Ancient Monuments Laboratory
Report 13/97

LINCOLN EXCAVATIONS 1972-87: REPORT ON THE HUMAN SKELETAL REMAINS

A Boyleston
C Roberts

Ancient Monuments Laboratory Report 13/97

LINCOLN EXCAVATIONS 1972-87: REPORT ON THE HUMAN SKELETAL REMAINS

A Boyleston
C Roberts

Summary

Bones from 65 individuals excavated from a number of sites in the city of Lincoln are examined. The majority of the material dates to the Medieval period, although there are 4 Anglo-Saxon burials and a total of 22 Romano-British burials of which 19 were infants. Also examined was a quantity of disarticulated remains from disturbed contexts, among which was identified a possible case of bovine tuberculosis; this is noteworthy as it is unusual to be able to document this type of tuberculosis in human skeletal remains.

Authors' addresses :-

MS A Boyleston
UNIVERSITY OF BRADFORD
Richmond Road
Bradford
W YORKS
BD1 1DP

Dr C Roberts
UNIVERSITY OF BRADFORD
Richmond Road
Bradford
W YORKS
BD1 1DP

LINCOLN EXCAVATIONS 1972 - 1987

Report on the Human Skeletal Remains

by

Anthea Boylston and Charlotte Roberts

Calvin Wells Laboratory
Department of Archaeological Sciences
University of Bradford
BRADFORD
BD7 1DP

February 1995

Basic data stored at: Calvin Wells Laboratory

Skeletons stored at: City of Lincoln Archaeological Unit

CONTENTS

HUMAN REMAINS FROM LINCOLN EXCAVATIONS 1972 - 1987

I. INTRODUCTION

Human bone recovered from a number of sites around the city has been analysed to provide demographic data for individual site reports and to study health status and disease in Medieval Lincoln. This project was carried out with a view to generating additional information to complement the much larger study performed by Dawes (Gilmour and Stocker, 1986). There were also 4 Anglo-Saxon and 3 Romano-British burials available for comparison (Appendix 1). In addition, 19 contexts containing infant bones have also been examined in order to study Romano-British burial customs and these are discussed separately at the end of this text.

Reports have been completed for the Wigford, Upper City and Lower City sites as part of a wider project integrating specialist reports with the archaeology for each area separately and these are attached as Appendices 3, 4 and 5. Disarticulated material was screened for pathological bone and in order to calculate minimum numbers. It was included in site reports but does not feature in the present synthesis. The exception is a pelvis which may have been affected by bovine tuberculosis.

Burials from the L86 excavations derived from a series of mass graves. In some of these, several individuals had been boxed as one context and it was not possible to separate out the individual interments. Graves 2, 8 and 15 have, therefore, been omitted from the final report since it is impossible to attribute an age and sex to the skeletal elements from these contexts.

Table 1 lists those sites from which burials were recovered, with their site code and date of excavation.

TABLE 1: Sites from Lincoln excavations which produced human skeletal remains for examination

Area	Site	Code	Period	No of burials	Additio-nal contexts
Wigford	St Mark's station	BR85	Medieval	1	-
		Z86		11	4
			Roman	3	-
		Z87	Medieval	5	-
		ZE87	Roman	2	-
	St Mark's church	SM76	Medieval	5	3
		SM77	Roman	3	-
	Chaplin St	CS73	Roman	1	-
	St Mary's Guildhall	SMG82	Roman	5	-
	High Street	HG72	Roman	1	3
Upper City	Lawn Hospital	L84	Medieval	9	2
		L85		8	4
		L86		21	15
		L87		1	5
		L89		-	4
	Lincoln Cathedral	LC84	Medieval	2	-
Lower City	Broadgate East	BE73	Roman	1	1
	Silver Street	LIN73	Medieval	6	4
			Post-medieval	1	4
	Saltergate	LIN73 Area D	Anglo-Saxon	4	5
	Spring Hill	-	Roman	2	-

II. PHYSICAL ANTHROPOLOGY

1. PRESERVATION

The Medieval burials from the Wigford and Lower City sites were mainly well-preserved and relatively complete (Table 2). Their articular and long bone shaft surfaces were intact. Four Anglo-Saxon burials from Saltergate in the Lower City were rather more fragmentary with poorer preservation of individual bones.

Burials from the Upper City were much more variable, ranging from almost complete individuals recovered from stone cists during the Lawn Hospital 1984 and 1985 excavations to some burials from the 1986 trench which has been truncated by the section and were without skulls and parts of the lower extremities. However, in most cases there was enough information to make at least a tentative estimate of sex and age since the pelvic area was retained.

TABLE 2: Preservation

Grade	Wigford	Upper City	Lower City
1 (>75%)	5	6	6
2 (>50%)	5	5	4
3 (>30%)	3	11	5
4 (>10%)	4	9	1

2. MINIMUM NUMBERS

Skeletal elements, such as the ends of the long bones, certain hand and foot bones and landmarks on the skull and pelvis were counted in order to calculate minimum numbers and to provide basic data for prevalence of disease (Appendix 2, Table 1). Joint surface counts, for example, are important when estimating frequency of osteoarthritis in a cemetery population (Waldron, 1994). The figures include individuals from all time periods. Males and probable males were combined, as were females and probable females. The skeletal element which survived most frequently was the proximal femur, both for adults and juveniles.

3. ESTIMATION OF SEX AND AGE

Estimation of sex was undertaken by examination of dimorphic features of the skull and pelvis by the methods of Bass (1987) and Phenice (1967). Additional information was provided by measuring diameters of the femoral and humeral heads and epicondyles according to Stewart (1979). Where the evidence was contradictory or poor preservation prevented a definitive estimation of sex, individuals were allocated to the probable male, probable female or adult category.

Adult age estimation was performed by as many methods as possible for each individual, namely dental attrition (Brothwell, 1981), scoring of the sternal ends of the ribs (Iscan et al, 1984; 1985) and observation of certain features of the pelvis such as the pubic symphysis (Katz and Suchey, 1986) and the auricular surface of the ilium (Lovejoy et al, 1985). Adult ages are given in broad categories since they depend on the rate of maturation and subsequent degeneration of various aspects of the human skeleton, all of which are subject to considerable individual variation.

