the snout was necessary once bleeding and draining had been completed. The flesh and bone around the cut may then have been singed for sterilization. Such speculation assumes two things: that the head was left on during the draining process, and that some degree of hygiene was practised. Perhaps the apparent decline of charred diastema fragments over the occupation period of the friary was indicative of a change in the draining process, such as the removal of the head prior to hoisting.

Table 35 shows the bones which bore metallic stains of which there were two types, both comprising light or heavy stains:

1. cupric stains, from copper containing objects such as bronze coins. Some of the heavy stains were disc shaped, corresponding to coins.
2. ferric stains, from iron objects. The light stains were absorbed by the bone, like the cupric stains, but the heavier ferric type took the form of encrustations.

An antler fragment from the phase 10 drain has a hollowed out area of beam with surrounding ferric stains, suggesting that the antler fragment had at one time been an artefact, housing an iron object. In addition to this antler, there were a further fourteen fragments which bore evidence of boneworking in the form of sawing, drilling, whittling, and polishing, the latter probably resulting from subsequent

Table 36a cont'd

BONE	GL	Bp	SD	Bd
HARE				
RADIUS		8.6(1)	4.5(1)	
TIBIA				15.0(1)
METATARSUS V	44.5-46.0(2)		3.1(2)	
RABBIT				
FEMUR	83.0(1)	17.8(1)	6.7(1)	13.0(1)

Table 35 Bones bearing ferric and cupric stains (mammals and birds)

PHASE	NUMBER OF STAINED FRAGMENTS			
	HEAVY CUPRIC STAIN	SLIGHT CUPRIC STAIN	FERRIC STAIN	ADHERING FERRIC DEPOSIT
1	1			
3A			1	1
3Bi	4	1	2	1
3F DRAIN				1
4A	3	1	1	1
4B	1			
5B				2
6A	1	1		
9A DRAIN 'S'	4	1		
'N'	1		1	1
10 DRAIN	6		2	1

Table 36b Mammal skull measurements

SKULL	OX X3300	OX	SHEEP (MOSTLY S11)	PIG P84	PIG	FALLOW DEER	DOG	CAT	POLE-CAT
MAXIMUM SKULL LENGTH			184.0	366.2					58.3
CONDYLORASAL LENGTH			181.0						58.1
BREADTH AT ZYGIONS				128.0			121.2	55.9	34.4
AKROKRANION-NASION	212.0		110.7				112.3	62.0	
GREATEST BREADTH ACROSS NASALS	48.2								
AKROKRANION-BREGMA					35.0				
BREGMA-NASION			67.2					29.4	
BASION-NASION	218.6		94.0						
BASION-PREMOLARE	288.0								
AKROKRANION-INFRAORBITALE	337.5								
BREADTH AT ECTORBITALES			103.7	101.3			40.0-65.5(2)	42.3	19.3
BREADTH AT ENTORBITALES	154.2		69.0					15.5	
STAPHYLION-PROSTHION				235.5					
BASION-OPISTHION	42.0		16.3				14.6	12.4	
BASION-AKROKRANION							51.0	22.2	
GREATEST OCCIPITAL HEIGHT	147.5								
LEAST OCCIPITAL BREADTH	135.7								
LEAST SQUAMOUS OCCIPITAL BREADTH				64.5					
GREATEST SQUAMOUS OCCIPITAL BREADTH				81.4					
GREATEST OCCIPITAL CONDYLE BREADTH	110.9		44.0-56.8(2)				39.1	19.4	15.6
GREATEST FORAMEN MAGNUM BREADTH			18.5				21.6	12.6	9.6
LEAST TEMPORAL GROOVE INNER HEIGHT	41.4								
GREATEST MASTOID BREADTH	197.5		59.6	128.5			70.9	38.0	31.3
GREATEST PAROCCIPITAL PROCESS BREADTH			54.7				56.3		
GREATEST NEUROCRANIUM BREADTH			62.0				62.0	41.8	26.5
LEAST PARIETAL BREADTH			35.1	17.4					
LEAST BREADTH BETWEEN SUPRAORBITAL FORAMINA				33.0					
BREADTH OF POSTORBITAL CONSTRICTION							39.7	32.4	16.1
GREATEST LACHRYMAL LENGTH			36.2	62.0	51.0-57.0(2)				
GREATEST LACHRYMAL DEPTH				25.3	24.0				
FACIAL BREADTH AT TUBEROSITIES	146.8		62.7						
GREATEST INNER LENGTH OF ORBIT	62.0		35.8-37.1(2)	38.0				22.7	
GREATEST INNER HEIGHT OF ORBIT	65.0		31.7-33.5(2)						
OCCIPITAL CONDYLE(ABORAL) TO INFRAORBITALE	318.2								
GREATEST PALATAL BREADTH				68.3					
CHEEKTOOTHROW (ALVEOLI)LENGTH P2-M3	123.5	122.0-125.0(2)	64.3-67.3(3)	105.8		79.7			
CHEEKTOOTHROW (ALVEOLI)LENGTH P4-M3				116.4					
MAXIMUM LENGTH M3				29.4					
LENGTH (ABORAL) M3-C				124.4					
LENGTH (ABORAL) P1-I3				53.5					
MAXIMUM LENGTH P4								9.6	
HORNCORE BASAL CIRCUMFERENCE	164.0	119.0-195.0(9)	72.5-84.0(3)						
HORNCORE GREATEST BASAL DIAMETER	55.4	46.3-67.3(2)	22.7						
HORNCORE LEAST BASAL DIAMETER	47.3	32.7-54.8(2)	19.0						
HORNCORE OUTER CURVATURE LENGTH		119.0-257.0(3)	75.5-79.0(2)						

use of the artefacts. Four fallow deer antler fragments had been sawn through either the beam or brow tine, and one of the brow tines had striae and polishing on its tip, suggestive of it having been used as an artefact. These four antler fragments came from 1 (1), 9A south drain (2), and 9A north drain (1).

Two ox femur proximal ends, one fused and one unfused, had signs of working. One came from phase 5A (drain) and had a hemispherical groove transcribing an arc right across the epiphysis underside (see Figure 66). The other came from the 9A south drain, and had a hole made through the centre (see Plate 18b).

A goose radius from phase 3Bi had been broken and fashioned into a pen-shaped object, with a polished tip. Another three goose radii (from phase 3Bi (2) and 4A (1)) had broken shafts with the bone whittled away near the break, but had been worked no further.

A horse metacarpus from the 9A south drain had been polished to a point (see Plate 18c).

An ox metacarpus from phase 5A (drain) had been sawn across the shaft near the proximal end (Figure 66). This piece of bone is very similar to those recovered as waste from a medieval workshop site at St Nicholas Circle, Leicester, where ox metapodials had been sawn to remove the ends. The shafts were then worked into such objects as bone pins and 'knife handles' (Thawley, unpublished c). The proximal and distal ends appear not to have been worked, and it is that type of fragment that is shown in Figure 66. The occurrence of only one of these offcuts from the friary suggests that there was no established boneworking industry at the friary. Plate 18a also shows a worked ox metapodial shaft, sawn at each end (as described above) and fashioned into a so-called knife handle (small find

of withers height (Chaplin 1971) were used, based upon sex determination from the metapodials by Howard's (1963) method. The withers height of cattle from the friary fell between 1.07 and 1.22m, the majority being between 1.10 and 1.20m.

Horn cores of cattle display sexual dimorphism, bulls being more dorso-ventrally flattened than cows and bullocks both of which have a circular cross section. This has been described by Armitage and Clutton-Brock (1976) whose system of classification when applied to the friary horn cores produces the following description: medium to long horned, twisted cores with pointed ends. However, like the metapodials, there were too few cattle horncores to attempt analysis of sexual dimorphism. No polled cattle were found. Plate 20 shows a poleaxed skull from the 3F drain, which gives an indication of the shape of the animal's head. The detailed measurements are given in Table 36b (bone number X3300).

