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The Anglo-Saxon Human Bone from School Street, Ipswich, Suffolk.

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Summary

Remains of 95 inhumations (35 male adults, 28 femails adults, 16 unsexable adults and 16 juveniles) are studied. The material was excavated (in 1983-5) from a cemetery situated just inside the town defences, and is of late Anglo-Saxon date (10^{th}-11^{th} century). A quantity of disarticulated bone from the same site, present as residual material in post-Saxon features, was also examined.

THE ANGLO-SAXON HUMAN BONE FROM SCHOOL STREET, IPSWICH EXCAVATED 1983-85

Introduction to the site

Bones of 95 inhumations are studied. The assemblage is from a late Saxon (10th-11th century) cemetery which runs along the inner side of the town defences. No church was located in the excavated area. A quantity of disarticulated bone (representing a minimum of 40 individuals) present as residual material in later features was also examined (see Appendix).

The human remains

1. Introduction to the material

Remains representing 95 individuals are studied. Of these 89 are discrete burials; these included 4 contexts (1076, 1078, 2168 & 2171) which consisted of 2 individuals whose bones were either collected separately or could be readily separated. One context (1346) consisted of the commingled bones of 2 individuals, and one (2083, which appears as a bone scatter on the plan) of the commingled remains of 4 individuals. Many of the burials contained a few stray human or animal bones.

(a) Preservation of the remains

The preservation of each individual is scored as good, moderate or poor on the basis of visual inspection of the bones. The results are shown in Table 1.

Table 1: Bone preservation

	Good	Moderate	Poor
Male adults	7	20	8
Female adults	9	14	5
Unsexable adults	1	8	7
Juveniles*	1	10	5
TOTAL	18	52	25

*=individuals thought to be aged under 18.

(b) Skeletal completeness

The completeness of a skeleton was estimated (discrete burials only) and scored into the categories shown in Table 2.

Table 2: Skeletal completeness

	Approximate percentage of skeleton present				
	>80	60-80	40-60	20-40	<20
Males	8	4	5	9	7
Females	5	8	4	6	4
Unsexable adults	0	0	0	0	14
Juveniles	0	1	3	1	10
TOTAL	13	13	12	16	35

(c) Representation of skeletal elements

A skeletal element is scored as present if it is represented by a complete or incomplete bone. The results are shown below for adults and juveniles. In the table for adults the number of each element present is also expressed as a percentage of that expected if each individual was represented by a complete skeleton. Only discrete burials (74 adults, 15 juveniles) - as opposed to commingled remains - are listed.

Table 3: Representation of skeletal elements of adults

Skeletal element	Number represented	% of expected
Skull	44	59.5
Mandible	41	55.4
Cervical vertebrae	184	35.5
Thoracic vertebrae	432	48.6
Lumbar vertebrae	195	52.7
Sacrum	38	51.4
Sternum	32	43.2
L ribs	322	36.3
R ribs	316	35.6
L clavicle	40	54.1
R clavicle	40	54.1
L scapula	44	59.5
R scapula	39	52.7
L humerus	47	63.5
R humerus	41	55.4
L radius	44	59.5
R radius	39	52.7
L ulna	46	62.2
R ulna	36	48.6
L carpals	119	20.1
R carpals	131	22.1
L metacarpals	155	41.9

R metacarpals	165	44.6
L hand phalanges	162	15.6
R hand phalanges	172	16.6
U hand phalanges	188	-
L pelvis	44	59.5
R pelvis	43	58.1
L femur	52	70.3
R femur	51	68.9
L patella	22	29.7
R patella	23	31.1
Skeletal element	Number represented	% of expected
L tibia	56	75.7
R tibia	53	71.6
L fibula	46	62.2
R fibula	45	60.8
L calcaneus	39	52.7
R calcaneus	40	54.1
L talus	38	51.4
R talus	39	52.7
L tarsals*	113	30.5
R tarsals*	106	28.6
L metatarsals	152	41.1
R metatarsals	127	34.3
L foot phalanges	53	5.1
R foot phalanges	52	5.0
U foot phalanges	95	-

L=left R=right U=unknown side *=excluding talus and calcaneus

Table 4: Representation of skeletal elements in juveniles

Skeletal element	Number represented
Skull	6
Mandible	5
Cervical vertebrae	19
Thoracic vertebrae	44
Lumbar vertebrae	16
Sacrum	5
Sternum	2
L ribs	37
R ribs	35
L clavicle	3
R clavicle	3
L scapula	5
R scapula	4
L humerus	9
R humerus	7

L radius	8	
R radius	7	
L ulna	8	
R ulna	7	
L carpals	0	
R carpals	3	
U carpals	0	
L metacarpals	11	
R metacarpals	7	
U metacarpals	13	
L hand phalanges	4	
R hand phalanges	2	
U hand phalanges	27	
L pelvis	8	
R pelvis	6	
L femur	10	
R femur	7	
L patella	0	
R patella	0	

Skeletal element	Number represented	% of expected
L tibia	10	
R tibia	6	
L fibula	7	
R fibula	8	
L calcaneus	6	
R calcaneus	6	
L talus	7	
R talus	6	
L tarsals*	16	
R tarsals*	19	
U tarsals*	1	
L metatarsals	16	
R metatarsals	21	
U metatarsals	12	
L foot phalanges	1	
R foot phalanges	2	
U foot phalanges	2	

L=left R=right U=unknown side *=excluding talus and calcaneus

The nature of a cemetery assemblage is affected by many variables, including damage or destruction of burials by later features, destruction of bones in the soil by physical, chemical and biological agents, and recovery factors during excavation. The first factor is certainly important at the School Street site - many of the skeletons have been partially destroyed by later features. Differential preservation of different bones may account for some of the patterning observed in the representation of skeletal elements, for instance the bones which are best represented tend to be the denser ones, particularly the longbones of the legs.

Bone preservation does not vary significantly (at the 5% level, using the Kolmogorov-Smirnov D statistic) with the age or sex of the individual.

Under-representation of smaller bones such as phalanges and carpals is probably partly due to preservation factors: smaller bones tend to be rather more poorly preserved (and hence missing or unidentifiable) due to their greater surface area:volume ratio. In addition, even for articulated skeletons where the positions of these bones may be anticipated, differential recovery may also play a part.

Few detailed studies have been done on patterns of human bone survival, but the general pattern observed in the present case is broadly similar to that found by Waldron (1987) for the Romano-British cemetery at West Tenter Street, London.

2. Demographic composition of the assemblage

(a) Determination of sex and age

Sex: this is determined primarily using the morphology of the pelvis and skull (Workshop of European Anthropologists 1980). Most aspects of skeletal sexual dimorphism can be considered as secondary sexual characteristics, and hence are only manifested after puberty,and, although there is evidence that some skeletal differences
are present from birth, there are considerable difficulties in applying this observation such that reliable determinations of sex can be made from the bones of juveniles. Thus no attempt is made to determine the sex of juveniles (for the present work defined as those aged under 18 years).

Age: dental development is used to estimate age in children, using the chart reproduced in Ubelaker (1978: Fig 62).

In the absence of dental evidence longbone length is used to give an approximate indication of age in children, with reference to the work of Stloukhal & Hanakova (1978).

For individuals over the age of 15 years dental development is of little help in age determination. For adolescents and young adults epiphysial fusion is the principle technique used to estimate age; use is made of the chart in Workshop of European Anthropologists (1980: Fig. 6).

The principal technique used to estimate age in adults isdental attrition, a technique which has been shown to be fairly reliable on a variety of populations living and dead.

Insufficient dental remains of juveniles are present to permit calibration of the rate of attrition as recommended by Miles (1963), hence age is estimated using the scheme of Brothwell (1981: Fig. 3.9).

The state of closure of the skull sutures is also taken into account, using the study of Perizonius (1984), as is the state of the pubic symphyses (McKern & Stewart 1957; Gilbert & McKern 1973).

Table 5: Composition of the assemblage by sex

Males	Females	Unsexable adults	Juveniles	Total
35	28	16	16	95

Table 6: Distribution of ages of juveniles

0<x<2	2<x<4	4<x<6	6<x<8	8<x<10	10<x<12	12<x<14	14<x<16	16<x<18
2	0	0	2	2	2	4	0	4

Table 7: Distribution of ages of adults

	18<x<25	25<x<35	35<x<45	45<x<55	55+	Adult
Males	5	8	3	7	4	8
Females	6	5	8	1	0	8
Total	12	16	12	8	4	27

Table 8: Mean age at death of adults

Males	Females	All adults
39.2	32.5	35.7

The difference in the numbers of males and females in the sample is not significant.

In the absence of modern medical care rates of infant mortality are generally high - up to about 50% of individuals die in childhood, the great majority of these in the first few years of life (Hassan 1981: 138). In this light the proportion of juveniles in the School Street sample (17%) seems rather low, and indeed it is rather lower than at many Anglo-Saxon cemeteries (e.g. Thetford Red Castle and Norwich Castle), although it is similar to that at North Elmham Park (figures in Wells 1982) and Burgh Castle (Anderson & Birkett 1989). Table 5 shows that only 2% of burials are aged under 5 years at death. This lack of very young children is almost certainly due to their disposal elsewhere, although the effects of differential destruction and, as the cemetery has not been completely excavated, the possibility that greater concentrations of infant burials exist in unexcavated parts, should not be overlooked.

The mean ages at death for adults are fairly similar to those calculated from other Anglo-Saxon cemeteries in East Anglia: North Elmham Park (37.0), Thetford Red Castle (33.9 - Wells 1967, 1980), Norwich Castle (31.7 - Stirland 1985) and Burgh Castle (39-40 - computed from Anderson & Birkett 1989). Brothwell (1972), from pooled Anglo-Saxon cemetery data, gives figures of 33.7 years for males and 31.3 years for females.

The lower mean age at death for females is general for archaeological data and the interpretation of this is problematic. At Ipswich there was no evidence, in the form of distribution of skeletal pathologies, to suggest that poorer diet or general living conditions amongst females might be responsible for this. Hazards associated with childbirth are frequently cited as an explanation for lower mean age at death of females in archaeological assemblages (although this has been criticised - Wells 1975); it is possible that this might be the explanation at Ipswich.

3. Metric variation

(a) Stature

Adult stature is estimated from longbone measurements using the formulae of Trotter & Gleser (1952, 1958, reproduced in Brothwell 1981: Table 5).

Table 9: Distribution of adult statures (figures in cm)

	148<x<152	152<x<156	156<x<160	160<x<164	164<x<168	168<x<172
Males	0	0	0	1	5	5
Females	1	5	9	4	1	2

	172<x<176	176<x<180	180<x<184	184<x<188
Males	9	5	0	1
Females	1	0	0	0

Table 10: Adult stature: means and ranges

	N	Mean	Range
Males	26	171.5cm (5'7")	163-186cm (5'4"-6'1")
Females	23	159.1cm (5'3")	149-172cm (4'11"-5'8")

The stature figures for the School Street site are similar to those found at other East Anglian Anglo-Saxon sites, for example North Elmham Park (males 172.1cm, females 157.5cm) and Norwich Castle (males 170.2cm, females 160.1cm), although the Ipswich people are rather shorter than those from Burgh Castle (males 176cm, females 163cm). From a study of skeletal remains Manchester (1983) reports a mean height of 173.2cm for males in the Anglo-Saxon period. The School Street statures are also similar to modern figures: 173.8cm for males, 160.9cm for females (Adult Heights and Weights Survey 1981, cited in White 1988).

(b) Cranial measurements

The condition of the crania prohibited extended analysis of this class of metric data, however a few measurements (selected from Howells 1973) could be taken. Of these for only three were there sufficient data for the calculation of summary statistics to be worthwhile.