Ageing of subadults depended upon development of the deciduous and permanent dentition (Hillson, 1986), measurement of long bone lengths (Workshop of European Anthropologists, 1980) and fusion of epiphyses (Williams and Warwick, 1980).

The St Mark's station excavation sampled two areas of the White Friars' cemetery. The first excavation (Z86) produced 10 high status burials (Vince, pers comm). The five adults were all male and included 2 young, 2 young/middle-aged and 1 mature adult. The four adolescents also had a very masculine pelvic conformation. In addition, the watching brief the previous year (BR85) produced a further male cranium. The second excavation (Z87) in a different area of the White Friars' cemetery provided 5 individuals, of whom 2 were mature females, one a young female, a middle-aged probable male and an adolescent (Table 3; Appendix 2, Tables 2 and 3).

The Upper City sites split into the LH84/85 excavations which sampled a number of carefully planned graves in stone cists from St Bartholomew's churchyard and a more disorderly collection of mass graves from the L86 trench. Burials from the former site consisted of 4 males, 5 females, 1 probable female, 4 subadults and 1 infant burial. However, those excavated in 1986 (L86 & L87) were almost exclusively males or probable males (6 males, 5 probable males and 1 female), apart from a group interred in Grave 15 (see Appendix 4) and one subadult. Only one mature adult (G17) was found in this area (L86).

The Lower City site of Silver Street included individuals of both sexes and all age groups: 3 males, 2 probable males, 8 females, 2 probable females, one adult of indeterminate sex and one subadult. There were 3 Anglo-Saxon females and one probable male from Saltergate. A Romano-British female from Broadgate East completed the sample (Table 3; Appendix 2 Table 3).

TABLE 3: Age and sex of individuals from 3 areas sampled

Site	SA	YA	YMAA	MAA	MA	Ad
Wigford						
Male		2	3	0	1	0
? Male		0	0	1	1	0
Female		1	0	0	2	0
? Female		0	0	0	0	0
Adult		0	0	0	0	0
Subadult	6					
Upper City						
Male		1	3	3	3	0
? Male		0	1	1	1	2
Female		0	3	2	0	1
? Female		0	0	1	0	1
Adult		1	0	0	0	0
Subadult	7					
Lower City						
Male		1	1	1	0	0
? Male		1	1	0	0	0
Female		1	2	0	4	1
? Female		0	1	0	1	0
Adult		0	0	0	0	1
Subadult	1					
Total	14	8	15	9	13	6

SA = Subadult (<20 years of age)
YA = Young adult (20 - 25 years approximately)
YMAA = Young/middle-aged adult (26 - 35 years)
MAA = Middle-aged adult (36 - 45 years)
MA = Mature adult (>45 years)

Subadults formed 21.5% of the total sample but there were only one infant burial dating to the Medieval period. A similar proportion (20.3%) had survived into late-middle or old age. Males and females were almost equally long-lived (6: 7). There was also a peak in the mortality figures for the 25 - 35 year age group with 23% of total deaths occurring in that period.

4. STATURE ESTIMATION

Stature was calculated for individuals with complete long bones by the method of Trotter (1970). Where possible, bones from the lower extremity were measured for this purpose since the standard error is smaller. Mean male stature was 173.1 cm and female stature 158.9 cm (Appendix 2, Table 4). Comparisons were made with figures for lay cemeteries of sufficient size from a similar and earlier periods and with the monastic cemetery of St Andrew, Fishergate. The figures for the present study are near the top of the scale but the numbers were quite limited. Seventeen males and eight females had complete long bones from which stature could be estimated (Table 4).

TABLE 4: Stature comparisons

Site	Date	Male	Female	Reference
Trentholme Drive	C4	1.70 m	1.56 m	Wenham, 1968
Castledyke, Barton-on-Humber	C6-7	1.72 m	1.60 m	Drinkall & Foreman, 1996
St Helen's-on-the-Walls, York	C10-16	1.69 m	1.57 m	Dawes & Magilton, 1980
St Mark's, Lincoln	C10-16	1.71 m	1.56 m	Gilmour & Stocker, 1986
Lincoln sites 1972 - 1987	C10-16	1.73 m	1.59 m	This study
St Nicholas Shambles, London	C11-12	1.73 m	1.57 m	White, 1988
Jewbury, York	C12-13	1.67 m	1.56 m	Lilley et al, 1994
St Andrew, Fishergate, York	C13-16	1.71 m	1.59 m	Stroud & Kemp, 1993

5. CRANIAL MEASUREMENTS

Skulls are traditionally measured in order to determine affinities between populations. There was a general trend in this country from long-headed (dolichocranic) to round-headed (brachycranic) from the Early Medieval (Anglo-Saxon) to Late Medieval periods, although there has been some reversal since that time (Stones, 1989). Cranial indices from Christchurch, Spitalfields have a mean value at the lower end of the mesocranic range (Molleson and Cox, 1993). There has been a general tendency towards brachycephalization in many parts of Europe since the Neolithic period (Henneberg, 1976).

Measurements for the present study were taken between landmarks on the skull described by Brothwell (1981). These figures were then used to calculate indices which describe the shape of the cranium, face, orbits, nasal aperture and palate as listed in Bass (1987). Results are listed in Appendix 2, Table 5 (cranial measurements) and Table 7 (indices).

Two female skulls were sufficiently well preserved for most measurements to be taken. One of these was mesocranic (medium skull), and the other hyperbrachycranic (very round-headed). These gave a mean index of 83.6. The female cranial index derived from the population at St Helen-on-the-Walls was 81.6 (Dawes and Magilton, 1980). Three male skulls had a mean index of 80.5 which is at the lower end of the brachycranic range but other male indices were similar to those of the females. This

figure is very similar to that computed by Dawes of 79.4 for the males of St Helen's-on-the-Walls, and to those for the period 6 males from Fishergate, York (from 1195 onwards). The mean nasal index for both males and females was leptorrhine (narrow) and the orbital indices came in the mesoconchic (or medium) range. This is a normal distribution for a Caucasoid European population of the period (Novotny et al, 1993).