During the identification of the bones no distinction was made between the long bones of sheep and goats. Only one goat skull fragment occurred, while most of the other skull fragments were clearly those of sheep. If this ratio is reliable then the low proportion of goats points to an agricultural regime favouring sheep farming, with a few goats being kept around the homesteads to provide a small scale milk supply. According to historical sources, such as those quoted by Trow-Smith (1957), the medieval period saw a thriving British sheep industry. The measurements of the sheep bones show that the animals were quite small, but largely compatible with other medieval sheep measurements given by Noddle (1975). One point of interest, already shown in Table 29b is that two types of sheep occurred, some with horns and some without. A hornless sheep skull from the phase 2D drain is shown in Plate 21. Boessneck et al (1964) showed certain sheep

THE MAMMAL, BIRD, AND FISH BONES

Clare R Thawley

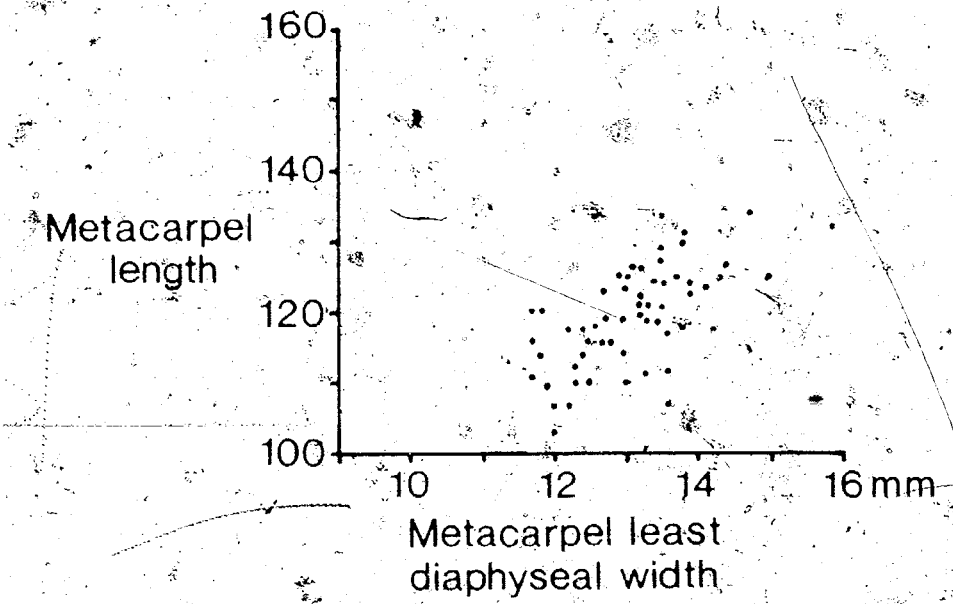
During the excavation of this site 11,759 bones were recovered, of which 8,063 mammal, bird, and fish bones were identified. Of these 8,063 bones, 7,648 are to be discussed in this report, the remainder originating from the Romano-British layers predating the friary.

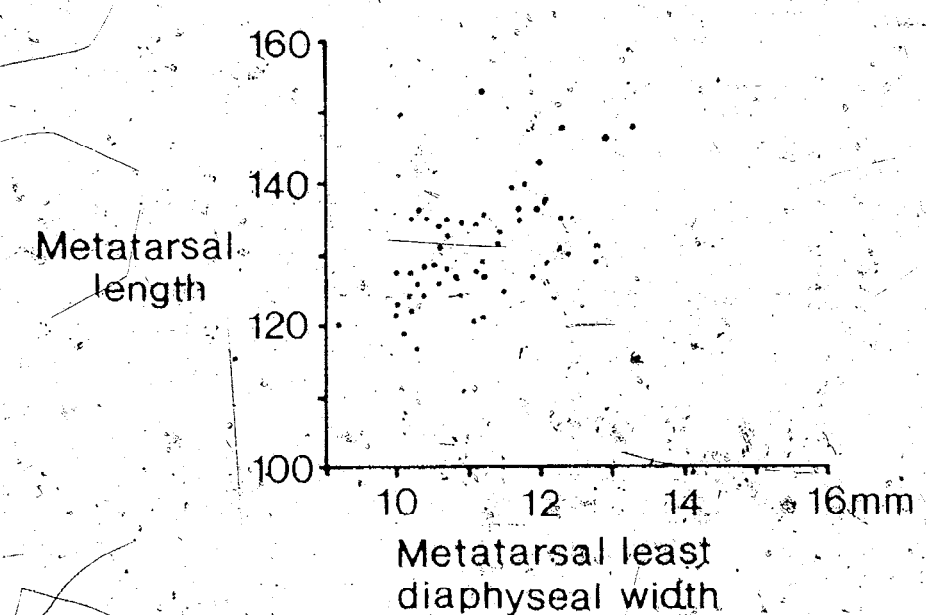
Thirteen species of mammals occurred (comprising 6,999 fragments), 17 species of birds (521 fragments), and 10-11 species of fish (128 fragments). These species were:

Mammals	Total Bones or Fragments per Species
Ox (*Bos taurus*)	5,888
Sheep (*Ovis aries*) / Goat (*Capra hircus*)	1,925
Pig (*Sus scrofa*)	717
Horse (*Equus caballus*)	278
Fallow deer (*Dama dama*)	115
Red deer (*Cervus elephus*)	2
Dog (*Canis familiaris*)	38
Cat (*Felis domesticus*)	26
Hare (*Lepus europaeus*)	5
Rabbit (*Oryctolagus cuniculus*)	3
Woodmouse (*Apodemus sylvaticus*)	1
Polecat (*Putorius putorius*)	1
Birds	
Domestic fowl (*Gallus gallus*)	246
Domestic goose (*Anser anser*)	232
Mallard (*Anas platyrhynchus*)	17
Cormorant (*Phalacrocorax carbo*)	1
Heron (*Ardea cinerea*)	1

Plate 21 Hornless sheep skull

Fig 67 The variation of sheep metapodial length and breadth





bones to be sexually dimorphic, in particular the skull, atlas, axis, sacrum, pelvis, metacarpus, and metatarsus. Quite a large number of complete sheep metapodials were recovered from the friary, largely from the desertion levels. The measurements of these are expressed graphically in Figure 67. Boessneck showed the metapodials of females to be narrower in the shaft than males, and although his histograms showed considerable overlap between males and females, the narrowest were all females whilst the broadest were all males. This is probably also the case in Figure 67 (whose axes are somewhat different from those in Boessneck's histograms), the broadest being male, the narrowest being female, and the intermediate majority comprising large females, small males, and castrates. Using Teichart's (1975) withers height estimation factors, the friary sheep were mostly between .52 and .66m at the withers, with one estimated to have been .485m and one .695m.

Few pig bones could be measured on account of the high proportion of sub-adult bones. Most of the bones were of a similar size and stature to the wild pig, which would have still been extant in Britain at that time. The length of the third molar is one way in which wild and domestic pig jaws can be distinguished. The mandibular M3 range from the friary was 26.5-34.7(6)mm while that given by Miller (1912) from wild pig skulls held at the British Museum was 29.0-47.0(9)mm. Despite the overlap in size ranges, the absence of very large teeth from the friary could indicate that predominantly domestic pigs were eaten. Wild pigs were probably becoming quite rare, and the frequent depictions of domestic swine in medieval illustrations shows that they were fairly commonplace. There was a swine market in medieval Leicester, which indicates that domestic pigs were reared and sold in the vicinity. An almost entire pig skull (bone number P84) was recovered from the 9A north drain, and is shown in

Plate 16 (in text). Its upper M3 was 29.4mm long, and Miller's range was 27.0-41.6mm, suggesting that this skull may have been a domestic pig. Compared with modern pigs, this skull is long and narrow, and conforms to Zeuner's (1963, 267) description, 'the medieval pig was a high-legged, long-snouted form'. Table 29c shows that for the whole site, male pig teeth outnumbered female by a ratio of 48:30. Possibly castration was practised not only as a population control, but also to aid fattening for the table. Since both sexes were present, variations in the measurements in Table 36 may be due to sexual dimorphism.