Table 11: Craniometric data (figures in mm)

Males	Measurement	N	Mean	Standard deviation
	Left mastoid height	8	29.2	2.67
	Right mastoid height	10	29.1	2.31
	Bregma-lambda chord	5	114.9	5.22
Females				
	Left mastoid height	8	25.8	3.43
	Right mastoid height	6	26.9	3.30
	Bregma-lambda chord	7	111.8	8.39

(c) Post-cranial measurements

(i) Meric and cnemic indices. The meric index is a measure of the anterior-posterior flattening of the subtrochanteric part of the femoral diaphysis; the cnemic index expresses the transverse flattening of the tibia at the level of the nutrient foramen. The significance of these indices is uncertain: most authors suggest that they vary with the amount of bone material available for bone formation, which in turn is a result of dietary factors, or that they represent remodelling of the bone in response to the action of mechanical stresses. For the cnemic index at least this last seems the more convincing explanation (Lovejoy et al. 1976). The indices are taken according to the definitions of Brothwell (1981: 88, 89).

Table 12: Distribution of meric indices

	Hyperplatymeric (x<75)	Platymeric (75<x<85)	Eurymeric (x>85)
Males			
Left	6	13	0
Right	6	8	0
Females			
Left	8	7	1
Right	5	4	4

Table 13: Meric indices, means and ranges

Males	N	Mean	Range
Left	19	77.1	70.0-83.8
Right	14	76.9	73.1-82.8
Females			
Left	16	76.0	65.2-85.1
Right	13	77.3	64.1-88.6

Table 14: Distribution of cnemic indices

	Hyperplatycnemic (x<55)	Platycnemic (55<x<63)	Mesocnemic (63<x<70)	Eurycnemic (x>70)
Males				
Left	1	5	7	7
Right	0	4	6	8
Females				
Left	0	1	5	8
Right	0	1	5	10

Table 15: Cnemic indices, means and ranges

Males	N	Mean	Range

Left	20	66.7	54.0-83.0
Right	18	68.6	58.4-83.9
Females			
Left	14	70.6	61.9-78.9
Right	16	72.7	60.9-79.9

(ii) Others. Vertical diameter of the femoral head and femoral bicondylar width are also measured. These measurements are of some significance in sex determination. Definitions are taken from Stewart (1968: Fig 52).

Table 16: Vertical diameter of femoral heads (figures in mm)

Males	N	Mean	Standard deviation	Range
Left	14	48.0	2.65	43.4-52.3
Right	13	47.8	3.14	43.5-54.2
Females				
Left	15	41.4	2.23	37.1-46.1
Right	9	41.2	1.71	39.5-44.5

Table 17: Femoral bicondylar widths (figures in mm)

Males	N	Mean	Standard deviation	Range
Left	13	80.4	4.08	70.9-88.5
Right	12	81.7	5.32	70.0-89.7
Females				
Left	6	71.9	2.62	68.9-74.3
Right	6	72.2	3.42	66.9-75.4

4. Non-metric variation

Non-metric traits take the form of minor variations in skeletal form such as presence or absence of bony spurs or foramina. For at least some of these variants there is evidence that they are to some extent inherited, although the causation of many remains obscure. 33 cranial and 20 postcranial traits are scored. The cranial traits are mainly from those defined by Berry & Berry (1967). Those not studied by Berry & Berry are selected from deVilliers (1968) and Ossenburg (1977). Where the scoring rules of Berry & Berry (1967) conflict with those of Sjo/vold (1984) the latter were used. The presence of the supra-orbital foramen was scored according to the definition of Dodo (1974). The post-cranial traits are mainly from those defined by Finnegan (1978).

In children the presence of many traits is age correlated, hence most workers omit these individuals from population studies, a strategy pursued in the present work. Traits are scored on a presence/absence basis; those traits with the scope for bilateral expression are scored separately for left and right sides.

Table 18: Frequency of cranial non-metric traits

Trait	1	0	1/1	-/1	1/-	1/0	0/1	-/0	0/-	0/0
Metopic suture	4	26								
Ossicle at lambda	6	19								
Lambdoid ossicle	13	7								
Inca bone	0	26								
Sagittal ossicle	1	18								
Ossicle at bregma	0	22								
Coronal ossicle	6	8								
Fronto-temporal articulation			0	0	0	0	0	3	2	5
Squamo-parietal ossicle			0	0	0	0	0	5	3	9
Epipteric bone			0	0	0	0	0	4	2	4
Parietal notch bone			1	0	1	1	0	5	3	15
Auditory torus			0	0	0	0	1	4	9	20
Foramen of Hushke			0	0	0	0	0	5	7	20
Ossicle at asterion			0	0	0	0	1	3	3	17
Clinoid bridging			1	0	0	0	0	0	1	0
Palatine torus	5	13								
Maxillary torus	0	11								
Mastoid foramen extra-sutural			5	1	2	5	6	3	4	8
Mastoid foramen absent			1	1	1	1	3	3	6	17

Trait	1	0	1/1	-/1	1/-	1/0	0/1	-/0	0/-	0/0
Double condylar facet on occipital			0	0	0	0	0	8	5	9
Parietal foramen			7	1	1	3	5	1	3	9
Accessory infra-orbital foramen			0	0	2	0	1	5	2	2
Zygomatic-facial foramen			9	8	7	0	2	0	2	1
Divided hypoglossal canal			1	4	2	0	3	2	6	6
Posterior condylar canal patent			1	4	5	1	1	1	1	3
Precondylar tubercle			0	0	0	1	0	3	3	9
Foramen ovale incomplete			0	2	2	1	0	4	4	4
Accessory lesser palatine foramen			1	1	6	1	0	0	1	2
Supra-orbital foramen complete			3	0	2	5	3	5	3	7
Maxillary M3 agenesis			1	1	0	0	0	2	3	15

Mandibular M3 agenesis			4	0	0	1	0	2	1	22
Mandibular torus	0	28								
Mylohyoid bridging			5	1	0	0	1	2	3	19

1=trait present 0=trait absent -=no observation possible. Scores for bilateral traits are presented as score for left side/score for right side.

Table 19: Frequency of postcranial non-metric traits

Trait	1	0	1/1	-/1	1/-	1/0	0/1	-/0	0/-	0/0
Fossa of Allen			8	1	1	7	2	1	4	9
Plaque formation			6	0	3	0	2	3	3	17
Exostosis in trochanteric fossa			6	1	1	2	2	2	6	10
Supra-condyloid process			1	0	0	0	0	7	12	27
Septal aperture			2	1	6	0	2	6	10	17
Acetabular crease			1	0	0	3	1	5	8	19
Accessory sacral facets on ilium			0	0	1	0	0	7	8	9
Spina bifida occulta	1	17								
Sixth sacral segment	2	16								
Acromial articular facet			1	1	0	1	0	7	8	8
Os acromiale			0	0	1	0	1	8	7	9
Supra-scapular foramen			0	1	1	0	0	5	10	6
Vastus notch			3	5	5	1	1	2	6	6
Vastus fossa			0	1	0	0	0	6	10	11
Emarginate patella			0	0	0	0	0	8	10	10
Anterior calcaneal facet double			9	4	2	0	0	5	3	18
Anterior calcaneal facet absent			1	0	0	1	0	8	6	25
Atlas facet double			1	0	0	2	1	4	4	12
Posterior atlas bridging			0	1	0	0	0	4	5	14
Lateral atlas bridging			0	0	0	0	0	5	4	14

1=trait present 0=trait absent -=no observation possible. Scores for bilateral traits are presented as score for left side/score for right side.

Of these traits the chi-square test shows that only one (anterior calcaneal facet double) has a significantly different frequency (at the 5% level) for males and females (more frequent in males). One statistically significant result among 53 traits might be expected by chance alone.

The occurrence of those of the non-metric variants for which a literature search (Mays 1987) revealed evidence of an inherited component in their causation, was plotted on the site plan in an attempt to discern whether there was any spatial patterning which could be construed as evidence for genetically related individuals being buried together in "family plots". This exercise revealed that, of the 21 traits identified as sufficiently heritable to render them useful in discerning small scale ("family") genetic relationships, there was an apparent concentration of 3 fairly uncommon traits (metopic suture, coronal ossicle and palatine torus) among burials in an area immediately around, and to the south of, grid peg F5. It seemed possible that this clustering could be fortuitous since this area of the site contained the most dense concentration of burials. In order to try and investigate whether this cluster was statistically significant it was decided to compare the frequencies of these 3 traits in the "F5 area" with their frequencies the rest of the cemetery.

The "F5 area" was defined as that area lying around grid peg F5, bounded to the north by the edge of the site and on the other 3 sides by baulks (Fig. 1). Bones from 26 adult burials from this area were received.

Palatine torus occurs in only 5 burials in the cemetery; all are located in the "F5 area". Fishers exact test showed that this segregation was significant (p=0.015). Coronal ossicle occurs in 6 individuals in the cemetery; all are located in the "F5 area". This distribution is statistically significant (Fisher's test: p=0.002). Like the above, all individuals showing retained metopic suture were located in the "F5 area", however this segregation did not reach significance at the 5% level according to Fisher's test (p=0.087).

It may thus be that, for some individuals at least, genetic relationships with pre-existing interments were a factor in determining their location in the cemetery. This result can only be considered tentative because the characteristics of the excavated area prevented the application of more sophisticated techniques of spatial analysis, and the boundaries of the "F5 area" were determined by aspects of the shape of the excavated area.

The extent to which this possible spatial patterning of "family groups" applies to the cemetery as a whole is uncertain because not all the cemetery was excavated and even within the excavated area many Saxon graves had been destroyed by later features, leaving a rather patchy distribution of burials.

Several individuals show other features which might be considered aspects of non-metric variation. Burial 1249 (female aged about 25) shows congenital fusion of the axis and third cervical vertebra. That this fusion resulted in increased stress on neighbouring joints is suggested by the finding of osteoarthritic changes on the inferior facet joints of C3 and the superior facet joints of C4, the only vertebrae to show evidence for osteoarthritis in this individual.

Burial 2073 (female aged about 35-45) shows spondylolysis of the 4th lumbar vertebra. Spondylolysis is the condition where the posterior part of the neural arch is cleft from the rest of the vertebra at the pars interarticularis; thus in skeletal material the posterior part of the neural arch appears as a separated fragment, although in life it is bound to the rest of the vertebra by fibrous tissue. There is strong evidence that spondylolysis is inherited (e.g. Wiltse 1962). The fibrous union between the two parts of the vertebra may be ruptured by trauma, leading to forward slippage of the vertebral body (spondylolisthesis). In 2073 there are large osteophytes on the margins of the body of the fourth lumbar vertebra and on the superior margin of the body of the fifth lumbar vertebra which also shows some sub-periosteal new bone on its anterior surface. These changes are suggestive of spondylolisthesis. In addition there is severe osteoarthritis with eburnation of the right diarthrodial articulation between the third and fourth lumbar vertebrae, this is probably a result of the increased stress imposed upon the joint by the forward slippage of the body of the fourth lumbar vertebra.

Burial 1253 (female aged 21-25) shows agenesis of all four second premolars in association with reduced maxillary third molars and crowding of the anterior dentition of the mandible with 90 degree rotation of the mandibular canines. Burial 2179 (female aged 21-24) shows agenesis of both mandibular second premolars and the left deciduous mandibular second molar has been retained into adulthood. Burial 2174 (juvenile aged 16-17) shows reduced maxillary third molars. Burial 1249 (female aged about 25) shows reduced maxillary third molars and the mandibular canines have bifid roots. The left maxillary canine of burial 0937 (female aged about 21) has bifid roots, as does the right mandibular canine of 2073 (female aged about 35-45).