6. POSTCRANIAL METRICS

Measurements of long bone lengths and diameters were taken to assist in stature estimation and to give additional information for attribution of sex (Appendix 2, Table 6). In addition, diameters of proximal femoral and tibial shafts were used to calculate platymeric and platycnemic indices which relate to antero-posterior and medio-lateral flattening of the two bones respectively. These conditions have been found to be more marked in early modern man. Unfortunately, different authors fail to agree on the index that constitutes platymeria. Townsley (1946) considers that below an index of 80 there is appreciable flattening and that 85 would be a normal figure for modern humans. However, for the purposes of this report Brothwell's (1981) figure of <85 was taken to indicate platymeria.

Some authors have attributed flattening of the bones of the lower extremity to differing mechanical stresses exerted on the femoral and tibial shafts at various periods, e.g. by activities such as squatting (Townsley, 1946). Females demonstrate platymeria more commonly than males, probably because the greater inter-acetabular distance in the former leads to increased medio-lateral bending stress. Platymeria is also often more marked in left femora than right ones.

Most femoral shafts from the White Friars' site were platymeric but eurymeria was almost equally common at the Lawn Hospital sites dating to the 13th and 14th centuries AD (Table 5).

Male platycnemia indices for the tibiae divided almost equally into mesocnemic (medium) and eurycnemic. Indeed all the females came into the eurycnemic range for both right and left tibiae (Appendix 2, Table 7).

TABLE 5: Comparison of platymeric indices between sites in Lincoln

Site	Male		Female	
	Right	Left	Right	Left
White Friars	4 Platymeric 2 Eurymeric	5 Platymeric 1 Eurymeric	2 Platy-meric	2 Platy-meric
LH 84/85, L86	6 Platymeric 4 Eurymeric	6 Platymeric 4 Eurymeric	1 Platy-meric 1 Eury-meric	2 Platy-meric 1 Eury-meric
Silver Street	1 Platymeric 1 Eurymeric	1 Platymeric 1 Eurymeric		
Romano-British	1 Platymeric	1 Platymeric	1 Platy-meric	1 Platy-meric
Salter-gate (Anglo-Saxon)	1 Platymeric	1 Platymeric	1 Platy-meric 1 Eury-meric	1 Platy-meric 1 Eury-meric

7. NON-METRIC TRAITS

These are minor variants in the skeleton which are discontinuous since they cannot be measured on an interval scale. They consist mainly of hyperostotic traits (e.g. atlas bridge), hypostotic traits (e.g. sternal foramen), minor variations in the foraminae or extra sutural bones (Saunders, 1989).

Cranial non-metric trait frequencies are shown in Appendix 2, Table 8. Those examined were mainly the traits listed in Berry and Berry (1967). Twenty-seven per cent of male and 36% of female skulls demonstrated lambdoid ossicles which been found in up to 50% of skulls in some Medieval cemetery populations in this country (White, 1988). Some traits, which appear to have a high degree of heritability, have been used to try to establish family relationships in cemetery populations by attempting to identify clusters. Indeed, two individuals buried in context KS21 (LH84) both had metopic sutures but with small sites from different parts of the city it is not possible to be more specific on this point.

Post-cranial non-metric traits, which were recorded by the method of Finnegan (1978), are listed in Appendix 2, Table 9. There is a marked difference between the sexes in the prevalence of squatting facets, although the numbers were too small to test for statistical significance. Lateral tibial squatting facets were much more common in females than males (right = 87% F: 29% M) and medial squatting facets were only found in females (33% of right and left tibiae). These facets may indeed be caused by squatting

(Trinkaus, 1975) but there may also be other activities (eg locomotor stresses) which affect the reaction area of the distal tibia.

The prevalence of septal aperture is very low in both males and females. Stroud found a much higher rate of septal aperture in period 4 than period 6 at Fishergate (Stroud and Kemp, 1994).

a. Dental non-metric traits: Only one male showed evidence of third molar agenesis, which is an hereditary condition where the tooth bud fails to develop. Burial 7 (Z86) had no maxillary third molar on the right and on the left side only a peg tooth in this position. This is in contrast to other sites of the period such as St Nicholas Shambles in London where up to 33% of third molars had never erupted (White, 1988) or St Helen's, York where the figure was 22-26%.

III. PALAEOPATHOLOGY

In recent years, increasing importance has been given to the differences in prevalence of certain pathological conditions in separate environments, such as contrasts between urban, rural and monastic populations who practice widely varying lifestyles. There is a shortage of excavated cemeteries from rural sites from the Medieval period available for study, however.

Human remains form the most important source of primary evidence of disease in the past, although only chronic diseases leave their mark on the skeleton. An acute infection such as bubonic plague, which kills the sufferer within a matter of days, will be unrecognizable. The most heavily mineralized, and therefore most likely parts of the body to be preserved after burial, are the teeth.

1. DENTAL HEALTH AND DISEASE

Dentitions were examined for the presence of caries, calculus, abscesses, antemortem tooth loss and periodontal disease. Dentitions were recorded from 16 males or probable males dating to the Medieval period and from 10 females or probable females. There were also 7 subadult dentitions. Three Anglo-Saxon females, one Anglo-Saxon probable male and one Romano-British female were not included in the sample but will be discussed separately.

There was a total of 796 teeth (filling 78.7% of tooth sockets present) available for observation (Appendix 2, Table 10), 94 teeth (9.2% of sockets) had been shed before death occurred and a further 122 teeth (12.1%) were lost postmortem (Appendix 2, Tables 11 and 12). Antemortem tooth loss, which may be due to destruction of the tooth by caries or periodontal disease, was most commonly seen in the female maxilla (20.7% of sockets) as opposed to the male maxilla and mandible which were equally affected (8.2% and 8.9% respectively). The female mandible was least affected (4.2%). The first molar was most likely to be shed antemortem, a common finding since it erupts at around 6 years of age and is therefore subject to far more wear than the other two.

a. **Caries**

These are caused by the action of acidophilic bacteria in the presence of plaque and they create a focal demineralization of the tooth which is progressive and irreparable since the dentine and pulp do not have a blood supply. Caries which occur on the smooth surfaces of the teeth, the most common type in antiquity, are often caused by Streptococcus mutans (Cawson, 1991). Sugar was introduced into this country progressively from the 12th century onwards (Hardwick, 1960) but it was the lifting of the sugar tax in the mid 19th century which led to the modern epidemic of fissure caries (Cawson, 1991).