The horse bones, principally from the desertion and destruction levels, were of variable size. Using the Kiesewalter (1888) height estimation factors, the shoulder heights fell between 1.28 and 1.57m (roughly $12\frac{1}{2}$-$15\frac{1}{2}$ hands) with one animal of about 1.70m from the 4B cloister midden.

The dog bones did not show a great variety in size. The shoulder heights were calculated using Harcourt's (1974) method, but measurements from only the humerus, radius, ulna, and tibia were available. The shoulder heights fell between 412.5 and 533.1mm (from six bones). Most of the bones came from fox sized dogs, with one slightly smaller mandible and a few slightly longer long bones. No very large or small dogs were found. The drilled dog skull (Plate 19) was of a similar size to the cranium of a modern Alsatian, but unfortunately the snout of this dog was not recovered.

Most of the cat bones were from small individuals, being of a smaller size than most of the wild and domestic cat skeletons held at Leicester Museum.

The fallow deer measurements showed a variation typically associated with sexual dimorphism. The skull and mandible measurements fell within the ranges given by Miller (1912).

The bird bones (Table 37) showed a variety of size in the domestic species. The domestic fowl measurements probably varied because of sexual dimorphism rather than difference of breeds; some of the metatarsals were from cocks, and were generally longer than those of hens. The goose bones were very similar to the grey lag (Anser anser) and were probably a domesticated form. The duck bones were identical to mallard, but were often slightly larger than even wild drakes, and were probably a domesticated form.

The presence of eggshells at the friary may indicate that the friars kept their own poultry and waterfowl. The geese and ducks would have required some water, but since neither dive underwater the river and drains would have been unsuitable. There may have been a duckpond somewhere within the friary, perhaps outside the limits of the excavation, and also a dovecote for the domestic doves.

The wild birds and mammals showed little variation in their measurements, for two reasons:

1. only a few specimens were recovered
2. compared with modern specimens, the friary wild species were virtually identical in size, presumably because they had not been subjected to the genetic pressures of domestication.

The occurrence of a crane bone is of interest since it is larger than a common crane but smaller than the large pleistocene extinct cranes described by Harrison and Cowles (1977). The crane bone was part of a tibia shaft, which bore the fibula attachment process.

PATHOLOGY

67 mammal and 8 bird bones bore signs of disease or injury, whose detailed analysis is beyond the scope of this report. A summary of these bones is given in Table 38.

Table 38

BONE DEFECT	NUMBER OF BONES								
	OX	SHEEP	PIG	HORSE	DEER	DOG	FOWL	GOOSE	DUCK
DENTAL ABCESS	1	1		2	2				
CONGENITALLY ABSENT MPM 1	1								
CONGENITALLY ABSENT P2	1	9							
OTHER DENTAL ANOMALIES	5	3	2						
BROKEN AND HEALED BONES	6	1	2			2		1	
BONE CANCER				4					
ARTHRITIC METATARSALS	3								
ARTHRITIS	5	2					2		1
FUSION AROUND METATARSALS	2								
BROADENING OF DISTAL METACARPUS	1								
POROSITY	1								
BONE WARPING (?NEOPLASTIC)			2				1		
BONY GROWTHS	6		3	3			2	1	

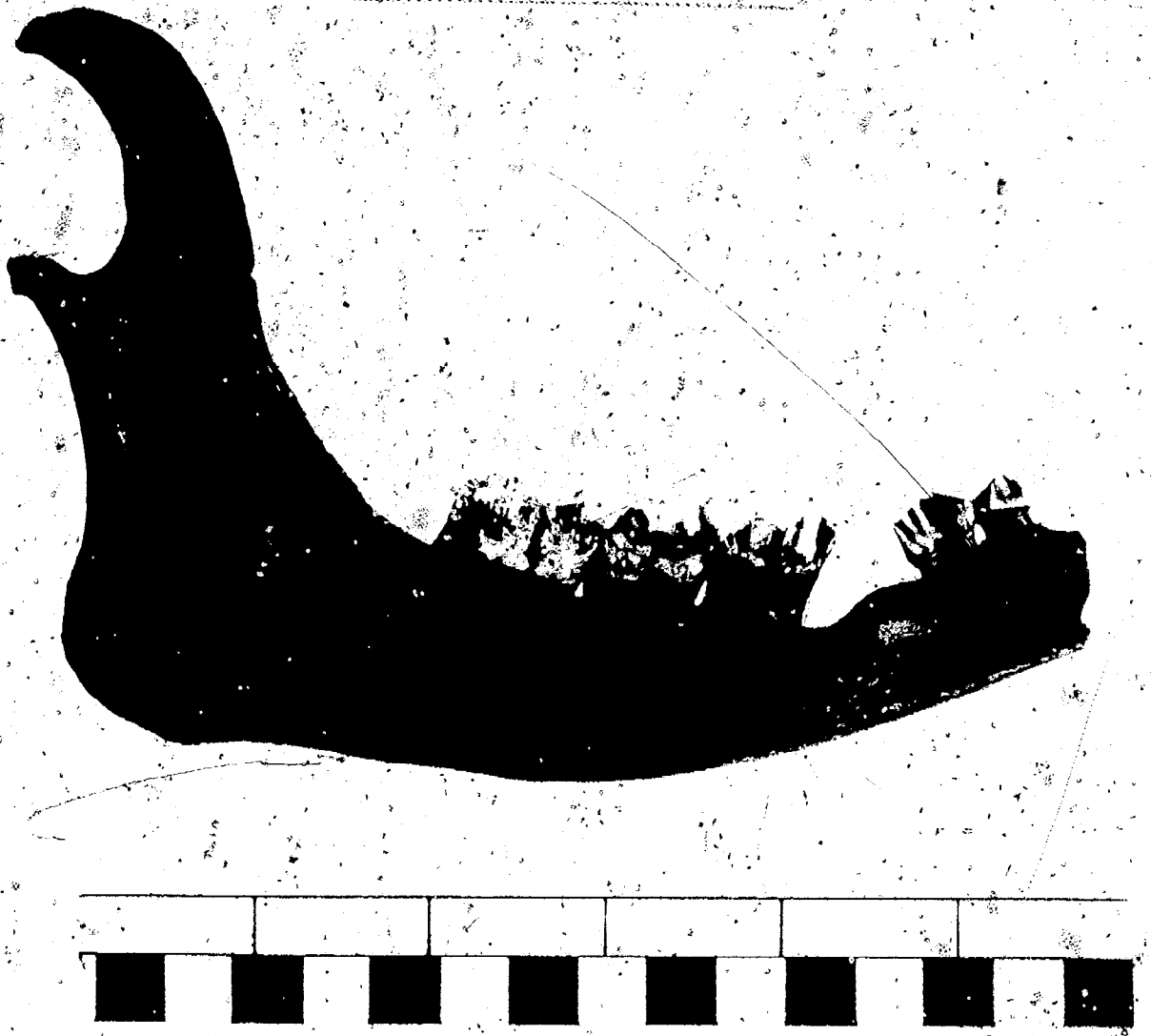
The abcesses were all associated with mandibular cheekteeth, some teeth had been lost, presumably as a result of the abcess rotting the tooth, and there was noticeable mesial slip in some of the adjacent teeth. The fallow deer jaws (from the same animal) with periodontal abcesses were of particular interest; one jaw had lost its fourth premolar (Plate 22) and the alveolus contained twelve cruciferae seeds (identified by the Institute of Archeology, London, through Dr D R Brothwell).