Inheritance seems to be the most important cause of congenital absence of one or more teeth (hypodontia) and of reduction in tooth size (Grahnen 1956). Studies of modern populations show that the permanent teeth most frequently missing congenitally (other than third molars) are maxillary lateral incisors and mandibular second premolars (Graber 1978). As jaws were not X-rayed routinely the two cases mentioned above are likely to represent an under-estimate of the true frequency of root anomalies in the School Street assemblage. The presence of bifid roots on teeth which normally bear but a single root is not uncommon, particularly in the mandibular canines and premolars (Shafer et al. 1983:45).

5. Pathologies

(a) Oral

(i) Dental caries. Dental caries is scored on a presence-absence basis for each tooth and as present or absent in individuals with one or more teeth available for study. Of the 16 juveniles, 6 had one or more erupted teeth available for study. These 6 individuals had a total of 68 permanent and 8 deciduous teeth. Of these, 2 individuals show dental caries in one tooth each (one left mandibular permanent first molar and one right mandibular permanent second molar).

The dental pathology data for adults is shown in Tables 20-24.

Table 20: Prevalence of dental caries in adults

	Present	Absent
Males	13	8
Females	9	12
Total adults	26	21

Table 21: Prevalence of caries in the adult permanent dentition

	Carious teeth	Total teeth
Males	43	285
Females	22	341
All adults	68	680

Table 22: Distribution of carious permanent teeth in adult males

	MAXILLA															
	LEFT								RIGHT							
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3	Unid. teeth

Teeth	5	6	4	9	10	9	8	7	4	8	9	8	8	7	5	4	3
Carious	2	2	2	3	3	0	0	0	0	1	1	2	1	1	3	1	1
Teeth	11	12	9	15	15	13	10	8	6	10	14	10	11	7	9	9	2
Carious	0	3	3	2	0	0	0	1	0	2	1	0	1	3	2	1	1

MANDIBLE

Table 23: Distribution of carious permanent teeth in adult females

MAXILLA

	LEFT								RIGHT								
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3	Unid. teeth
Teeth	11	11	12	9	10	12	9	6	8	11	12	10	11	10	9	9	1
Carious	0	0	2	0	0	0	0	0	1	0	0	1	3	1	0	2	0
Teeth	10	14	10	12	13	11	11	10	7	10	10	14	13	11	13	11	0
Carious	1	3	0	0	1	0	0	0	0	0	0	0	2	3	1	1	-

MANDIBLE

One female retained her left deciduous mandibular second molar into adulthood; this tooth is carious.

Table 24: Distribution of carious permanent teeth for all adults

MAXILLA

	LEFT								RIGHT								
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3	Unid. teeth
Teeth	18	20	17	20	22	22	19	15	12	19	22	18	19	17	14	13	4
Carious	2	3	4	3	3	0	0	0	1	1	1	3	4	2	3	3	1
Teeth	22	28	22	29	31	27	24	20	15	23	27	27	26	20	25	21	2
Carious	1	7	4	2	1	0	0	1	0	2	1	0	3	6	3	2	1

MANDIBLE

Dental caries is a multifactorial disease, but many studies on non-industrial peoples (e.g. Turner 1979 & refs therein) have shown a strong correlation between caries rates and the quantity of carbohydrate in the diet.

When making comparisons between samples the mean ages at death should be taken into account; it is a general finding that older individuals have higher caries rates since their teeth have been longer exposed to the agents of decay (e.g. Moore & Corbett 1983).

The overall caries rate with respect to total teeth (10.0%)

is slightly higher than that for the North Elmham Park adults(6.4%) who have a similar mean age at death to those from the School Street site (Wells 1980) and for Norwich Castle (2.6% - Stirland 1985), although adults from this last site have a slightly lower estimated mean age at death than the Ipswich assemblage.

Males have a slightly higher prevalence of caries than females, both when measured with respect to total teeth and with respect to individuals. Comparisons between rates with respect to total teeth are not amenable to statistical analysis since teeth in a particular mouth do not represent independent observations. The difference between the sexes in terms of presence-absence in individuals is not statistically significant; in any case a slightly higher prevalence might be expected in males due to their somewhat greater mean age at death.

The pattern by which molars are the most, and anterior teeth the least, affected by caries is paralleled by modern (Shafer et al. 1983: 436) and archaeological (Moore & Corbett 1983) studies.

(ii) Ante-mortem tooth loss. Ante-mortem tooth loss is scored on a presence-absence basis for each erupted tooth position and as present or absent in individuals with one or more tooth positions available for study. No juvenile showed evidence for ante-mortem tooth loss. The prevalence and distribution of ante-mortem tooth loss in adults is shown in Tables 25-29.

Table 25: Prevalence of ante-mortem tooth loss in adults

	Present	Absent
Males	14	6
Females	7	11
Total adults	22	20

Table 26: Prevalence of ante-mortem tooth loss in the adult dentition

	No of tooth positions showing ante-mortem tooth loss	Total tooth positions
Males	67	439
Females	29	434
Total adults	97	922

Table 27: Distribution of ante-mortem tooth loss in adult males

MAXILLA

LEFT RIGHT

	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	7	7	10	12	11	12	11	10	12	13	13	13	13	12	10	7
A-m loss	1	2	4	1	1	1	1	1	1	1	1	2	3	5	4	2
Tooth posits.	18	19	19	18	18	16	17	17	17	17	16	16	15	15	15	13
A-m loss	5	4	6	3	0	0	0	1	2	0	0	1	2	6	4	2

MANDIBLE

Table 28: Distribution of ante-mortem tooth loss in adult females

MAXILLA

LEFT RIGHT

	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	10	11	12	11	12	13	13	13	13	13	13	12	11	11	11	10
A-m loss	0	0	0	0	0	1	0	0	0	0	0	0	1	2	3	1
Tooth posits.	12	16	16	15	16	16	14	20	14	15	16	16	14	16	16	14
A-m loss	1	3	7	1	0	0	0	0	0	0	0	0	1	5	2	1

MANDIBLE

Table 29: Distribution of ante-mortem tooth loss for all adults

MAXILLA

LEFT RIGHT

	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	18	19	23	24	24	26	24	23	25	26	26	25	24	23	21	17
A-m loss	1	2	4	1	1	2	1	1	1	1	1	2	4	7	7	3
Tooth posits.	31	37	37	36	37	35	34	39	34	35	35	35	32	34	34	29
A-m loss	6	7	13	4	0	0	0	1	2	0	0	1	3	12	6	3

MANDIBLE

Dental caries and diseases of the periodontal tissues are major causes of ante-mortem tooth loss.

As for dental caries mean age at death should be taken into account when making comparisons between samples, as older individuals generally show greater prevalence of tooth loss.

The prevalence of ante-mortem tooth loss with respect to total number of tooth positions (10.5%) is similar to that observed at other cemetery sites in East Anglia: it was 11.1% at North Elmham Park and 15.9% at Thetford Red Castle (Wells 1982).

Analogous to the situation with dental caries, prevalences of tooth loss with respect to total tooth positions are not amenable to statistical analysis since tooth positions in a particular mouth are not independent observations, however males show more than twice the prevalence of females of tooth loss quantified in this way (15.3% versus 6.7%). When the condition is scored as present or absent in individuals, however, male and female prevalences are not significantly different, but the males do have the higher frequency. The greater mean age at death of males may to some extent account for the higher figures for males.

The pattern by which molars are the most frequently lost teeth is paralleled by other studies (Tal & Tau 1984; Wells 1982).

(iii) Alveolar abscess cavities. These are scored in terms of number of affected tooth positions, in an analogous way to ante-mortem tooth loss. No juvenile shows any evidence for alveolar abscesses. The data for adults is shown in Tables 30-34.

Table 30: Prevalence of alveolar abscesses in adults

	Present	Absent
Males	8	12
Females	4	14
Total adults	13	29

Table 31: Prevalence of alveolar abscesses in the adult dentition

	Number of tooth positions showing alveolar abscesses	Total tooth positions
Males	20	439
Females	9	434
Total adults	30	922

Table 32: Distribution of alveolar abscesses in adult males

MAXILLA

	LEFT												RIGHT			
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	7	7	10	12	11	12	11	10	12	13	13	13	13	12	10	7
Alv. abscesses	0	1	1	1	0	0	0	0	1	1	0	0	1	2	2	1
Tooth posits.	18	19	19	18	18	16	17	17	17	17	16	16	15	15	15	13
Alv. abscesses	1	1	3	1	0	0	0	0	1	0	0	0	0	2	0	0

MANDIBLE

Table 33: Distribution of alveolar abscesses in adult females

MAXILLA

	LEFT												RIGHT			
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	10	11	12	11	12	13	13	13	13	13	13	12	11	11	11	10
Alv. abscesses	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
Tooth posits.	12	16	16	15	16	16	14	20	14	15	16	16	14	16	16	14
Alv. abscesses	0	1	1	1	0	0	0	1	1	0	0	0	0	0	1	1

MANDIBLE

Table 34: Distribution of alveolar abscesses for all adults

MAXILLA

	LEFT												RIGHT			
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	18	19	23	24	24	26	24	23	25	26	26	25	24	23	21	17
Alv. abscesses	0	1	1	1	0	0	0	0	1	1	0	1	2	2	2	1
Tooth posits.	31	37	37	36	37	35	34	39	34	35	35	35	32	34	34	39
Alv. abscesses	1	2	4	2	0	0	0	1	2	0	0	0	0	3	1	1

MANDIBLE

Alveolar abscesses are generally a consequence of infection of the pulp cavity of a tooth. This may occur as a result of exposure of the pulp chamber to the oral environment as might occur as a consequence of caries, trauma or excessive attrition of the teeth. Mechanical irritation of the periodontal tissues (e.g. by impacted food material) can lead to their becoming infected and hence to alveolar abscess formation (Shafer et al. 1983: 498). Of the 28 discrete abscess cavities (occupying 30 tooth positions - 2 cavities covered two tooth positions) 8 are at the apices of teeth whose crowns had been extensively destroyed by dental caries, indicating caries as the factor responsible for the abscesses. Two are located at the apices of teeth whose pulp cavities had been exposed through excessive attrition. The causes of the remainder are uncertain as they are situated at the apices of teeth which had been lost ante- or post-mortem.

Burial 2173 (male aged 40-60) displays two abscess cavities, situated in the right maxilla at the apices of the second premolar and first molar. The first molar had been lost ante-mortem and the abscess at this tooth position has pierced the right maxillary sinus (antrum of Highmore) and set up an infection therein, as evidenced by reactive new bone formation. There is also some reactive new bone formation in the medial part of the left frontal sinus of this fragmentary skull.

Burial 2171 (unsexable adult aged about 25-35) shows abscess cavities at the apices of the carious right maxillary premolars. The buccal surface of the right maxilla has a pitted appearance where pus from the abscesses has exited through the buccal plate, causing osteitis of the maxilla. A similar pitted, osteitic area is

found on the buccal surface of fragments of the left maxilla of burial 1073 (male aged 25-40); this lesion is probably a result of inflammation originating from the abscess cavity at the socket of the left maxillary second molar (the tooth was lost ante-mortem).

Burial 1249 (female aged about 25) shows some new bone formation, suggestive of inflammation, in a fragment of the right maxillary sinus. No dental abscesses are evident in this individual, although the right maxillary second molar had been lost in life.

(iv) Dental calculus. This takes the form of a concretion on the teeth consisting mainly of calcium salts and, in life, organic material in which flourish numerous bacteria. It may be considered as mineralised dental plaque and is associated with poor oral hygiene.