There was a total of 31 carious lesions (3.9% of teeth) which is a low rate for the Medieval period (Appendix 2, Tables 13 and 14) and is almost identical to the prevalence of 4% found by Dawes in her study of 248 burials from St Mark's cemetery, Lincoln (Gilmour and Stocker, 1986). However, the high rate of antemortem tooth loss suggests that some carious teeth may have been lost and that, therefore, the recorded prevalence may be artificially low, but this applies to all studies of this type.

The low rate of carious lesions suggests that the diet was exercising a protective effect on the teeth at this period. Foods that contain trace elements such as fluoride, e.g. fish (Wells, 1964) and are low in selenium are beneficial to dental health. It is probable that some carious teeth were lost before death and others are no longer visible due to heavy wear on the occlusal surfaces of the teeth. Sucrose was evidently consumed in much smaller quantities than in recent times.

There was no difference between males and females in the percentage of teeth affected. Eight males (50%), 8 females (80%) and 3 subadults (43%) had one or more carious teeth (Appendix 2, Table 15). The site of origin was most often found to be the mesial or distal (interproximal) surface of the tooth. In many cases the disease had progressed too far for the origin to be detected. No caries were found in the four dentitions from the Anglo-Saxon individuals from Saltergate, although one of the Romano-British (ZE87 806) dentitions showed evidence of two carious teeth. Different sites are compared in Table 6.

TABLE 6: Comparison of caries prevalence between sites

Site	Dates	Total teeth	% carious	Reference
St Helen-on-the-Walls	C10-16	7806	4.4	Dawes & Magilton, 1980
St Nicholas Shambles	C11-12	?	5.5	White, 1988
St Mark's, Lincoln	C10-16	1364	4.0	Gilmour & Stocker, 1986
Lincoln sites 1972 - 1987	C10-16	796	3.9	This study
St Andrew, Fishergate	C10-12 C12-16	1406 2945	4.3 12.1	Stroud & Kemp, 1993
Christchurch, Spitalfields	C18-19	2140	17.9	Molleson & Cox, 1993

b. **Abscesses**

These are indicated on dry bone by a circular sinus, through which trapped pus has drained, and they occur most commonly in the alveolar bone of the maxilla or mandible. Abscesses are normally caused by carious infection which tracks down the root of an affected tooth. More rarely they may be seen perforating the hard palate (SM87 Cist burial) or in the periapical region, where they are most easily demonstrated on X-ray. One of the males from the White Friars site had abscesses which perforated both internally (into the maxillary sinus) and externally through the alveolar bone.

In total, 15 abscesses were found in the present study (1.5% of tooth positions). This prevalence is higher than that found by Dawes (0.5%) in her study of the human remains from St Mark's (Gilmour and Stocker, 1986) but similar to that found at St Helen-on-the-Walls (1.2%). The male maxilla was the most frequent site (Appendix 2, Table 16). There was a marked contrast between the figures for period 4 at St Andrew, Fishergate (1.9%) and period 6 (4.5%). Dawes also found a slight predilection for the maxilla in the material from St Mark's, Lincoln.

c. **Calculus**

In societies where dental hygiene is not practised, calculus accumulates on the teeth as a result of mineralization of plaque, a filamentous substrate composed largely of bacterial polysaccharides (Cawson, 1991). It tends to localize particularly on the lingual surface of the lower incisors and the buccal surface of the upper molars near the salivary glands from which the calcium is derived. Calculus is much less frequent in children but in ancient times the condition was very common in adults.

In the present study 321 teeth (40.3%) were affected by calculus formation but only 22 (14.3%) juvenile teeth (Appendix 2, Table 17). All the adult individuals had one or more teeth which exhibited calculus (or tartar) formation. Males and females were similarly affected (47% and 44% respectively). Calculus was graded in severity according to illustrations published in Brothwell (1981).

d. **Periodontal disease**

Chronic inflammation of the gums, often caused by irritation of the tissues by calculus, leads to resorption of the alveolar bone following inflammation of the gums, although the former occurs to some extent naturally with age. Most periodontal disease, therefore, is seen in older members of the community, although there may be acute, more localized episodes of periodontitis in younger individuals.

Twelve of 16 males (75%) and all females displayed some degree of periodontal disease (Appendix 2, Table 18). This increased with age, although 2 young/middle-aged adults and 3 middle-aged

adults had severe periodontal disease, as scored by the method of Brothwell (1981).

e. **Enamel hypoplasia (amelogenesis imperfecta)**

A transient disturbance in the metabolism caused, for example, by childhood fevers, infantile diarrhoea or malnutrition may cause an interruption in the formation of the enamel which results in a pit or a horizontal groove on the tooth. Complications (e.g. secondary infection causing a high fever) of measles in the past were sometimes implicated (Cawson, 1991). Enamel hypoplasia is often used as one of the indicators of the health of a particular population.

Only 23 of 796 (2.8%) of teeth showed hypoplastic lines and there were no instances of multiple deep grooves in the teeth. The lesions were localized almost entirely to the central incisor and the canine, particularly the latter. Five of 16 males (31.3%), 2 of 10 females (20%) and one of 7 subadults (14.3%) showed hypoplastic defects (Appendix 2, Table 19). One of the Romano-British burials (807) also showed hypoplastic grooving of four teeth. A summary of dental pathology is shown in Appendix 2, Table 20.

f. **Dental anomalies**

Six adults (of 26) showed some rotation of at least one tooth, normally an incisor or canine. Crowding of the teeth was found in three subadult dentitions, one from the White Friars cemetery (Z86 5) and two from St Bartholomew's (LH84 CS7 and CS9). The last two are discussed in detail in Appendix 4 and contain multiple anomalies. One adult dentition showed evidence of crowding of the left maxillary incisors (LH84 CS4).