The case of congenitally absent premolars in ruminant jaws is an interesting one, which has been discussed by Andrews and Noddle (1975). This phenomenon has been recorded from neolothic sites rights through to the present day. Of the nine sheep mandibles, six came from phase 9A (south drain) and accounted for 18% of all the fragments bearing cheekteeth from that phase.

Other dental anomalies included:

1. teeth with uneven wear (eg a high cusp) resulting from a broken tooth opposite
2. teeth which had an uneven enamel layer through extra growths, receding enamel, tooth decay;
3. a rotated ox tooth

Plate 22 Fallow deer mandible with periodontal abscess



4. a sheep mandible with a chipped P4. The toothchip became wedged nearby and continued to be worn
5. a sheep mandible with a porous area around the M3 and a larger perforation 4mm long.

Broken and healed bones comprised ten ribs (of ox, sheep, pig, and dog), a goose keel, and the dog skull shown in Plate 19. The dog skull had a damaged frontal, just above the right eye.

A benign form of bone cancer was identified by Dr J Baker of Liverpool University (pers comm) from bony tubercles growing on the longbone shafts of four horse bones from the phase 10 north drain assemblage.

The metatarsal joint surfaces of the cattle appear to have been susceptible to contracting arthropathy. There were three metatarsals with arthritic proximal surfaces, one fused metatarsal and cuboid with surrounding bony growth, and one severely deformed metatarsus fused to the first phalanx (no X814, from phase 9A, north drain). Two other foot bones bore extra bony growth, tending to widen the distal ends. These bones comprised a metacarpus and first phalanx. The widening may have been in response to strain on the feet, possibly through being used for draught. A similar ox metacarpus has been described by von den Driesh (1975), and Jewell (1963) suggests that broad footed cattle may have been plough oxen. On the whole, though, most of the friary metacarpals were not as broad distally as those cited by Jewell.

The remaining arthritic bones came from the following species:

ox : phalanx I, mandible articulation
sheep : humerus, radius
fowl : femur, tibia
duck : metatarsus

The other three categories of disease occurred from the following species:

POROSITY	Calf	: tibia, excessively porous
WARPING	Pig	: tibia, with an internal bony, plate across the shaft
		: humerus
BONY GROWTHS	Ox	: rib shafts (2), phalanx I shafts (2), thoracic and lumbar vertebrae
	Pig	: tibia shaft (2), rib shaft
	Horse	: 3 vertebrae
	Fowl	: femur, ulna
	Goose	: tibia

A selection of diseased material is displayed in Figure 68.

BUTCHERY TECHNIQUES

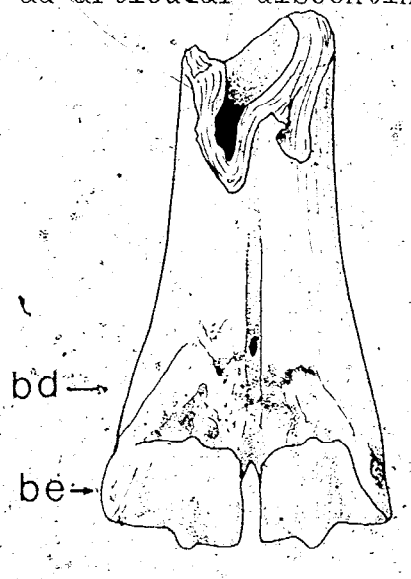
Although 51% of the ox bones were butchered, there were insufficient to determine whether any significant changes had occurred in the butchery technique during the occupation period. The butchery will be discussed below for the whole site, and on a descriptive rather than quantitative basis.

The head region (comprising skull, mandible, hyoid, atlas, and axis vertebrae) showed a variety of cuts, suggesting that the head was removed from the body fairly early in the general butchery process. The majority of the backbone was usually split along the median plane by successive strokes from an axe or cleaver.

The atlas and axis were only occasionally cut in this fashion; they were more often cut laterally and split into two halves, leaving the front half with the 'head' and the rear half on the 'neck'. The cuts around the occipital condyle were generally from the lateral or ventral. One occipital condyle from phase 1 had posterior cuts, possibly an indication that the skull was not removed until after the back bone had been split. All the lateral and ventral cuts to the axis and

Fig 68 A selection of diseased bone. Scale 1:2.
Key: sf spinally fractured; bd broadening of diaphysis; be broadening of epiphysis on lateral side; ad articular discontinuity

VI 99



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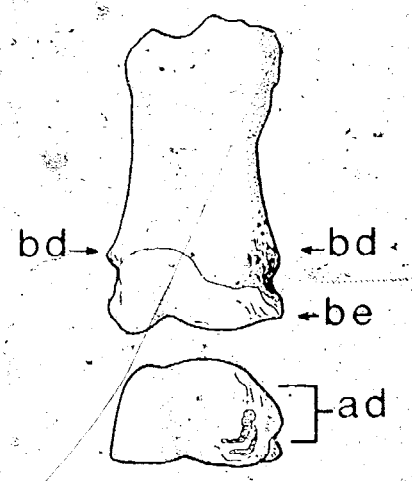
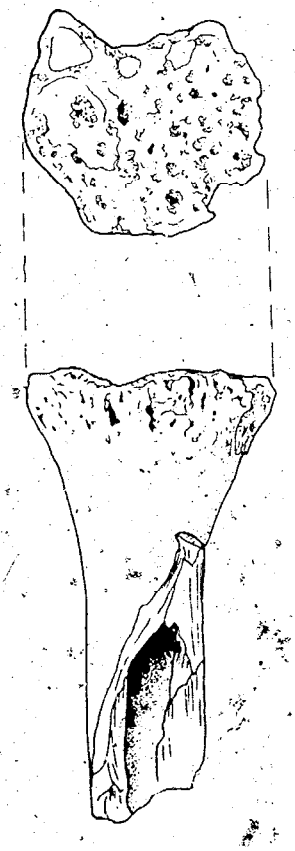
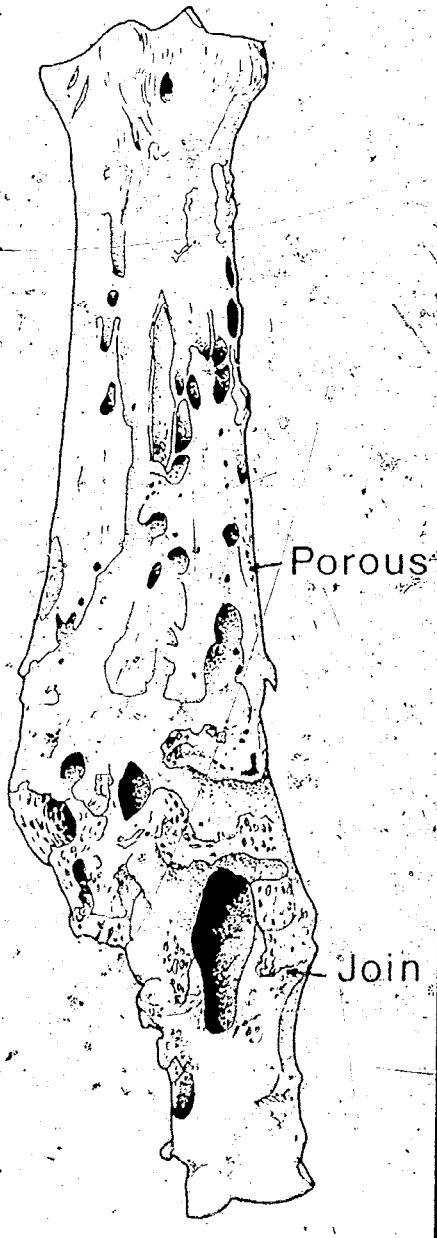


I 184



IV 58

IV 39



50mm

atlas occurred from phase 3Bi onwards. This may correlate with the suggestion made during the discussion of the charred bones that during the early phases the heads were sometimes left on the carcasses during the bleeding and draining process, and removed after the backbone was split. This suggestion is still rather tenuous, since the sample is very small. Presumably, where the atlas and axis had been split longitudinally, they had been left on the carcase, while the head had been severed at the occipital condyle.