Dental calculus is scored on the scale of Dobney & Brothwell (1987); the results are shown in Table 34.

Table 35: Dental calculus

	Degree of development				
	0	I	II	III	IV
Males	8	4	3	1	0
Females	6	6	6	0	1
Total adults	17	11	9	1	1
Juveniles	2	2	0	0	0

No significant difference exists in the distribution of the degree of development of dental calculus between males and females, or between adults and children. Calculus deposits have a tendency to fall off the teeth, either during burial or during storage or cleaning; it is thus highly probable that the frequency and severity of calculus deposits are under-estimated.

(v) Dental enamel hypoplasias. These appear macroscopically as linear bands of depressed enamel or as areas of pitting on the enamel surface (Sarnat & Schour 1941). They are associated with a wide variety of stressors including infectious and nutritional diseases (Pindborg 1970: 138-210). The anterior dentition is most susceptible to hypoplasias (Goodman et al. 1980). Of 37 individuals (12 males, 16 females, 4 unsexable adults and 5 juveniles) with anterior dentition in a sufficiently unworn state for the condition to be scored, 12 showed one or more hypoplastic defects. The location of defects on a particular tooth was used to estimate the age at which the individual suffered the stress episode giving rise to the defect (using the methodology of Goodman et al. 1980). The results are shown in Table 36.

Table 36: Dental enamel hypoplasias

Individual	Type & no of defects	Approximate age when defect formed (years)
0459 (male aged about 20)	1 line	2.5
1073 (male aged 25-40)	2 lines	3.1
		3.6
1191 (male aged 25-40)	3 lines	3.6
		4.5
		5.4
1344 (male aged 25-35)	1 line	3.1
	1 pitted area	3.6-5.4
1345 (female adult)	1 line	2.8
2020 (juvenile aged about 12)	1 pitted area	2.4-3.2
	3 lines	3.8
		4.5
		5.2
2068 (male aged 40-60)	2 lines	2.6
		3.3
2073 (female aged 35-45)	2 lines	4.8

		5.8
2083 (juvenile aged about 9)	2 lines	4.8
		5.5
2127 (male aged 21-24)	1 line	4.0
2167 (female aged 25-35)	1 line	3.3
2207 (unsexable adult aged about 30-40)	1 line	neonatal

The difference in frequency of hypoplastic defects between the sexes (6/12 males against 3/16 females) is not significant, but a higher male value might be expected as the growing male is more sensitive to environmental stress (Goodman et al. 1980). The overall frequency of hypoplastic defects is significantly lower in the Ipswich skeletons than in those from the Norwich Castle site, where the frequency was 80% (Stirland 1985). Although inter-observer error is likely to be significant in the scoring of hypoplasias it seems unlikely that this alone could explain the difference between the 2 sites; it seems probable that the Norwich group suffered a greater prevalence of disease and nutritional stress in childhood than did the Ipswich group.

(vi) Other oral pathology.

Periodontal disease is an inflammation of the gums and other periodontal tissues associated with poor oral hygiene. The manifestations of the condition in skeletal material are porosis and profile changes of the interdental septa, and infra-bony pockets may form in severe cases (Costa 1982). Alveolar resorbtion generally accompanies these changes, but apparent alveolar resorbtion alone is an insufficient basis upon which to diagnose the disease: as they wear the teeth continue to erupt during adult life to maintain occlusion; this gives the misleading appearance of recession of the alveolar bone. Four individuals showed periodontal disease (Table 37).

Table 37: Periodontal disease

Individual	Alv res	Por ids	Prof ids	Ibp
1078 (unsexable adult aged about 25)	I	1	0	0
2132 (female aged 17-24)	I	1	0	0
2168 (male aged 25-35)	II	1	0	0
2207 (unsexable adult aged about 30-40)	I	0	1	1

<u>Key</u>: Alv res = alveolar resorbtion, scored as grade I, II or

III with reference to the scale of Brothwell (1981: Fig. 6.14).

Por ids = porosis of interdental septa, scored as present (1) or absent (0).

Prof ids = profile changes of interdental septa, scored as present (1) or absent (0).

Ibp = infra-bony pocket(s) present (1) or absent (0).

Burial 2172 (female aged 35-45) shows ante-mortem chipping of the right mandibular canine.

(b) Arthropathies

(i) Degenerative joint disease. This is generally divided into two categories: that affecting the vertebral bodies is termed osteophytosis and that affecting the other joints is termed osteoarthritis (Collins 1949). Both human and animal studies have shown that mechanical stress is an important factor in the aetiology of degenerative joint disease. The most usual cause seems to be repeated minor traumata, as might result from day to day activities (although it may follow acute traumatic injury to a joint); this leads to degeneration of the intervertebral disc or joint cartilage with subsequent macroscopic bony changes, including marginal lipping and joint surface irregularities. Degenerative joint disease is associated with general 'wear and tear' to the joints and as such its prevalence varies with individual age and with the amount of physical stress to the joints in life.

Degenerative joint disease is distinguished from other arthropathies using criteria described by Steinbock (1976), Ortner & Putschar (1985) and Rodgers et al. (1987).

Osteophytosis and osteoarthritis are scored as grade I, II or III with reference to the scheme of Sager (1969, reproduced in Brothwell 1981: Fig. 6.9). The results (adult discrete burials only) are quantified with respect to individuals for whom observations could be made and with respect to vertebrae or diarthroidal joint surfaces. Only those bones whose joint surfaces showed no other pathology (other than osteochondritis dissecans or Schmorl's nodes) are included. The results are shown in Tables 38-45.

Table 38: Osteophytosis: maximum severity by individuals

	Maximum severity			
	0	I	II	III
Males	7	12	5	1
Females	8	8	5	1
Total adults	17	20	12	2

Table 39: Osteophytosis: prevalence by vertebrae

	Cervical				Thoracic				Lumbar				Total			
	0	I	II	III	0	I	II	III	0	I	II	III	0	I	II	III
Males	60	5	3	2	102	41	9	0	47	24	8	1	209	70	20	3
Females	49	6	3	5	109	35	17	0	39	24	5	0	197	65	25	5
Total adults	113	12	8	7	220	84	26	0	90	48	13	1	423	144	47	8

Table 40: Spinal osteoarthritis: maximum severity by individuals

	Maximum severity			
	0	I	II	III
Males	15	8	2	5
Females	13	4	1	2
Total adults	33	13	3	7

Table 41: Spinal osteoarthritis: prevalence by vertebrae

	Cervical				Thoracic				Lumbar				Total			
	0	I	II	III	0	I	II	III	0	I	II	III	0	I	II	III
Males	73	4	6	2	147	26	13	3	78	18	0	0	298	48	19	5
Females	51	4	4	5	135	11	4	5	72	3	3	0	258	18	11	10
Total adults	127	9	10	7	290	39	17	8	138	21	3	0	555	69	30	15

Table 42: Osteoarthritis: males (excluding spine)

	Severity			
Skeletal element	0	I	II	III
L mandibular condyle	12	0	0	0
R mandibular condyle	13	0	0	0
L ribs	122	49	8	1
R ribs	114	34	8	1
L medial clavicle	12	1	0	0
L lateral clavicle	13	2	0	0
R medial clavicle	13	0	1	0
R lateral clavicle	10	1	0	0
L glenoid cavity	15	0	0	0
R glenoid cavity	14	0	0	1
L proximal humerus	15	0	0	0
R proximal humerus	13	0	0	1
L distal humerus	19	0	0	0
R distal humerus	19	0	0	0
L proximal radius	18	1	0	0
R proximal radius	15	0	0	0
L distal radius	16	0	0	0
R distal radius	14	2	0	0
L proximal ulna	14	5	0	0
R proximal ulna	14	1	0	0
L distal ulna	13	2	0	0
R distal ulna	11	2	0	1

L carpals	60	4	0	0
R carpals	64	2	0	1
L metacarpals	77	1	1	0
R metacarpals	81	0	0	0
L hand phalanges	82	4	0	0
R hand phalanges	87	2	0	0
U hand phalanges	86	1	0	1
L acetabulum	17	4	1	1
R acetabulum	13	6	0	1
L proximal femur	17	4	1	1
R proximal femur	16	3	0	1
L distal femur	21	1	1	0
R distal femur	17	2	0	1
L patella	11	3	0	0
R patella	8	3	0	1
L proximal tibia	23	0	0	0
R proximal tibia	18	0	0	0
L distal tibia	22	0	0	0
R distal tibia	21	0	0	0
L proximal fibula	10	0	0	0

	Severity			
Skeletal element	0	I	II	III
R proximal fibula	10	0	0	0
L distal fibula	15	0	0	0
R distal fibula	12	0	0	0
L calcaneus	17	1	0	0
R calcaneus	18	0	0	0
L talus	18	1	0	0
R talus	19	0	0	0
L tarsals*	55	0	0	0
R tarsals*	47	0	0	0
L metatarsals	78	0	0	0
R metatarsals	53	0	1	0
L foot phalanges	23	0	0	0
R foot phalanges	28	1	0	0
U foot phalanges	40	1	0	0

L=left R=right U=unknown side *=excluding talus and calcaneus

Table 43: Osteoarthritis: females (excluding spine)

	Severity			
Skeletal element	0	I	II	III
L mandibular condyle	12	0	0	0
R mandibular condyle	8	0	0	0
L ribs	115	19	4	1
R ribs	108	27	5	1

L medial clavicle	14	0	0	0
L lateral clavicle	15	0	0	0
R medial clavicle	13	0	0	0
R lateral clavicle	10	1	0	0
L glenoid cavity	16	2	0	0
R glenoid cavity	13	1	1	0
L proximal humerus	12	1	0	0
R proximal humerus	10	1	0	1
L distal humerus	20	0	0	0
R distal humerus	17	0	0	0
L proximal radius	16	0	0	0
R proximal radius	16	2	0	0
L distal radius	16	1	0	0
R distal radius	16	1	0	0
L proximal ulna	19	0	0	0
R proximal ulna	16	2	0	0
L distal ulna	17	0	0	0
R distal ulna	10	0	1	0
L carpals	55	0	0	0
R carpals	64	0	0	0
L metacarpals	75	0	0	1
R metacarpals	81	1	0	1
L hand phalanges	74	1	1	0
R hand phalanges	82	1	0	0
U hand phalanges	100	0	0	0
L acetabulum	18	1	0	0
R acetabulum	17	2	0	0
L proximal femur	18	0	0	0

	Severity			
Skeletal element	0	I	II	III
R proximal femur	14	1	0	0
L distal femur	18	0	0	0
R distal femur	16	1	0	0
L patella	7	0	0	0
R patella	10	0	0	0
L proximal tibia	14	0	0	0
R proximal tibia	15	0	0	0
L distal tibia	17	0	0	0
R distal tibia	19	0	0	0
L proximal fibula	6	0	0	0
R proximal fibula	6	0	0	0
L distal fibula	12	0	0	0
R distal fibula	14	0	0	0
L calcaneus	14	0	0	0
R calcaneus	16	0	0	0
L talus	13	1	0	0
R talus	16	1	0	0

L tarsals*	47	0	0	0
R tarsals*	42	0	0	0
L metatarsals	63	1	0	0
R metatarsals	57	1	1	0
L foot phalanges	22	0	0	0
R foot phalanges	14	0	0	0
U foot phalanges	35	0	0	0

L=left R=right U=unknown side *=excluding talus and calcaneus

Table 44: Osteoarthritis: all adults (excluding spine)