2. CONGENITAL AND DEVELOPMENTAL

Congenital malformations are defined as such because they are present at birth. However, many skeletal abnormalities only become apparent in childhood with growth and development. Ninety per cent of such conditions have a genetic basis (Barnes, 1994) but the immediate predisposing cause may be environmental, traumatic or infectious. There are certain crucial times during the development of the skeleton when abnormalities arise with particular frequency. It may be possible to observe genetic affinities between populations by recording the patterns of such anomalies.

The spinal column is often affected by minor structural alterations which may be asymptomatic. Spina bifida occulta is often manifested by a cleft at the apex of the neural arch in one or more sacral vertebrae and may occur in up to 25% of individuals in a cemetery population (Barnes, 1994). It does not normally result in any paralysis or loss of function in the lower limbs, unlike spina bifida cystica which is recognized clinically

when the neural tissues protrude through a defect in the neural arch and produce a meningocoele. Spina bifida occulta was seen in 5 of 8 subadult sacra (62.5%), in 5 of 19 male or probable male sacra (26.8%) and in one (of 8) female or probable female sacrum (Appendix 2, Table 21).

Developmental abnormalities in the spine occur most frequently at the border between the different types of vertebra (Barnes, 1994). Sacralization involves just such a process - a 5th or 6th lumbar vertebra assuming the shape of a sacral vertebra and becoming fused to the sacrum, often with a degree of torsion. There was partial sacralization of the 5th lumbar vertebra in a male from G6/86 and probable sacralization of a 6th lumbar vertebra in a male individual from the White Friars' cemetery (Z86 G8) although the vertebra was fragmentary. A more unusual finding was the lumbar rib associated with sacralization (or lumbarization) of a 5th lumbar vertebra in burial LIN73 context 10, since the presence of an additional rib is also evidence of shifting of the lumbar-thoracic border.

The precondylar tubercle (formerly considered a non-metric trait) seen in a probable male from the Anglo-Saxon levels at Saltergate (context 17) probably represents a slight shift at the occipito-cervical border.

Spondylolysis involves separation of the neural arch from the vertebral body at the pars interarticularis. It occurs in 5 - 7% of the population in modern times (Wiltse et al, 1976) and there is normally a hereditary predisposition. The immediate cause is often a stress fracture which may be due to hyperextension of the upper extremity. There were 2 cases of spondylosis in the present study, one affecting a male (1 of 16 fifth lumbar vertebrae, 6.3%) and one a female (1 of 11 fourth lumbar vertebrae, 9.1%).

3. INFECTION

a. **Non-specific infection:** Evidence of infection is seen on dry bone where there is formation of new bone in response to an insult which may be traumatic or infective in origin. It is termed 'non-specific' when the causative organism cannot be isolated although often Staphylococcus aureus may be implicated. Periostitis affects the surface of the bone under the periosteum and is often seen on the tibia; osteitis affects cortical bone and may cause thickening of the shaft and narrowing of the marrow cavity; osteomyelitis is transmitted via the bloodstream and affects the entire bone.

Periostitis was observed on 6 of 16 (37.5%) male right and 4 of 16 (25%) male left tibiae (Appendix 2, Table 22). It was only seen on 1 of 12 right and 2 of 12 left female tibiae. Two of 8 (25%) subadult right and left tibiae were also affected. Two male right and one left femora also showed periostitis (9.5% and 5% respectively).

The maxillary sinus has recently been found to be much more

frequently affected by non-specific infection than was previously supposed (Boocock et al, 1995). The aetiology of the condition is multifactorial (Lewis et al, 1995), chronic inflammation being caused by repeated infections, allergies, pollution and other factors.

The sinuses were not able to be examined where crania were intact but often the maxilla is broken as the facial bones are very delicate. Four right male sinuses (of 10, 40%) and 2 left sinuses (of 11, 18.2%) showed some evidence of past infection as did one (of 4) female right and 2 (of 5, 40%) left sinuses. One subadult (of 4) also had sustained a recent infection bilaterally (Appendix 2, Table 23).

However, the most dramatic example of infection in this area was found in a young adult female from Anglo-Saxon Saltergate (189). She had extensive deposits of lamellar bone covering the entire surface of both maxillary antra (see Appendix 5). The severity and well-healed nature of the lesions suggested that there must have been a chronic infection over a long period.

b. **Specific infections: Tuberculosis**: Tuberculosis has historically been a disease associated with overcrowding and poor living conditions. In the past, it was probably acquired by humans from their livestock (Manchester, 1992) as a result of consuming infected milk and meat (gastrointestinal tuberculosis). However, with the rise of urbanization, the organism is thought to have adapted to a mode of transmission from human to human by droplet infection (coughing, etc) with the primary lesion occurring in the lung. It is interesting, therefore, to find a probable case of gastrointestinal tuberculosis in an urban situation. However, the Medieval period was notorious for the number and condition of the slaughterhouses which were situated in the cities (Rose, 1975).

The infected pelvis (see Appendix 4) was found among a collection of mixed bones from an area of the LH85 excavation which had been landscaped in the 18th century and was not in a securely datable context although it may well date to the same period as the rest of the burials, namely the 13th and 14th centuries.

The lesions were seen on the visceral surface of the left iliac fossa, on the ventral aspect of the sacrum and affecting the entire right sacro-iliac joint. There was a large circular perforation in the iliac crest, through which pus had been discharged, probably secondarily to the sacro-iliac infection. On X-ray the lesions were found to be both erosive and proliferative in nature. (See Appendix 4 for discussion of the differential diagnosis.)

4. TRAUMA

This category was represented by fractures in three individuals and one case of multiple head injuries.

a. **Fractures**

In a recent study of fractures sustained by individuals living in a Medieval urban and an early Medieval rural environment (Judd, 1994) the clavicle was the bone most often subjected to trauma among the males. Such fractures may be indirect, i.e. due to a fall where the shock is relayed to the clavicle via the arm. A mature male (CS6 LH84) had suffered a fracture of the left clavicle which was well-healed but in poor alignment and there was some disuse atrophy of the left arm bones and secondary osteoarthritis of the left acromioclavicular joint.