Two cattle skulls showed signs of slaughter, both from the phase 3F drain. One was a calf skull which showed signs of having been struck, and the other was a nearly complete skull that had been poleaxed through the frontal region (see Plate 20). Medieval illustrations, in particular the 'autumn' scene in almanacs, often depict an ox about to be poleaxed, one man holding the beast by its horns while the other lifts an axe, back edge downwards, above the animal's head, poised ready to strike. The break on the skull in Plate 20 was made with a blunt tool resembling the type of break expected from a poleaxe or the heel of an axe.

The remaining cuts found on cattle skulls from the friary seem to have been associated with the removal of the horns, jaws, and snout. Cuts around the horn region were predominantly at a latero-ventral slant, with occasional blunt anterior, posterior, and dorsal cuts around the horn base. The deliberate removal of the horns, from as near to their bases as possible, suggests that the horns were saved. Too few horn cores occurred at the friary to suggest that any horning trade was carried out there. The horns may have been saved and collected up to be sent to a local horner, or have been utilized on a small scale by the friars.

In the region of the mandible and skull articulation, lateral cuts were predominant. On the mandible hinge region, the cuts were predominantly antero-dorsal, indicating that the

axe was swung from above. The abundance of cut fragments from this region suggests that the removal of the mandible from the skull was a common practice, which occurred throughout the friary occupation period. Cuts also occurred in the diastema region, often of a rather blunt nature, sometimes followed by charring around the break. Other, less frequent, cuts to the mandible comprised:

1. lateral cuts to the cheektooth row area, the jaw then being broken
2. occasional posterior or ventral cuts to the symphysis, an area which is not fused in cattle. These cuts occurred from phase 6B onwards.

The object of removing the jaws is not entirely clear. If the masseter muscle had set with rigor mortis, then the muscles would not allow the jaws to open to extract the tongue. The jaws may have been removed to enable the tongue to be removed in one piece. However, the further cutting of the jaw suggests that they were used for some other purpose. The cattle teeth were never worked, but the poleaxed skull had had all its cheekteeth cut out by lateral axe strokes, possibly to enable jaw removal since the articulation region was uncut.

Of the few hyoids recovered, only three were cut, possibly during tongue extraction. Some skull and mandible fragments bore superficial cuts which may have arisen during skinning, since in this part of the body the skin and bone are virtually adjacent.

The vertebral fragments had various cuts depending upon their position in the spine. The cervical, thoracic, and lumbar vertebrae were predominantly cut from the posterior by successive axe strokes aimed roughly along the median plane, suggesting that the carcasses were hoisted to be cut and split longitudinally into halves. Sometimes the backbone had been split from ventral cuts, again roughly

along the medial plane. The longitudinal splitting was probably one of the first stages of the butchery process, along with the splitting of the sternum and removal of both head and feet. Few sternebrae were recovered, but some had been cut from the ventral and split roughly in half longitudinally. To facilitate splitting of the backbone, the sternum would first need to have been split and the rib cage opened out.

Other cuts to the vertebrae probably occurred after the initial splitting was complete. These comprised:

1. lateral or medial cuts through or between the vertebrae, cutting the backbone down into shorter lengths. The cuts would probably have been from the medial, cutting straight into the split vertebrae and thus avoiding damaging the meat with the axe
2. lateral cuts removing the neural spines, particularly from the thoracic vertebrae
3. surface slices, probably arising from filleting
4. removal of the transverse processes of the lumbar vertebrae from varied cuts
5. consecutive medio-ventral or ventral cuts to the 'wing' of the first sacral vertebrae, probably to detach the pelvic girdle from the backbone
6. posterior cuts removing the rib articulations of the thoracic vertebrae. Some thoracic vertebrae displayed posterior cuts only through one or both rib articulations, the median plane having been missed or avoided

Only one caudal vertebra had been cut, from the posterior, removing a sliver.

The ribs were highly fragmented, many having been chopped and then broken through, probably to provide lengths of bone short enough to be handled easily. The ribs were probably removed after the longitudinal splitting, either by cutting into the medial sides of the shafts or into the ventral sides of the proximal ends. The rib blade fragments bore predominantly lateral cuts, probably made after the ribs and

backbone had been severed. Surface cuts occurred on many rib fragments, having probably arisen during filleting. Some of the semi-ossified 'ventral ribs' had been cut, possibly from the ventral.

The removal point of the forelimb is not too certain. The scapula shaft was often cut at a ventral slant to its medial side, which would be the expected cutting point if the carcase was lain on its back with the foreleg held out. However, it would have been easier to remove the forelimb by slicing through the muscle between the scapula and rib cage. Cuts to the scapula blade suggest that the bone was left in the meat, and that the flesh was not filleted. The blade was often cut at a perpendicular, from the lateral or medial, and sometimes the thinnest part of the blade bore a solitary hole that may have been made by a pointed tool such as a meathook, spit, carving fork, or fleshhook. Around the shaft there were occasional superficial slices and the spine was often cut from the ventral. These cuts may have been the result of flesh removal. Around the articulation, cuts to the anterior and medial faces were usually from the ventral.

Many humerus shaft fragments had been split by spiral fracture, and where cuts were visible they had been made from all directions, although predominantly from the posterior and anterior. Few cut proximal ends were found, possibly because this part of the bone was unfused in many of the animals at the time of their death, the vulnerable epiphyses having subsequently perished. The distal ends were cut from all sides around the joint, but predominantly from the medial, presumably to avoid the problems of having to cut through the olecranon process of the ulna.

Medial cuts, often at a posterior slant, were predominant amongst those found on the proximal ends of the radius and ulna. The elbow joint appears to have been quite frequently butchered, although this probably involved considerable effort on the part of the butchers since axes were apparently

used for the majority of the cutting. Perhaps by cutting through the joints, the butchers were able to avoid damaging the best meat lying over the long bone shafts, the shafts being boned out at a later stage and smashed to extract the marrow. Alternatively, the cooking technique may have required the meat to have been cut down into small portions, which would necessarily involve cutting through the joints.

The shafts of the radius and ulna fragments were most often cut from the medial and posterior, the radius sometimes having been cut at a dorsal slant. Many radius shaft fragments had been split by spiral fracture. The distal radius and ulna fragments were few, and only four had signs of butchery, from various directions.

Only one carpal was cut, and the proximal metacarpus fragments bore only occasional cuts and surface slices. The front feet appear to have been removed from the carcase by cutting through the metacarpus shafts from the lateral, then breaking the bones across. Some of the tools used for cutting had sharp edges, while others were blunt. Many of the bones were just broken, and bore no evidence of cutting. The phalanges (from both fore and hind feet) bore little sign of butchery. Only two had cuts, both from the posterior, and were possibly associated with sheath removal.