	Severity			
Skeletal element	0	I	II	III
L mandibular condyle	23	0	0	0
R mandibular condyle	22	0	0	0
L ribs	239	69	12	2
R ribs	231	63	14	2
L medial clavicle	27	1	0	0
L lateral clavicle	28	2	0	0
R medial clavicle	26	0	1	0
R lateral clavicle	21	2	0	0
L glenoid cavity	34	2	0	0
R glenoid cavity	28	1	1	1
L proximal humerus	28	1	0	0
R proximal humerus	23	1	0	2
L distal humerus	39	0	0	0
R distal humerus	36	0	0	0
L proximal radius	34	1	0	0
R proximal radius	31	2	0	0
L distal radius	33	1	0	0
R distal radius	30	3	0	0
L proximal ulna	33	5	0	0
R proximal ulna	30	3	0	0
L distal ulna	30	2	0	0
R distal ulna	21	2	1	1

	Severity			
Skeletal element	0	I	II	III
L carpals	115	4	0	0
R carpals	128	2	0	1
L metacarpals	152	1	1	1
R metacarpals	162	1	0	2
L hand phalanges	156	5	1	0
R hand phalanges	169	3	0	0
U hand phalanges	186	1	0	1

L acetabulum	35	5	1	1
R acetabulum	30	8	0	1
L proximal femur	35	4	1	1
R proximal femur	30	4	0	1
L distal femur	40	2	1	0
R distal femur	34	4	0	1
L patella	18	4	0	0
R patella	18	3	0	1
L proximal tibia	37	1	0	0
R proximal tibia	35	0	0	0
L distal tibia	41	0	0	0
R distal tibia	44	0	0	0
L proximal fibula	16	1	0	0
R proximal fibula	16	0	0	0
L distal fibula	28	0	0	0
R distal fibula	27	0	0	0
L calcaneus	33	1	0	0
R calcaneus	36	0	0	0
L talus	32	3	0	0
R talus	37	2	0	0
L tarsals*	107	0	0	0
R tarsals*	99	0	0	0
L metatarsals	145	2	0	0
R metatarsals	116	1	2	0
L foot phalanges	46	1	0	0
R foot phalanges	44	1	0	0
U foot phalanges	84	2	0	0

L=left R=right U=unknown side *=excluding talus and calcaneus

Table 45: Osteoarthritis: maximum severity by individuals

	Maximum severity			
	0	I	II	III
Males	12	8	6	6
Females	9	10	4	3
All adults	28	23	11	10

Chi-square tests show that there is no significant difference (at the 5% level) in the prevalence of osteophytosis, spinal osteoarthritis or osteoarthritis in the whole body between males and females.

(ii) Erosive arthropathies. These are a group of joint diseases in which, in lesions of the joints, bone resorbtion predominates over bone proliferation. These arthropathies include rheumatoid arthritis, gout, ankylosing spondylitis, Reiter's disease, colitic arthropathy and psoriatic arthropathy (Rodgers et al. 1987; Edwards 1989). These last three conditions are examples of reactive arthropathies: they seem to be initiated by soft tissue infections, frequently gastro-intestinal, venereal or skin diseases.

Burial 2163 (unsexable adult, <20% complete - lower leg bones only present). There is extensive destruction of the joint surfaces forming the articulation between the left talus and calcaneus. The eroded areas have a porotic and irregular appearance and there is some bony proliferation at the margins of the eroded joint surfaces. Similar changes were present on both joint surfaces making up the right first metatarso-phalangeal articulation (Plate 1). X-ray revealed a lytic area beneath the distal joint surface of the right proximal hallucial phalanx. The distal joint surfaces of the left tibia and fibula show erosive changes, with slight proliferation of new bone at their margins. The distal ends of the right lower leg bones show similar (if less marked) changes. X-ray shows that the erosions in the distal left tibia communicate with 2 large sub-chondral holes. The erosions lack sclerotic margins. The lower leg bones show periosteal reactions (Plate 2); these were mainly confined to the lower portions of the bones and were more marked on the left than on the right leg. There was also periostitis of the left talus and calcaneus.

These changes are suggestive of a reactive arthropathy; the absence of the rest of the skeleton precludes a more precise diagnosis.

(iii) Osteochondritic lesions. Osteochondritis dissecans is an avascular, aseptic necrosis occurring in the sub-chondral bone of a joint. As the disease progresses the necrotic fragment cleaves away leaving a pit in the joint surface (Wells 1974). This pit is the characteristic lesion of the disease in dry specimens, however a few cases exhibit healing which manifests itself in skeletal remains as a localised overgrowth of bone, filling the defect and often rising proud of the original joint surface (Manchester 1983: 69-70). All the lesions in the present material take the form of pitting of the joint surface. The precise aetiology of osteochondritis dissecans is obscure, although trauma certainly seems to play a role (Jacobs 1976).

Table 46: Osteochondritis dissecans

Individual	Location of lesions
0937 (female aged about 21)	Distal joint surfaces of left tibia
1166 (female adult)	Proximal joint surface of left hallucial proximal phalanx
1249 (female aged about 25)	Distal joint surface of the right tibia
2115 (female aged about 30-40)	Right femoral head
2167 (female aged 25-35)	Lateral condyle of the left femur

In addition to those on the tibiae, burial 0937 also displays lesions on the lumbar vertebrae. These consist of erosions of the anterior margins of the vertebral bodies and are located on the superior surface of L5, both superior and inferior surfaces of L4 and the superior surfaces of L3 and L2. There is marked sclerosis at the eroded areas. The other vertebrae present (L1 plus 3 thoracic and 3 cervical) are normal. It is probable that these lesions are a result of Scheuermann's disease, an aseptic necrosis of the vertebral epiphyses (Jacobs 1976).

(c) Trauma

(i) Fractures. A total of 11 healed fractures were found in 7 individuals (Tables 47 & 48).

Table 47: Location of fractures

Individual	Location of fracture
0933 (male aged 45-60)	Right tibia - distal third

Right fibula - proximal fifth
Left clavicle - midshaft
1073 (male aged about 25-40) Tenth left rib - 6-7cm from
head
Eleventh left rib - 5cm from
head
Compression fracture of body
of tenth thoracic vertebra
1345 (female adult) Right rib - 3-4cm from facet
for transverse process
2068 (male aged 40-60) Left humerus - at deltoid
tuberosity
2073 (female aged 35-45) Left ulna, distal third
2167 (female aged 25-35) Left second metacarpal -
proximal third
2171 (female aged 25-35) Left rib, one third to half
way from head

Table 48: Frequency of fractures by skeletal elements (skeletal elements quantified as in section 1(c))

Skeletal	Males		Females		Total adults	
Element	Fractures	Total	Fractures	Total	Fractures	Total
Thoracic vertebrae	1	226	0	168	1	432
L ribs	2	180	1	136	3	322
R ribs	0	157	1	139	1	316
L claviculae	1	18	0	20	1	40
L humeri	1	23	0	21	1	47
L metacarpals	0	79	1	76	1	155
R tibiae	1	25	0	20	1	53
R fibulae	1	22	0	20	1	45
L ulnae	0	24	1	22	1	46
TOTAL IDENTIFIABLE BONES	7	2226	4	2020	11	4401

Fractures healing many years prior to death may be invisible on the bones, even to X-ray; hence the frequencies found probably represent slight underestimates of the true frequency of fractures.

The compression fracture to the tenth thoracic vertebra of 1073 has resulted in slight anterior wedging of the vertebral body, and ankylosis has taken place between the tenth and eleventh thoracic vertebrae.

In individual 0933 the lateral part of the shaft of the right tibia proximal to the fracture line has a pitted and striated appearance indicative of a periosteal reaction to infection. Infection is a particular danger in the case of fractures to the tibia since it lies close to the surface and fractures to it tend to leave a sharp pointed end which is readily pushed through the skin. The right fibula of 0933 shows no sign of periostitis. All 3 fractures in this individual are at a similarly early stage of repair (the fracture lines are still clearly visible), suggesting that all were the result of the same incident.

Other than the above no fractures show any sign of infection and all are strongly healed with minimal deformity. This does not, however, imply any treatment in the form of splinting etc - Schultz (1967) has shown that many fractures in wild-living apes heal strongly with little deformity.

All the fractures here, save one, are more likely to be a result of accident rather than intentional injuries. The exception is the ulna fracture sustained by 2073. Fractures of the shaft of the ulna frequently occur when an attempt is made to protect the head or face from a blow by raising the forearm; the junction between the middle and distal third of the shaft (the site of the fracture in 2073) is a particularly common site for such fractures (Benjamin 1982). Blows from swords and other sharp weapons leave characteristic marks on bones - no evidence for any such injuries (healed or unhealed) was found in the School Street material.

(ii) Schmorl's nodes. An intervertebral disc consists of a tough outer layer (the annulus fibrosus) surrounding a core (the nucleus pulposus) which, until early adulthood, is composed of semi-gelatinous material. In younger individuals excessive compression of the spine (such as might occur due to heavy lifting) may result in extrusion of material from the nucleus pulposus into the adjacent vertebral body. The bony manifestation of this is a depression or cleft - the Schmorl's node. In some individuals congenital weaknesses in the cartilage plate of the vertebral body may increase the likelihood of the formation of Schmorl's nodes, but there is no doubt that a single trauma may rupture a healthy disc (Schmorl & Junghanns 1971: 158-168).

Table 49: Distribution of Schmorl's nodes

Individual	No of affected vertebrae	No of nodes
0496 (male aged about 40-60)	1 lumbar	2
0933 (male aged 45-60)	2 thoracic	2
1089 (unsexable adult)	2 thoracic	2
1191 (male aged about 25-40)	3 thoracic	3
1249 (female aged about 25)	1 thoracic	1
1344 (male aged 25-35)	1 thoracic	1
1352 (male aged 23-28)	1 thoracic, 1 lumbar	3
1710 (male aged about 30-40)	3 lumbar	3
2112 (male aged 55+)	3 thoracic	3
2126 (female aged 35-45)	2 lumbar	4
2172 (female aged 35-45)	1 thoracic	2

Frequency with respect to individuals and with respect to vertebrae can be obtained using the totals from the osteophytosis scores (Tables 38 & 39).

(d) Cribra orbitalia

Cribra orbitalia takes the form of small pits or perforations in the orbital roofs. Thirty-four individuals (15 males, 13 females, 1 unsexable adult and 5 juveniles) could be scored for cribra orbitalia. Eight showed evidence of the condition. The lesions (classified according to the scheme of Brothwell 1981: Fig. 6.17) are described in Table 50.

Table 50: Cribra orbitalia

Individual	Lesion
0942 (male aged 50+)	Cribriotic
0965 (juvenile aged about 8)	Cribriotic
1253 (female aged 21-25)	Trabecular
2083 (juvenile aged about 9)	Cribriotic
2127 (female aged 21-24)	Porotic
2138 (juvenile aged about 10)	Porotic
2179 (female aged 21-24)	Porotic
2208 (male aged 25-35)	Very slight porotic

Cribra orbitalia seems to be associated with iron deficiency anaemia (Hengen 1971; Stuart-Macadam 1987). In addition to deficient dietary intake of iron, anaemias may be caused by gut parasites - these were no doubt common in the unhygienic conditions prevailing in antiquity.

It seems a general finding that cribra orbitalia is more frequent in juveniles; this is probably related to the extra demands for iron to meet the needs of the growing skeleton. However the difference in prevalence between adults and juveniles did not reach significance (at the 5% level).

(e) Infections

(i) Non-specific infections. Where it is not possible to distinguish a particular micro-organism as responsible for an inflammation it is termed a non-specific infection. Bone infections are generally divided into three classes: periostitis- that which affects the periosteum, osteitis - that affecting the bone,and osteomyelitis - that involving the marrow cavity (Steinbock 1976:60).