Another mature probable male (from Grave 17, L86) had fractured his right femoral neck. The fracture was oblique in nature and had led to a quantity of new bone formation, although it had healed without much loss of alignment. This is an injury which is normally found in individuals over the age of 60 when there may have been some loss of bone density due to senile osteoporosis. It is often caused by a fall and this theory is supported by the fact that the same individual had an old, healed rib fracture (Appendix 2, Table 24).

The distal fibula of a middle-aged probable male from the White Friars cemetery (Z87) was likely to have been fractured although the only evidence that remained was the fusion of the distal end to the well-preserved tibia. This probably represents a Potts' fracture which is sometimes sustained when the ankle is twisted (Crawford Adams, 1983).

Ununited fractures are fairly rare, even in large population surveys (Stewart, 1974). However, when they do occur the ulna is the bone that most often fails to unite after fracture. The left ulna in an additional burial from context 17 (LIN73 Area A) was ununited and the distal end had not been recovered (see Appendix 4).

Multiple head and neck injuries had been suffered by a male aged between 26 and 35 years from a double grave excavated at the Lawn Hospital (L86). There was a well-healed injury of the third cervical vertebra, a gaping wound just behind the left mastoid process on the occipital bone, an injury caused by a pointed weapon on the left parietal bone and a circular hole in top of the skull from an injury which must have proven fatal - S. Novak pers comm. (see Appendix 4). The second and third injuries seem to have occurred shortly before death since there was some evidence of healing.

5. METABOLIC

Certain deficiency diseases leave traces upon the skeleton, e.g. rickets, which is caused by a lack of vitamin D. More controversial are the conditions of porotic hyperostosis which includes porosity of the cranial bones (with thickening) and of the orbital roofs (cribra orbitalia). These lesions are thought to be caused by episodes of iron deficiency anaemia in childhood and are normally found in healed form in adult crania. Iron

deficiency may have had a protective effect against infections and parasites in ancient times by depriving pathogens of a source of iron (Stuart-Macadam, 1991a).

a. **Cribra orbitalia**: Crania were examined for this condition by the method of Stuart-Macadam, 1991b). Most of the examples of cribra orbitalia and porosity of the cranial bones were found in disarticulated contexts in this study and it is therefore probable that the prevalence reported in Appendices 4 and 5 is more representative than the few examples reported in the present study. One subadult had cribra orbitalia affecting the left orbital roof (33.3%), one male and one female had porosity of both orbits (male: 6.3% of left and 6.6% of right orbits; female: 10% of both orbits).

b. **Osteoporosis**: This is characterized by loss of bone mass although the bone itself is chemically normal. Bone mineral content begins to decline from the fourth decade of life onwards, a process which is especially marked in postmenopausal women. Bone formation continues in a relatively constant fashion but the rate of resorption increases. Examination of osteoporosis in human bone from archaeological contexts is complicated by the effects of post-depositional diagenesis (Huss-Ashmore et al, 1982).

The spine of a mature female from Silver Street in the Lower City (LIN73 A15) showed advanced osteoporotic changes with the characteristic biconcave 'cod fish' vertebrae, particularly in the thoracic spine (see Appendix 5).

6. NEOPLASIA

Osteomas are benign tumours which consist of hard masses of bone occurring on those skeletal elements which are formed in membrane, most commonly the frontal and parietal bones of the skull although they may also occur within the maxillary and frontal sinuses. They are either smooth or nodular to the touch and are represented most commonly in archaeological material by small button osteomas.

One of the crania from Silver Street (LIN73 111B) demonstrated a large ivory osteoma measuring 30 mm in greatest diameter on the right parietal bone (see Appendix 5). It is very unusual to find benign tumours of this size in a cemetery population. There was also a small button osteoma in the centre of the left parietal bone of the skull of BR85 13.

7. JOINT DISEASE

This topic has been subdivided into joint disease of the spine and osteoarthritis or erosive arthropathies affecting the major synovial joints of the body or small joints of the hands and feet. The two topics must not be viewed in isolation since

osteoarthritis of the facet joints of the spine is often associated with the same condition in other joints of the body.

a. **Spinal joint disease**

Vertebrae were examined by the method of Sager (1969) for the presence of osteophytes, porosity, Schmorl's nodes and eburnation of the facet joints indicative of bone-to-bone contact. From the third decade of life onwards, the intervertebral disk loses its elasticity and small outgrowths of bone (osteophytes) composed of disk material begin to project from the endplates of the vertebral bodies, particularly in the lower thoracic and lumbar regions.

Schmorl's nodes are etched in the vertebral end plates by the prolapse of the disk as a result of stress on the back at a young age when the cancellous centre of the vertebral body is at its most impressionable. Porosity occurs both on the endplates, particularly in the cervical and lumbar regions, and as part of the degeneration of the facet joints.

Table 26 (Appendix 2) shows the number of adult vertebrae which were observed for the presence of joint disease and Table 27 illustrates the findings for each individual. Spondylosis of the vertebral bodies is given in Tables 29 and 30. Osteophytes and porosity were almost twice as frequent in females than males, although Schmorl's nodes were very much more common in males (31.4% as opposed to 12.9%), particularly in the thoracic region. These figures probably reflect the greater number of young and young/middle-aged males in the sample.

When the figures for disease of the articular facets were compared, the males were found to have higher levels of osteoarthritic change affecting the cervical vertebrae (Appendix 2, Tables 31 and 32).

b. **Diarthrodial joint disease**

This category of disease may be systemic, when it represents a degenerative condition associated with advancing age, or it may affect a single joint in a younger person as a result of trauma, occupation or a pre-existing developmental condition which has affected the integrity of the joint, e.g. congenital hip dislocation (Collins, 1948). Most people will have at least one affected joint by the age of 60 but, unless one of the weight-bearing joints is severely affected, they will often be unaware of the fact. The prevalence rises sharply after 70 years of age.

Osteoarthritis is recognized in dry bone by the presence of eburnation (polishing), subchondral cysts, joint surface contour change and osteophytes (bony outgrowths) at the margins. Certain individuals had different combinations of affected joints. Two mature males from the Upper City site of St Bartholomew's church (LH84/85) had arthritic changes of one or more synovial joints.