The pelvic fragments show few actual signs of longitudinal splitting, but the orientation of some of the secondary cuts implies that the innominates had been separated. Although most of the fragments consisting of thin bone around the pubic symphysis were broken, a few bore cuts which may have resulted from longitudinal splitting:

1. some fragments of the ischium blade near the innominate symphysis had cuts either from the ventral or posterior
2. other ischium blade fragments had ventral cuts
3. most of the pubis shaft fragments had ventral cuts

These cuts all appear to have been made 'off-centre' to the innominate symphysis; thus avoiding the slightly thicker bone of the symphysis, but having instead to cut through the adductor tendons.

There were only a few cuts around the union of the sacrum and ilium, suggesting that cuts to this area were generally avoided. The ventral cuts to the 'wings' of the first sacral vertebrae have already been mentioned in the discussion of the backbone butchery, and where cuts occurred around the auricular area of the ilium, they were from the anterior, posterior, dorsal, or ventral.

Some of the other cuts to the pelvis would have been impractical or even impossible to make had the carcase not previously been split longitudinally; lateral and medial cuts, perpendicular to the median plane, could not have been made unless the pelvis had been split. Cuts to the ilium shaft fragments were principally from the lateral or medial, although a few dorsal and ventral cuts occurred. By cutting the ilium shaft, the sacrum could have been left on the ilium blade, and the remaining part of the pelvis (the modern aitch-bone) separated before further butchery. More ventral cuts occurred on the aitch-bone fragments than the ilium, possibly reflecting a difference in the butchery technique indicative of the previous halving of the innominates.

The acetabulum was cut mainly from the ventral or medial, then split through, but to facilitate this the femur would need to have been removed or twisted round to present the least obstruction to the butcher's axe. Medial cuts to the acetabulum would initially avoid the ligamentary capsule around the ball and socket joint, and would also avoid damaging the rump flesh. In addition to the acetabulum, medial cuts were found on many of the pelvis fragments. Once the abdominal cavity had been cleaned out and the pelvis split longitudinally, axe strokes from

the medial would have less ligament and muscle to penetrate before reaching the bone.

A number of femur heads had been severed from the ventral or medial, suggesting that the acetabulum was sometimes cut with the femur in situ. Once the femur head had been cut off, the remainder of the bone could have been removed and butchered. The great trochanter had been cut and split off predominantly from the ventral, possibly as a simple measure to release the rest of the femur for further butchery by splitting off the great trochanter with its connected tendons from the rump muscles (the gluteus medius, gluteus minimus, gemelli, pyniformis, and obturator internus). Sometimes the great trochanter bore posterior and medial cuts. The femur shaft had quite often been cut, but there were in addition a large number of split fragments bearing no cuts. The cuts on the shaft varied according to the original position of the fragment; the main corpus of the shaft bore mainly posterior or medial cuts, while near the proximal end there were also latero-ventral cuts (including the lesser trochanter), but near the distal end the few cuts that did occur were either lateral or anterior in orientation. The distal end was often cut, which apparently involved some effort judging by the multiplicity of the cuts, which were frequently at an anterior slant from the dorsal, medial, and lateral. A few anterior cuts occurred suggesting prior patella removal in order to expose the knee joint ligaments for cutting. The posterior epicondyles were rarely cut, but when cuts did occur they were apparently a continuation of butchery started elsewhere on the joint. The other bones around the knee joint were rarely cut; two patella had been cut from the posterior, removing the end or ends, and a few proximal tibia fragments bore medial cuts, or occasional anterior, lateral, or posterior cuts. The tibia shaft fragments were mainly cut from the medial, with fewer fragments bearing posterior, antero-ventral, and lateral cuts. The tubercle on the crest was sometimes cut from the ventral

in a series of scoops, probably resulting from the severing of the patella ligament. A number of shaft fragments were split only. The distal end fragments bore few cuts, although like the tarsals cuts were apparently directed to avoid the corpus calcamei (to which the achilles tendon is attached). Medial cuts were predominant amongst those found on the calcaneus and astragalus, although a number of the cuts to the astragalus were at a dorsal slant. The ankle joint may sometimes have been a zone for the removal of the hind foot.

There were surface slices around the cuboid, navicular, and proximal metatarsus fragments, like those found around the wrist joint, which may have resulted from skinning activities. Many metatarsals had been cut in their shafts from the posterior, lateral, or medial, and/or been broken. There were no distal metatarsals with cuts, suggesting that, like the metacarpals, the metatarsals were severed mid-shaft to remove the feet.

The butchery of sheep bones was broadly similar to that of cattle. However, only 36% of all the sheep fragments were butchered (compared with 51% of the cattle remains) which can be explained by the fact that sheep are so much smaller than cattle and would therefore require less butchery to create cuts of meat small enough for the kitchen.

The backbone was frequently split, predominantly from posterior cuts, with fewer ventral cuts. The atlas and axis vertebrae were almost exclusively cut from the posterior and split longitudinally, presumably continuing from the rest of the spine. The focus for removal of the head was apparently the occipital condyle, or thereabouts; three skull fragments had been cut there, from the ventral or dorsal. No signs of slaughter were apparent from the skull fragments, but some bore cuts suggestive of penetration of the cranium, with intent to extract the brain. Contemporary

illustrations never show sheep being stunned or poleaxed, as they often do cattle and pigs, but instead show kneeling sheep being held by the muzzles, with the throats being cut. Throat cutting would not necessarily leave any marks on the bones that could be distinguished from the subsequent butchery marks.

Most of the cuts found on the skull were made in conjunction with the removal of the horns mostly from lateral cuts. The single goat horn had also been severed from a lateral cut. Most butchered mandible fragments had been cut laterally through either the diastema or midcheek, and very rarely elsewhere.

There were some anterior cuts along the median plane of the lumbar vertebrae, suggesting that in some cases the carcasses may have been cut into fore- and hind-quarters before longitudinal splitting, or that splitting occasionally was performed using anterior cuts. Other cuts found on the trunk vertebrae consisted of dorsal cuts removing the neural spines from some thoracic vertebrae, and general lateral or medial (probably medial) cuts reducing the spine into shorter lengths after longitudinal splitting. All those sacrum fragments bearing part of the centrum had been split longitudinally from posterior or ventral cuts.

The forequarter butchery was similar to, but less complex than, that found on the cattle bones. The ribs were principally cut laterally on the blade, medially on the shaft, and sometimes ventrally on the proximal end. On the whole, the proximal ends appear to have been left attached to the backbone (like modern mutton chops) while the blades formed a separate cut of meat (like the modern breast of mutton). There were no butchered sternebrae.

A number of scapula blade fragments bore 'meathook/spit' marks, like the cattle. The blade was often cut from the lateral, but the shaft and articulation were rarely cut. The humerus was generally cut in the shaft from diverse directions, which suggests that the shoulder region was

divided into two cuts: 1) the blade; 2) the scapula shaft, articulation, and upper humerus. The distal end of the humerus and proximal ends of both ulna and radius were rarely cut.

The shafts of the ulna and radius were often split by spiral fracture, and some were cut, from various directions. The distal ends were never cut and neither were the proximal metacarpal fragments. The point of removal for the front feet seems to have been the metacarpus shaft, likewise the metatarsus for the hind feet. The shafts were mostly split, but some had cuts. The assemblage of sheep metapodia in the north drain in phase 10 were cut more often than metapodia from other phases, and cut phalanges occurred only from this deposit.

The pelvis bore both lateral and medial cuts, implying prior longitudinal splitting. The ilium was cut the most frequently, through the shaft from the lateral. Other parts of the pelvis were less frequently cut, suggesting that the innominates were commonly divided into the ilium blade and aitch-bone. Two sacrum 'wings' had been split off, presumably being left attached to the ilium.