Burial 1240 (male aged 25-35, skeleton 60-80% complete, skull missing). This individual shows depositions of woven bone upon the normal cortex of the lateral/anterior part of the right ilium, the inferior part of the anterior surface of the wing of the right scapula, the distal part of the left radius, the diaphyses of both femora (especially the posterior surfaces), posterior surfaces of both tibiae and, to a slight degree, the medial side of the right calcaneus. The reaction is most marked on the femora. These lesions represent periostitis. Periostitis may be a response to a systemic disease, or to local trauma (see burial 1076, below, and 0933, section (c)i, above): the widespread nature the lesion in 1240 indicates the former as the likely cause. A wide range of specific diseases can cause periosteal reactions (Mensforth et al. 1978).

Burial 2174 (juvenile aged 16-17, skeleton 60-80% complete). Most of the foot bones except the phalanges were present, and of these 3 right and 4 left metatarsals show periostitis, as do the interosseous borders of the distal parts of the tibiae and left fibula (the right fibula appears normal but is somewhat damaged post-mortem). These lesions bear a striking resemblance to those which may be found on the lower legs and feet in cases of leprosy (e.g. in burial 1392, below); however the (somewhat damaged) facial bones show no evidence for any changes consistent with leprosy (see catalogue of burials for detailed description). It seems probable that the lesions in burial 2174 are caused by systemic disease rather than local injury, but a more precise diagnosis is difficult, although leprosy remains a possibility.

Burial 2171 (juvenile aged 11-16, skeleton <20% complete). Only one metatarsal is present and it displays periostitis. One tarsal is present and is normal. The only other bones from this individual are from the right hand and wrist. With so few bones present it is impossible to ascertain the cause of the periosteal reaction.

Burial 1076 (male aged 40-60, skeleton <20% complete). The right tibia shows a smooth, raised area on its anterior border about one third to one half way from the proximal end. The medial surface of the tibia in the region of the lesion is pitted and striated. A radiograph shows that the raised area consists of a deposit of new bone upon the external surface of the cortex. The presence of a nodular focus on the sub-cutaneous border suggests local trauma as the cause of this lesion.

Burial 1139 (female aged 40-60, skeleton 60-80% complete). An intermediate phalanx from the right hand shows periostitis of its shaft and destruction of its distal end. A further 10 right and 11 left hand phalanges are present and are normal.

A fragment of the left ilium of an adult, found as an intrusive bone in context 1166 showed a periosteal reaction on its lateralsurface.

Burial 1259 (male aged about 35-50, skeleton >80% complete). There is marked swelling of the distal diaphysis and metaphysis of the right tibia; there is some nodular sub-periosteal new bone on the interosseous border, otherwise the surface of the lesion is smooth (Plate 3). Five centimetres superior to the medial malleolus there is an oval depression (approximately 15mmx30mm and 5mm deep). The distal third of the right fibula shows a periosteal reaction on its medial side and is thickened with respect to the left fibula.

Burial 1076 (male aged 40-60, skeleton <20% complete). The left radius shows irregular swelling of the distal diaphysis and metaphysis, and the surface of the bone has a pitted appearance (Plate 4). These last 2 probably represent cases of osteomyelitis. In osteomyelitis the pathological process is one of bone destruction, pus formation and bone repair. In consequence the osteomyelitic bone generally appears enlarged and deformed. Abscess cavities develop in the bone interior and in general these eventually discharge into the surrounding soft tissues via a sinus through the cortex. It is likely that the rounded depression in the tibia of 1259 represents a healed sinus. In the case of 1259 X-ray showed that in the area of the lesions the original cortex is enclosed within a shell of subperiosteal new bone (involucrum formation - Steinbock 1976: 64f). Parts of the original cortex seem to have been removed by remodelling. Osteomyelitis may result from transport of bacteria to the bone via the bloodstream from a primary infection in the soft tissues, or from direct infection of the bone from an overlying skin lesion or penetrating injury. In adults the latter is the more common cause.

(ii) Leprosy. Burial 1392 (female aged 21-25, skeleton >80% complete). The maxilla shows atrophy of the anterior nasal spine to Mo/ller-Christensen's (1961) II , together with some new bone formation in the anterior part of the nasal cavity and fine pitting of the superior surface of the hard palate (the posterior part of which has suffered destruction post-mortem). There is some erosion of the pyriform margins and the inferior surface of the hard palate shows markedly increased pitting. There is erosion of the maxillary alveolar bone in the region of the central incisors to Mo/ller-Christensen's (1961) II (Plate 5). The orbital roofs are missing, hence it is not possible to ascertain whether cribra orbitalia was present.

The lower leg bones show considerable sub-periosteal new bone formation, mainly confined to the distal two-thirds of the tibiae and fibulae. The lesions are particularly pronounced on the interosseous borders. The sub-periosteal bone is of a longitudinally striated appearance but is nodular where deposition is thickest (Plate 6).

The calcanei and tali, and all metatarsals and tarsals are present, together with 6 phalanges from each foot. Both calcanei show slight osteitic changes. The left talus shows osteitis of the neck and head, together with destruction of the articular surface for the navicular bone. The corresponding facet of the left navicular is also destroyed and the bone shows extensive osteitis. The other tarsals of both feet show osteitic pitting.

The metatarsals show osteitic, pitted, irregular surfaces and/or periosteal reactions (Plate 7). The head of the rightfirst metatarsal has been destroyed ante-mortem.

The left hallucial proximal and distal phalanges show osteitic changes and periosteal reactions, as do 3 of the 4 proximal phalanges present from the right foot. There is an ante-mortem erosion at the base of the right hallucial proximal phalanx. Most foot phalanges show enlarged nutrient foramina. Many foot bones are osteoporotic.

All the hand bones except one left phalanx are present and are normal.

These lesions are highly suggestive of leprosy (Mo/ller-Christensen 1961, 1974; Patterson 1961; Andersen 1969). The cranial signs are termed facies leprosa and are a direct consequence of the action of the leprosy bacillus; the changes seen in the foot bones of 1392 are a result of trauma and infection of feet anaesthetised by the neurological damage which is such a prominent feature of leprosy.

The cuboid, and lateral and intermediate cuneiforms of both feet of 1392 show dorsal exostoses (Plate 8) of the type described by Andersen & Manchester (1988). It is uncertain whether the left or right talus and navicular bore similar exostoses due to florid osteitic changes and post-mortem damage respectively. These exostoses mark the site of ligamentous insertions. Leprosy frequently involves loss of function of the posterior tibial nerve, the motor component of which supplies most of the muscles responsible for maintaining the integrity of the longitudinal arch of the foot. Loss of motor function leads to development of pes planus (flat foot) and this places increased strain on the dorsal ligaments of the talo-navicular, cuneio-navicular and cubo-navicular joints; this extra stress tends to lead to the formation of bony exostoses at the insertions of these ligaments. Thus Andersen & Manchester (1988) argue that the presence of such exostoses in cases of leprosy is suggestive of damage to the posterior tibial nerves.

(iii) Tuberculosis. Burial 0459 (male aged about 20, skeleton >80% complete). The body of the twelfth thoracic vertebra shows a large lytic defect in the right/anterior part of its inferior surface; about two-thirds of the depth of the centrum is destroyed. The borders of the defect are sclerotic and irregular, and bone regeneration is negligible (Plate 9). The trochlear joint surface of the left talus is irregular, with pits and clefts in its anterior part. Similar changes are present in the distal joint surface of the left tibia and in the posterior talus facet of the left calcaneus. The right talus is missing and the right calcaneus is normal.

There is a circular erosion (approximately 7mm diameter and 3mm deep) on the left superior articular facet of the axis vertebra. A similar, though smaller (2mm diameter) lesion perforates the right superior articular facet of the axis.

Burial 2127 (male aged 21-24, skeleton >80% complete). There is destruction of about 75% of the superior surface of the first sacral segment. The borders of the erosion have a pitted appearance but are not sclerotic and there is negligible bone regeneration, however there is some sub-periosteal new bone formation on the anterior surfaces of the first two sacral segments (Plate 10). The iliac face of the right sacro-iliac joint has been destroyed and here too the eroded area has a pitted appearance and bony regeneration is negligible (Plate 11). The left sacro-iliac joint is normal. There is a scalloped erosion on the left/anterior side of the body of the fifth lumbar vertebra, the margins of which are slightly sclerotic. There is a slight deposition of sub-periosteal new bone on the anterior of the centrum of this vertebra and on the inferior part of the neural arch. There is slight sclerosis around the periphery of the superior surface of the body of the fifth, and inferior surface of the body of the fourth lumbar vertebrae. There is a shallow, pitted erosion on the anterior margin of the superior surface of the body of L3.

The left ulna shows a lytic defect beneath the proximal joint surface. The defect pierces the bone transversely and there are some perforations in the joint surface itself (Plate 12). Bone regeneration is negligible. There are slight lytic changes and pitting at the margins of the proximal joint surface of the left radius.

The left humerus shows 2 lytic areas immediately proximal to the distal joint surface on the anterior aspect of the bone. There is slight reactive new bone formation between the 2 lytic areas and in the olecranon fossa.

The lesions displayed by 0459 and 2127 are highly suggestive of tuberculosis. Skeletal tuberculosis is generally a secondary infection from primary lesions in the soft tissues, most frequently the lungs, the tubercle bacilli reaching the bones via the bloodstream. These bacilli tend to locate themselves within the skeleton in areas of haemopoietic marrow which have high circulatory and metabolic rates, in adults these areas tend to be the metaphyses and epiphyses of the longbones and the cancellous bone of the ribs, sternum and, particularly, the vertebral bodies. Hence these are the parts of the skeleton which most frequently display tuberculous lesions. A characteristic of tuberculous abscess cavities is their relative lack of bony regeneration - lytic processes are dominant. Only about 5% of cases of tuberculosis involve the skeleton (Davies et al. 1984).

(f) Other pathologies

The internal table of the frontal bone of burial 2143 (probably male, probably aged 40+, skeleton 20-40% complete) is thickened and has a knobbly, irregular surface. This internal frontal hyperostosis is most commonly found in older females where it is thought to be associated with elevated androgen levels (refs in Armelagos & Chrisman 1988). According to Revell (1986:174) it is almost never seen in males and Henschen (1949, cited in Ortner & Putschar 1985) states that the female:male ratio in cases of hyperostosis frontalis interna is close to 100:1. The sex of 2143 was determined from the skull (which was borderline male) and the size and robusticity of the post-cranial bones - mainly from the legs and feet - which suggested male sex. In the light of the above discussion it is regrettable that a more certain determination of sex was not possible.

Harris lines are visible radiographically in bones as lines of increased density; they correspond to temporary cessations of bone growth as a result to environmental stressors including malnutrition, disease and psychological stress (Mays 1985). Bones were not routinely X-rayed for their presence but when bones were radiographed for other purposes their presence or absence was noted. Only one individual (burial 1259) showed evidence for Harris lines (see catalogue of burials).

6. Summary and discussion

Material representing 95 individuals was examined; many skeletons were rather incomplete, most were fragmentary and preservation of bone was generally moderate to poor.

The non-metric variants produced evidence for burials of genetically related individuals near one another in a "family group", although as only part of the cemetery was excavated it is uncertain to what extent this spatial patterning applies to the cemetery as a whole. No burial showed any evidence of injury from swords or other sharp-edged weapons. The frequency of healed fractures was low, and in only one case did it seem more likely that inter-personal violence rather than accident was the cause. In no case was cause of death apparent.