CS6 had arthritis of the left acromioclavicular joint (possibly secondary to a fracture of the left clavicle) and of the first right metatarso-phalangeal joint. There was also an erosive lesion affecting the same joint which may be indicative of gout (see glossary of terms). Burial KS20 had osteoarthritis of the cervical spine and both acromioclavicular joints (Appendix 2, Table 33). A middle-aged female (burial KS12) also had osteoarthritis of several joints in the right foot and some costovertebral joints.

A mature female from the White Friars site (Z87 WB1) had osteoarthritis of the left acromioclavicular joint and had suffered severe trauma to the lower thoracic and lumbar spine. The second lumbar vertebra had tilted sideways and its inferior articular process was wedged at an angle with the process of the vertebra below.

One of the females from Silver Street (burial 188 - a mature adult) had osteoarthritis of the right hip indicated by the presence of porosity and eburnation of the right femoral head and a probable female (116D) had osteoarthritis of one of the joints in the left foot which was associated with an erosive lesion of that joint. One of the Anglo-Saxon females from Saltergate had osteoarthritis of both knees, both acromioclavicular joints, some costo-vertebral joints and of some of the apophyseal joints in the thoracic and lumbar spine.

c. Diffuse idiopathic skeletal hyperostosis (DISH)

This condition is being recognized with increasing frequency in skeletal populations. Before the 1980's it was often confused with ankylosing spondylitis. Since it is often asymptomatic, the disease is not a major problem in modern clinical practice. However, up to 10% of males and 7% of females over 70 years of age are affected. It is not found in individuals who are less than 40 years old.

The main feature of DISH is ossification of the spinal ligaments, particularly the anterior longitudinal ligament. This is accompanied by ossification of tendons and ligaments at other sites in the body such as the patellar ligaments, Achilles tendon insertions on the calcanei and triceps insertions on the ulnae. There is thought to be an association with maturity onset diabetes (Julkunen et al, 1971) and DISH has been described by Waldron as almost an occupational hazard of monastic life in the Medieval period (Waldron, 1985).

There were three individuals who showed some evidence of DISH in the present study: two females and one male. The most extreme example was a mature female (LIN73 BII 422) from a Postmedieval context. Five lower thoracic vertebrae were fused together with a covering of new bone, particularly on the right side. She also had osteoarthritis of the left acromioclavicular and two costovertebral joints. The mature male (Z86 1) from the White Friars site had probable early DISH with ossified ligaments

causing fusion of both sacro-iliac joints and enthesopathies of both iliac crests, an Achilles tendon and capsular ligaments on the proximal femora. A mature female from Whitefriars (Z87 WB1) also had ossification of the ligaments surrounding the spine (although without fusion) and a number of extraspinal manifestations of early DISH.

8. MISCELLANEOUS

a. **Hyperostosis frontalis interna**: Thickening of the frontal bone, caused by a build-up of bony ridges, occurs almost exclusively in postmenopausal females. This process affected the cranium of a mature female from the White Friars' cemetery (Z87 WB1).

9. ROMAN INFANTS

During the course of excavations in Lincoln in the period 1972 - 1987, fifteen infant burials were found in 19 contexts, a few of which also contained animal bone. Twelve of these infants came from the Wigford Area (see Appendix 3), one from the Upper City (L87 context 295) and two from the Lower City (SPM83 129 and 423). As they all date to the same phase of occupation of the city, namely the late Romano-British period, they have been treated as one sample.

Long bones and cranial elements were measured and Scheuer et al's (1980) linear regression analysis method was used to calculate an age in weeks of gestation for each infant by using the femur which was preserved in all cases. There is a standard error of two weeks quoted for these figures. Ages of Roman infant burials are shown in Table 7 and Appendix 3, Fig 1.

TABLE 7: Gestational age in weeks of Roman infant burials (S.E. - 2.08 weeks)

Skeleton no	Femoral length	Age (in weeks)
359A	79	40
359B	80	40
359C	82	41
360	72	37
2018	78	39
BVD	75	38
CJE	73	38
DAC	76	39
EB	73	38
638	76	39
641	72	37
656	77	39
295	73	38
129	82	41
423	72	37

Death had occurred in all cases between the age of 37 and 41 weeks, namely during the perinatal period. This narrow range of age at death has also been found at many other settlement and cemetery sites dating to the late Roman period (Mays, 1993). A very different picture is seen in attritional community cemeteries where the range of infant ages-at-death is much wider (Drinkall and Foreman, forthcoming).

Infanticide is referred to in the literature of the time as having been a recognized practice in Pagan societies (Watts, 1989) when infants below a certain age were treated as non-persons, but it was proscribed by Christian teaching. Indeed, neonatal infants are found as ritual deposits and buried by walls (sub grundariis) when other members of the community were interred extramurally but they appear in the cemeteries once Christianity begins to take a hold in the 4th century AD, e.g. at Poundbury (Farwell and Molleson, 1993).

Scott (1991) viewed such burials on settlement sites as ritual offerings designed to ensure fertility but was unable to determine whether stillbirth, infanticide or natural death in the immediate postnatal period was the most likely cause of death.

The relatively small number of infants found at Lincoln means that their cause of death can only be speculation.

IV. DISCUSSION

Several different types of urban excavation were incorporated in the present study. Firstly, there were two monastic cemeteries, namely the White Friars' site, latterly St Mark's station, excavated in 1986 and 1987 and the Grey Friars' cemetery situated in Silver Street where excavations took place in 1973. Burials of different categories of individual were often situated in separate parts of the cemetery or friary church. Therefore, it is not surprising that the small group of high status interments from the White Friars' cemetery consisted solely of male burials, adolescents who were probably also male and one subadult aged between 11 and 14 years. The adolescents may represent child oblates who were attached to the friary.

By contrast, the 1987 excavation at the White Friars' site was demographically more varied, as were the burials from Silver Street. Both included mature females who could have been high status members of the laiety (such individuals would often pay considerable sums for the privilege of burial in the friary cemetery), or they may have been benefactresses of the friary. When Pope Innocent IV gave permission to the friars to bury members of the local community in their cemeteries, the parish priests were incensed at the loss of part of their revenue.