The femur head was rarely severed, unlike with the cattle. Instead the shaft was often cut or broken at both ends, leaving the proximal end with the aitch-bone, the shaft by itself, and the distal end with the knee joint. The direction of the cuts to the femur was predominantly posterior, whilst the tibia was commonly cut at each end of the shaft, the joints being avcided. One cut to the tibia tubercle suggested severing of the patella ligament. The tarsals were occasionally cut, and even then the corpus of the calcaneus was avoided. The hind feet were removed at the mid-metatarsus.

Many bones were broken, split, or splintered and had no evidence of cutting, and were probably a consequence of the butchers' principal tool - the axe.

Only 28% of the pig fragments had been butchered. Very few vertebrae had been split longitudinally (from ventral or posterior cuts). The neural spines of some thoracic vertebrae and transverse processes of some lumbar vertebrae had been cut off, and a number of vertebrae bore lateral cuts reducing the backbone into shorter lengths. One axis had been longitudinally split, and one cut across the odontoid process, suggesting that this may have been an area for removal of the head. No butchered atlas fragments were found. The occipital condyle was cut on three skull fragments from various directions, and this was presumably one point for severing the head and neck. Two skull fragments from the phase 3F drain had been cut dorsally into the frontal, suggesting brain removal, and one fragment from the 9A north drain bore knife cuts inside the brain cavity. A number of skull fragments bore cuts around the hinge and eye area, corresponding to lateral cuts on the mandible. These cuts may have been associated with removal of the masseter muscle. The mandible was sometimes cut from the dorsal into the cheek toothrow, and quite often into the symphysis at a postero-dorsal slant. The symphysis is fused in pigs (but not in cattle or sheep) and the cutting of this area was possibly associated with longitudinal splitting or with deliberate jaw removal.

The ribs had been cut similarly to those of sheep, being predominantly cut either into the shaft from the medial or into the blade from the lateral. The resulting cuts of meat would be akin to the modern pork chops and breast of pork.

The principal cutting points (and cut orientations) of the limbs were:

forelimb: scapula blade (lateral)
humerus shaft (medial or posterior)
ulna and radius shafts (medial)

hindlimb: pelvis, ilium shaft (lateral or medial)
femur shaft (posterior or medial)
tibia and fibula shafts (various)
tarsals (lateral or medial cuts, surface slices)

No butchered metacarpals or metatarsals were found; these were probably removed by cutting into the ulna/radius and tibia/fibula shafts, and eaten as 'hock and trotters'. The pelvis fragments sometimes bore evidence of longitudinal splitting from ventral cuts to the innominate symphysis. The aitch-bone sometimes bore ventral cuts to the pubis and ischium shafts. Where surface slices occurred on the pig bones, they were generally from fleshy areas. Surface slices on the head and ankles may be an indication of skinning activities. However, the skin of pigs, when cooked, is gastronomically acceptable today and there is evidence to suggest that things were little different in the medieval period. Sabine (1933), discussing the problems of butchering in medieval London, describes the appearance of scalding houses in the early 14th century where 'pigs and other animals and likewise geese were scalded'. The scalding water, then being full of blood and hairs, was allowed to run away. Both pigs and geese were probably eaten with their skins still on, but animals whose skins were required for tanning would not have been scalded. Tastes in London were probably the same as those in the provinces.

Apart from antlers sawn for boneworking, 33% of the fallow deer fragments had been butchered. Longitudinal splitting was evidenced by ventral cuts along the innominate symphysis of two pelvis fragments. The head region had cuts to the diastema, those to the mandible being principally from the medial. Cuts also occurred on the mandible cheek and hinge fragments. The ribs bore medial cuts on the shafts and lateral cuts on the blades. The forelimb was poorly represented amongst those fragments recovered (see Table 29e) and only two had been butchered: a humerus shaft (cut from the posterior) and a radius shaft (cut from the medial). The pelvis fragments bore superficial cuts around the ilium shaft and acetabulum. The commonest of butchered fallow deer bones were the femur and tibia. The femur was generally cut mid-shaft from various directions, with frequent posterior

scoops where the flesh would have been severed. Cuts to the proximal end were (on two fragments):

1. the great trochanter cut ventrally and split off
2. the 'head' cut laterally, presumably being split and left attached to the acetabulum

Cuts occurred on distal femur fragments from various directions, coinciding with proximal tibia cuts. Two fragments had been cut into the tubercle, presumably to sever the patella ligament. The shafts were generally cut from the medial, and only two fragments around the ankle joint bore cuts. The only cuts on the metatarsals were superficial, possibly resulting from skinning.

Many of the fallow deer bones had been split by spiral fracture, suggesting deliberate breakage as part of the butchery and cooking process. The slightly higher numbers of hindquarter fragments (see Table 29e) could be due to donations of quarters of venison from the local deer parks, hindquarters being predominant.

Some butchered horse bones occurred, almost entirely from the phase 10 north drain assemblage, some of which had definite axe cuts whilst others bore marks suggestive of occasional skinning activities. However, two cut horse bones occurred from the occupation levels of the friary:

1. from the phase 3F (drain), a metacarpus fragment with distal superficial cuts, possibly from skinning
2. from the phase 9A south drain, a butchered lumbar vertebra.

The latter bone raises several questions: was horsemeat eaten, when, and by whom?

The frequency of cut horse bones was:

	butchered	sliced (from skinning?)
during occupation	1.2%	1.2%
after the desertion	3.6%	2.6%

If horsemeat was eaten, then it was only very occasionally. The meat may have been reserved for the dogs, whose teethmarks appeared on 9% of all the horsebones (see Tables 27 and 33).

One dog tibia, from the phase 9A north drain, had some surface slices on its posterior side. This is probably not an indication of the eating of dog flesh, but of skinning activities; a piece of dog nose was among the leather finds from this site.

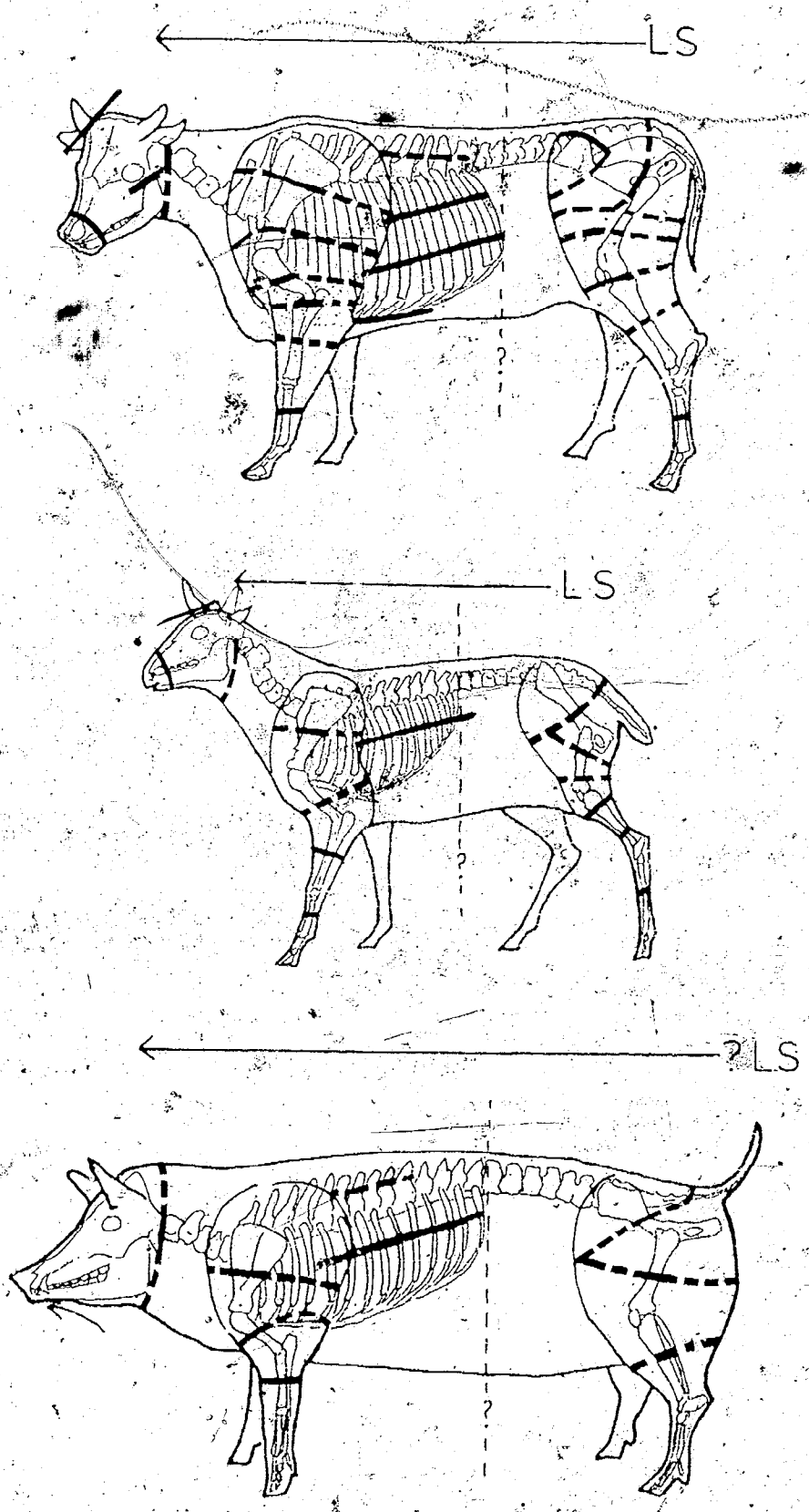
The principal areas of butchery of cattle, sheep, and pigs is shown in figure 69.