Similar numbers of male and female adults were present, but juveniles and especially infants were under-represented; this is true for many Anglo-Saxon cemeteries (Norwich Castle is unusual in that about half the burials here were of children (Stirland 1985), although even here infants were under-represented with respect to levels of infant mortality expected prior to modern standards of medical care) and must be a reflection of Anglo-Saxon funerary practices.

Mean age at death of adults from Ipswich is similar to that obtained from other Anglo-Saxon sites in the region (figures range from 31.7 at Norwich (Stirland 1985) to 39-40 at Burgh Castle (Anderson & Birkett 1989)) and the stature figures too are unexceptional, although it is worth noting that this group do seem to be noticeably shorter than the rather tall Burgh Castle people. It is regrettable that the nature of the material prevented analysis of cranial and post-cranial measurements, although the impression gained on examining the material was that they seemed to be a fairly homogeneous group with respect to cranial type.

Dental enamel hypoplasias were significantly less frequent in the School Street group than among their urban counterparts at the Norwich Castle site, occurring in 32% of the former and 80% of the latter. Although inter-observer error is likely to be significant in scoring hypoplasias it seems unlikely that this could account for such a marked difference - it seems probable that those at Norwich suffered from a greater frequency of childhood disease and malnutrition than those at the School Street site. This hypothesis is to some extent supported by the finding of one fairly certain, and a few other possible, cases of rickets (a rarity in skeletal collections prior to the post-mediaeval period) at Norwich Castle, whereas there was no suggestion of the presence of this disease (either active or healed) in the School Street assemblage.

The frequency and distribution of degenerative joint disease was unexceptional for a skeletal collection such as this. As far as the rarer pathologies were concerned there was one probable erosive arthropathy, 2 probable cases of tuberculosis and one case of leprosy. Probable cases of tuberculosis are known from the Roman period onwards, but the disease only became widespread with increasing urbanisation in the later Middle Ages (Manchester 1984). The earliest fairly certain case of leprosy in Britain dates from the 6th century AD; finds of leprous skeletons of Saxon date in Britain are few but geographically widespread; documentary evidence also testifies to the pre-conquest presence of the disease (Clay 1909).

APPENDIX: RESIDUAL ANGLO-SAXON BONE

Introduction

In addition to the material from the discrete inhumations, discussed above, a quantity of disarticulated human bone of Anglo-Saxon date was received. This represented bone from Anglo-Saxon inhumations which had been disturbed by later features. The only work done on this material was to calculate minimum numbers and to scan it for pathologies or anomalies.

Minimum numbers of individuals

The bone, which is in moderate to poor condition, comes from 17 single contexts plus 3 contexts which contained further sub-contexts (see context list). Assuming that no mixing has taken place between these 20 contexts the remains represent a minimum of 74 individuals: 53 adults (16 males, 6 females, 31 unsexable), 1 adolescent/young adult and 20 juveniles.

Although quite a large number of individuals seem to be represented by this collection the total quantity of bone is fairly small - the mixing and loss of material as a result of post-Saxon disturbance is considerable. Consistent with this is the following: if mixing is considered possible between all 20 contexts, minimum number of individuals is reduced to approximately 40, of which about 32 are adults. This large reduction in minimum numbers is mainly because the 17 single contexts each contain relatively few bones; there is little duplication of skeletal elements between these contexts.

Pathologies

Unless stated all the discussion below relates to the remains of adult individuals.

Of 185 teeth present in the collection 4 show dental caries. There are a total of 374 tooth positions available for study; 44 show ante-mortem tooth loss and 18 show periapical abscesses.

An abscess cavity at the socket of the left first molar of a maxillary bone from a male aged 50+ from context 1088 has led to the formation of a radicular cyst in the maxillary sinus. Radicular cysts are fluid-filled cavities which arise as a result of periapical inflammation, although once formed they grow independently of that inflammation; they are generally asymptomatic (Shafer et al. 1983: 493).

Most of the teeth belonging to the skull of a male aged 17-25 from context 0967 show 3 hypoplastic lines; these are most pronounced on the mandibular canines.

Three bones show evidence for healed fractures. The proximal phalanx of a right thumb from sub-context 1077 shows a fracture just proximal to the distal joint surface. It is firmly healed with slight volar displacement of the distal part.

A right fifth metatarsal from sub-context 1218 shows a healed fracture one third of the way from its distal end. There is moderate callus formation and a large cavity immediately distal to the fracture; this last is strongly suggestive of osteomyelitis.

A right radius from sub-context 1222 shows a Colles' fracture. The break is firmly united with slight dorsal angulation of the distal end.

Three bones show evidence for soft tissue trauma. A left innominate of a female aged 40+ from sub-context 2094 shows a smooth exostosis about 2cm long on its anterior border at the sites for insertion of the heads of the rectus femoris, suggesting trauma to this muscle as the probable cause.

A right tibia, also from sub-context 2094 shows a bony exostosis near its distal end at the interosseous border - probably traumatic.

A left navicular bone from sub-context 2058 shows a large medial exostosis, together with eburnation of the articular surface for the talus. These lesions may have arisen as a result of trauma to the foot.

There are two cases of bony ankylosis. A proximal and intermediate hand phalanx from context 1167 are fused in a partially flexed position. There is no sign of any arthropathy; it seems probable that the cause was local trauma.

The right sacro-iliac joint of a male from sub-context 1745 is fused in its upper extremity by a smooth osteophyte. The cause of this lesion is uncertain. There is no sign of any erosive changes.

Two bones show evidence of periostitis: a right tibia from sub-context 2094 and a left tibia of a child from sub-context 1745.

Three skulls show cribra orbitalia: males from context 0967 and sub-context 2058 show changes of Brothwell's (1981) porotic type, and an unsexable adult from sub-context 1222 shows lesions corresponding to Brothwell's cribriotic type.

A right ulna from sub-context 2094 shows an eburnated patch on its shaft, just distal of the proximal articular surface for the head of the radius. A right radius from this context whichappears to articulate with the above has a very roughened tuberosity, giving the impression that it formed an articulation with the eburnated area on the ulna shaft. Only the proximal quarter is present from each bone. The cause of the lesions is uncertain but it is worth noting that pseudarthroses of this type between radius and ulna may form following fracture of one or both forearm bones.

List of contexts containing residual Anglo-Saxon human bone

Single contexts: 0572, 0696, 0967, 0968, 0979, 1047, 1087, 1167, 1724, 1743, 1871, 1951, 2018, 2046, 2078, 2088, 2456.

Contexts with sub-numbers: 0936 & sub-context 1077; 1088 & sub-contexts 1745, 1856, 2058, 2094; 1132 (from which no bone was received) & sub-contexts 1218, 1222, 1224, 1357, 2059.

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Location of archive: HBMC, London.
Location of bones: Suffolk Archaeological Unit, Ipswich.

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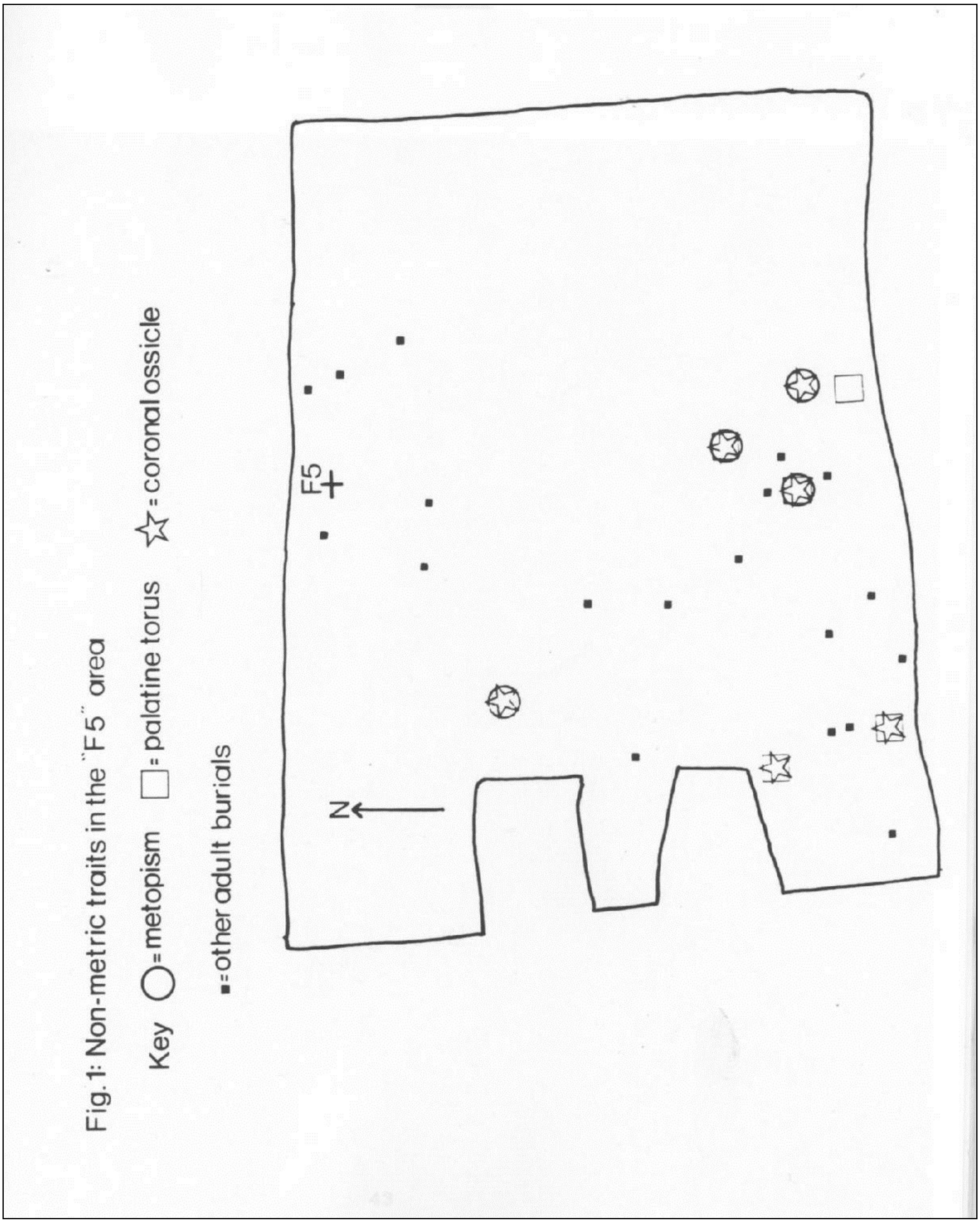

Fig.1: Non-metric traits in the "F5" area

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Plates

Plate 1: Burial 2163. Erosive changes at the right first metatarso-phalangeal and left talo-calcaneal joints

Plate 2: Burial 2163. Periosteal reaction on left lower leg bones.

Plate 3: Right tibia of burial 1259 (medial view) showing probable osteomyelitis

Plate 4: Burial 1076. Left radius showing probable osteomyelitis.

Plate 5: Maxillae of burial 1392 showing resorbtion of anterior nasal spine and maxillary alveolar bone in the incisor region. The skull on the left is a normal female (burial 0937) for comparison.

Plate 6: Burial 1392 lower leg bones showing periosteal reactions.

Plate 7: Metatarsals and phalanges of burial 1392.

Plate 8: Cuboid and laterial and intermediate cuneiforms of the right foot of burial 1392. Note the dorsal exosteses (arrowed).

Plate 9: Twelfth thoracic vertebrae of burial 0459

Plate 10: Sacrum of burial 2127 showing partial destruction of the first segment.

Plate 11: Right sacro-illiac joint of burial 2127 showing destruction of the iliac face.