Some bird bones had been butchered, but only those of the domestic fowl (4%), domestic geese (13%), and duck (12%). The cuts on the fowl were all on the hind end.

The pelvis and femur fragments had a few cuts possibly resulting from quartering the carcasses, and the feet appear to have been commonly removed by cutting through at the distal end of the tibiotarsus. The geese appear to have been butchered more extensively than the fowl. Neither fowl nor geese vertebrae had any signs of longitudinal splitting, but the bones around the breast of geese did. The sternum was quite often cut either or both sides of the keel from the ventral, and sometimes the clavicle had ventral cuts. One skull fragment had been cut dorsally just beside the median plane, possibly to extract the brain. However, the pelvis and synsacrum fragments all showed cuts severing this region from the thorax from ventral cuts on a lateral plane. Other less frequent cuts occurred on the following bones:

mandible	: lateral cut on the boundary of bill sheath and feather
coracoid	: 2 with ventral cuts to their opposite articulations and various surface slices
humerus	: 1 proximal end cut into the shoulder ligaments 2 distal ends cut laterally to sever them from the radius and ulna

Fig 69 Principal butchery techniques in cattle, sheep, and pigs (not to scale). LS: longitudinal section



radius : lateral cuts severing the distal end from the carpals
ulna : medial shaft cuts
metacarpus : proximal end cut laterally between it and the carpals
femur : shaft cuts
tibia : shaft and distal cuts
metatarsus : distal end cut off from the postero-medial

Cuts appear to have been directed at the joints, probably to avoid damaging the flesh over the shafts.

Only two duck bones had been cut; one ulna had dorsal shaft cuts, and one tibia had been cut medially to remove the distal end (and doubtless the foot as well).

The preceding analysis of the butchery marks leads to several conclusions about the butchery practices:

1. Mammal carcasses were often hoisted to be split longitudinally, and were probably hoisted to drain and cool before the splitting took place. Contemporary illustrations show carcasses hoisted on bars passed between the ankles and achilles tendons.

2. The heads of mammals were apparently removed prior to longitudinal splitting.

3. Butchery at the friary appears to have been an organized and skilled affair.

4. Whole animals were either killed or butchered at the site.

5. If the animals were killed or butchered on site, possibly skinning was also carried out at the friary. The method of disposal of the skins is of interest; they could have been tanned on site, tanned elsewhere in the vicinity for the friars, or just sold as a means of revenue.

6. Of the domestic animals, cattle were the most important for the friary meat supply; cattle would yield the highest quantity of meat per carcase of those domestic species apparently eaten.

7. The principal tool used for butchery was the axe, which often splintered the bone (from spiral fracturing following impact). Shaft splitting may have been carried out after flesh removal, for the extraction of marrow. Knives appear to have been used for filleting and skinning. Cleavers were possibly used for splitting the backbone. Some bones, particularly the scapulae of cattle and sheep, bore holes which may have been made by a spit for roasting. Worked bones were generally sawn.

8. Small joints of meat were generally cut; even the geese were cut up. This may indicate a cooking technique preferring small cuts of meat, which would cook more quickly than large ones and be easier to handle. The dimensions of the cooking vessels (eg cauldrons, pots, dripping trays) would determine the size of the pieces of meat; large cuts of meat may thus have been impractical.

9. The sheaths from the horns and feet of cattle and sheep were probably utilized by horners, since the bones bore cuts.

10. In this type of community, nothing was likely to have been wasted. Although there is no osteological evidence for it, the offals were no doubt used as well as the meat. All grades of meat appear to have been eaten.

Butchery marks occurred on six domestic species (ox, sheep, pig, fowl, goose, and duck) and on three wild species (fallow deer, cod, and salmon). However, some twenty or more species were probably eaten, including the other eight or nine species of fish, the marine molluscs (oysters, mussels, cockles, and whelks), and possibly some of the larger freshwater mussels. The types of meat eaten may have been stipulated by religious regulations such as fast days and lent, when all meat except

fish and shellfish was excluded (Henisch 1976). Both meat and fish were eaten at all stages of occupation of the friary, and marine molluscs appeared in the drain deposits after about AD1350.

The animal bones from the friary have yielded information about the friars' diet in general, the method of slaughter and butchery of the animals, the ages at which the animals died, their size, their diseases, and the variety of species present. The butchery of the bones suggests a type of cookery favouring small joints, and after the friars had finished with the bones, dogs were sometimes able to gnaw them. The bones were disposed of in different middens throughout the occupation period, the principal middens being the cloister midden (4B) until AD1400, and the south and north drains. The drains continued to receive bones after the desertion of the site, particularly the north drain, possibly because of its easier accessibility than the south drain.

The bones also yield some information about agricultural practice at the time. The presence of fields to the north of the friary and the occurrence of dung beetles (described in the environmental report) suggest that the domestic ungulates may have grazed there. These animals may have been subject to parasitic infestations in view of the proximity of the river; damp conditions encourage the sheep liver fluke to perpetuate itself. The shoe leather also reflected the problems of warble fly infestation in cattle (see leather report, in text).

If animals were owned by the friary and kept in the north field, then these may have been killed and/or butchered on site; the mammal bone evidence suggests that this was the case. However, presentations of meat to the friary appear to have been made, and both fish and shellfish were imported to the friary.

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APPENDIX

439 animal bone fragments were recovered from the foundations in Area VI, many of which were thought to have been redeposited from earlier deposits on the site. Many of the bones were broken, a few were butchered, and two bore signs of disease:

1. a fallow deer metatarsus with extra bony growth along the anterior side
2. an ox metatarsus (VI 99) whose distal end was exceptionally broad, probably as a result of ploughing. This is displayed in Figure 68.

The following species comprised the 439 fragments: ox, sheep, pig, fallow deer, dog, cat, fowl, goose, and cod.

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