Plate 12: left ulna of burial 2127

Plate 1

Plate 2

plate 3

plate 4

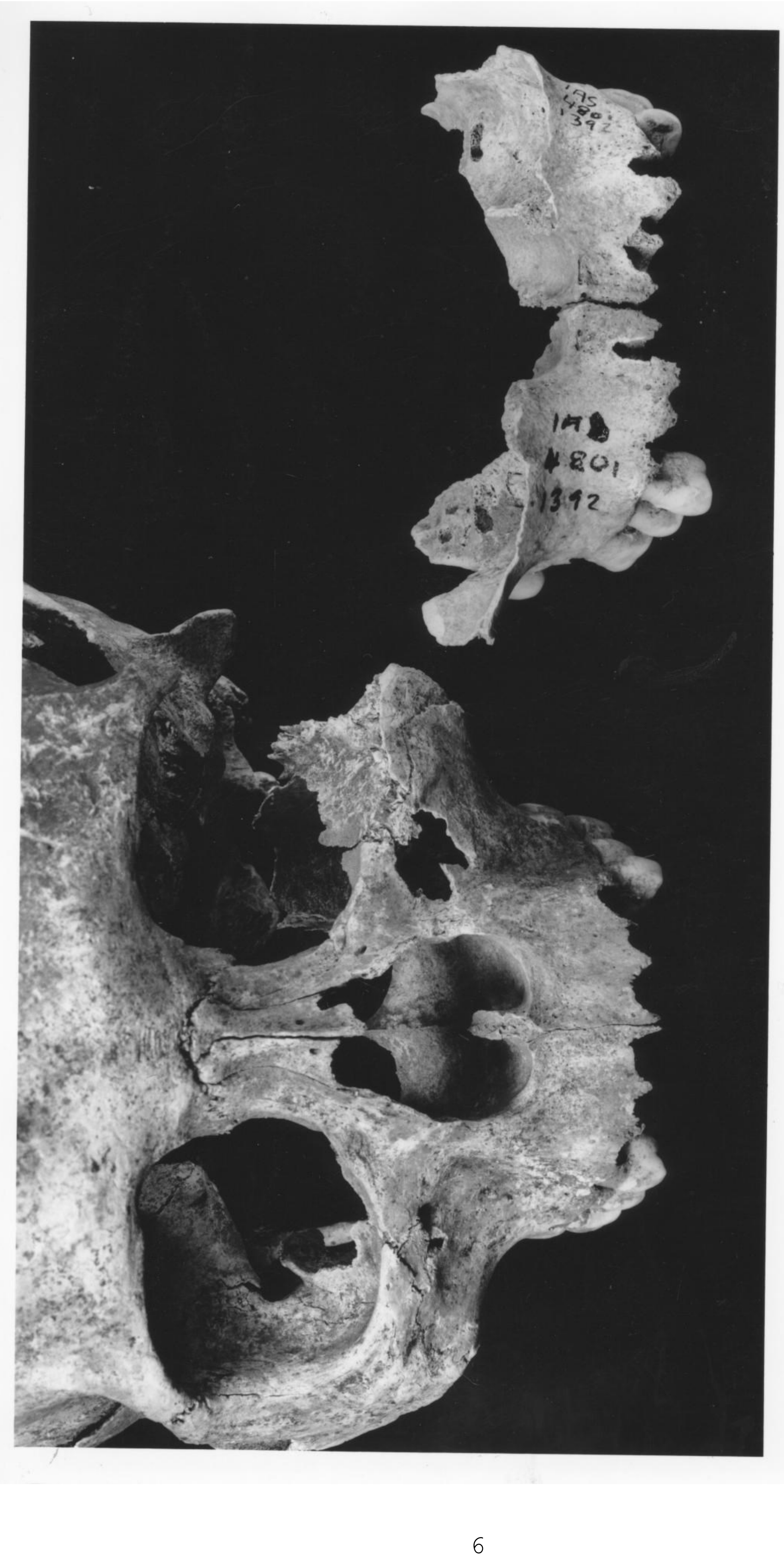

Plate 5

Plate
6

Plate 7

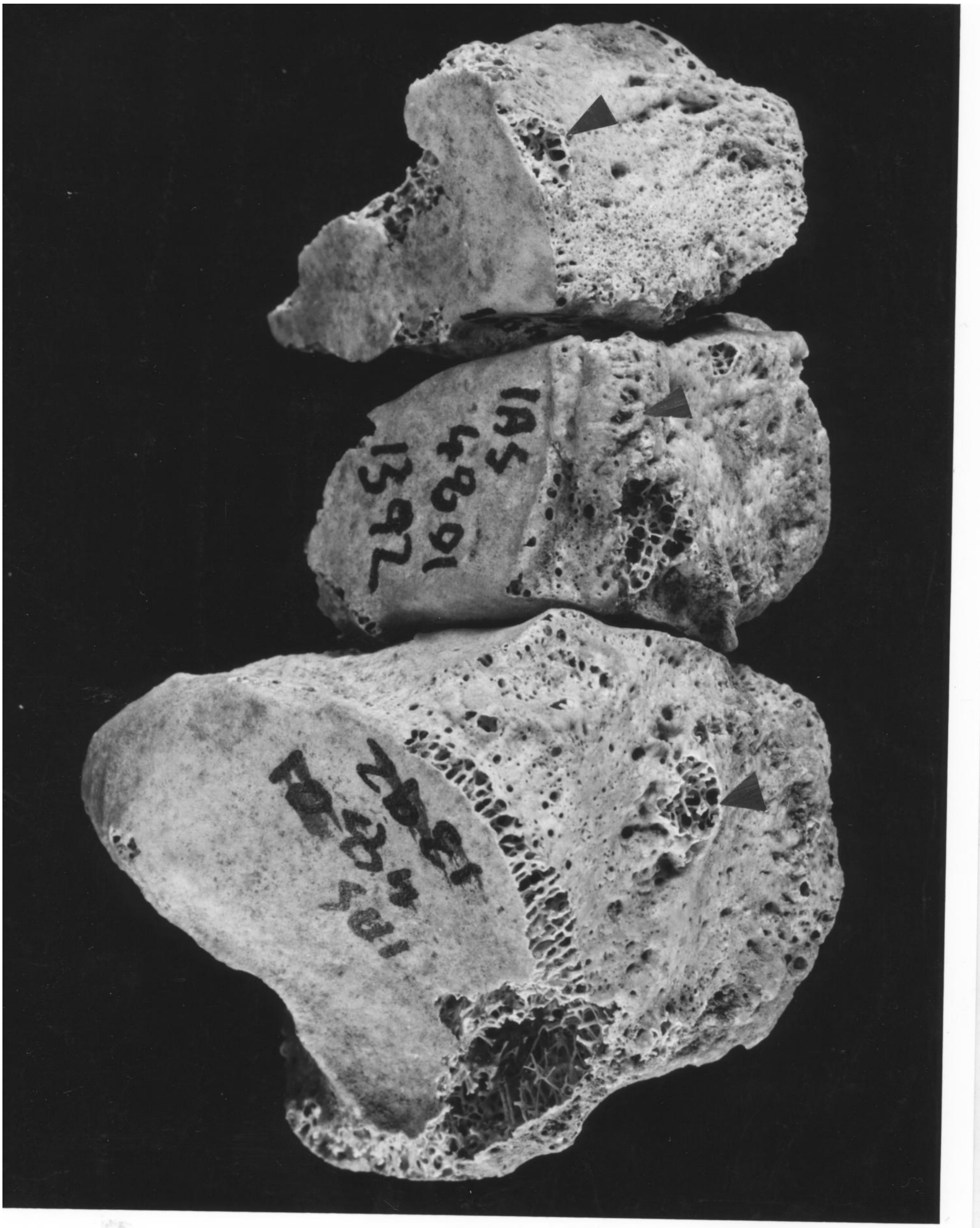

plate 8

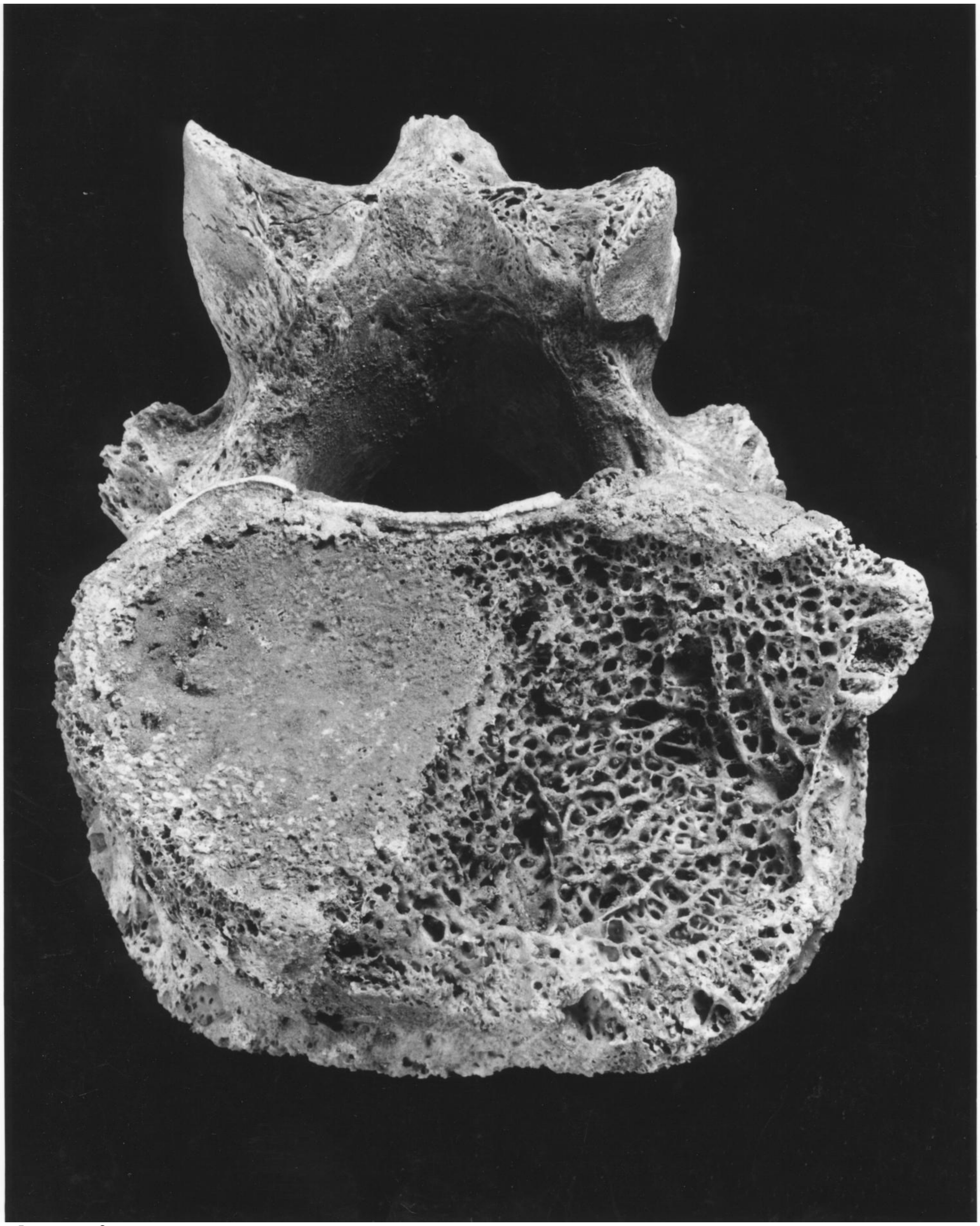
plate 9

plate 10


plate 11

plate 12