Excavations of the Carmelite friary at Aberdeen produced an almost equal number of males and females, although no females survived into old age (Stones, 1989). At Blackfriars cemetery in Gloucester (Wiggins et al, unpub) the most numerous age category was mature adult (over 45); a larger sample would be needed from Lincoln in order to be able to make a comparison.

The cemetery of St Bartholomew's Church, more recently the Lawn Hospital precinct, was the site of excavations in 1984 and 1985. The number of males, females and subadults was approximately equal and burials were placed in well-ordered stone cists, suggesting that time and effort had been expended on the burial rite. However, the L86 trench, situated in another part of the Lawn Hospital grounds and also previously thought to have formed a part of St Bartholomew's cemetery, revealed a very different picture. There were a number of mass graves with large spaces between them. The impression was of a careless disposal of a number of individuals, possibly at the same time or in quick succession. In addition, the demographic picture that emerged on examination of the burials was not that of a parish cemetery with a normal age and sex profile. All the burials, apart from one (G14) were males or probable males. Their ages fell into the 25 - 45 year range apart from one elderly male (G17).

It is possible that these interments may be the result of a civil war which took place at Lincoln in this period. Additional evidence is provided by the head injuries sustained by one member

of the group (G13) which appear to have been delivered by a heavy weapon such as an axe and two pointed objects, the second of which had succeeded in penetrating the skull. The site is situated just outside the entrance of Lincoln Castle and was referred to on 19th century maps as 'the entrenchments'. However, recent archaeological evidence appears to contradict this supposition. These interments were also located near the erstwhile gallows site and the unfortunate individuals may have died by this means (Vince, pers comm), although there is no osteological evidence.

Dental health was good with a low rate of caries for the period and little enamel hypoplasia. Studies comparing caries prevalence in different time periods found that, although caries were found more frequently in the Medieval period than in Iron Age or Romano-British contexts the difference was not statistically significant (Moore and Corbett, 1973). There were few examples of crowding of the teeth or failure of third molars to develop. It is interesting to note that the caries prevalence reported by Dawes for St Mark's Church is very similar (Gilmour and Stocker, 1986) which suggests that this is not a chance finding for Lincoln at this time.

Minor developmental abnormalities of the spine were common, as they are in most cemetery samples, although there were only two examples of spondylolysis. This appears to be much more frequent in rural populations (Drinkall and Foreman, forthcoming) than on urban sites but more studies are needed. Spina bifida occulta is difficult to quantify since the abnormality varies from relatively insignificant (only the last two vertebrae affected) to a sacrum where all the vertebrae are unfused at the neural arch.

Some of the subsamples (e.g. female tibiae) were too small to be able to guage the prevalence of non-specific infection in the population as a whole although maxillary sinusitis was found in up to 40% of sinuses which is not unlike the situation in Medieval Chichester (Boocock et al, 1995).

The presence of a possible case of bovine tuberculosis in Lincoln at this period is notable because it is unusual to be able to document this type of tuberculosis in humans. There are 3 strains of tuberculosis: bovine, avian and human. It is known to be a disease of great antiquity and probably first crossed the species barrier from cattle to human after the domestication of animals in the Neolithic period. The introduction of town dairies from 1750 AD exacerbated the problem and increased the likelihood of cross-species tranmission (Francis, 1947). It is unfortunate that the affected pelvis in this study did not come from a more securely datable context and that it was not possible to inspect other parts of the skeleton.

The chances of suffering a fracture increase with age, when falls become more likely, and indeed 3 of the affected individuals were mature adults (CS6, G17 and LIN73 A17 additional burial). Moreover, old people have had more time to accumulate healed

fractures than those in the younger age groups. Femoral neck fractures, in particular, are most likely to occur in the elderly. In this century, this type of fracture has continued to increase in prevalence, particularly among women.

V. BIBLIOGRAPHY

Barnes E 1994 Developmental defects of the axial skeleton in paleopathology. University Press of Colorado, Colorado

Bass WM 1987 Human osteology: a laboratory and field manual. Missouri Archaeological Society, Missouri

Berry AC and Berry RJ 1967 Epigenetic variants in the human cranium. J Anat 101: 361-79

Boocock P, Roberts CA and Manchester K. 1995 Maxillary sinusitis in Medieval Chichester, England. Amer J Phys Anthropol 98: 483-95

Brothwell DR 1959 The use of non-metrical characters of the skull in differentiating populations. Bericht uber die 6 Tagung der Deutschen Gesellschaft fur Anthropologie.

Brothwell DR 1981 Digging up bones. 3rd edition. British Museum (Nat Hist), London

Cawson RA 1991 Essentials of dental surgery and pathology. 5th edn. Churchill Livingstone, Edinburgh

Collins DH 1949 Pathology of articular and spinal disease. Edward Arnold, London

Corrucini RS 1974 An examination of the meaning of cranial discrete traits. Amer J Phys Anthrop 40: 425-45

Crawford Adams J 1983 Outline of fractures. 8th edn. Churchill Livingstone, Edinburgh

Dawes JD and Magilton JR 1980 The cemetery of St Helen-on-the-Walls, Aldwark, in Addyman PV (ed) The archaeology of York: the Medieval cemeteries. Vol 12/1. CBA Publications, York

Drinkall, G and Foreman M (forthcoming) The Anglo-Saxon cemetery at Castledyke South, Barton-on-Humber

Farwell D and Molleson T 1993 Poundbury. Vol 2. The cemeteries. Dorset Natural History and Archaeological Society Monograph series 11. Dorchester

Finnegan M 1978 Non-metric variation of the infra-cranial skeleton. J Anat 125: 23-37

Francis J 1947 Bovine tuberculosis, including a contrast with human tuberculosis. Staples Press Ltd

Gilmour BJJ and Stocker DA 1986 St Mark's church and cemetery, in Jones MJ (ed) The archaeology of Lincoln. Vol XIII-1. CBA Publications for Trust for Lincolnshire Archaeology

Hardwick JL 1960 The incidence and distribution of caries throughout the ages in rerlation to the Englishman's diet. Brit Dent J 108: 9-17

Henneberg M 1976 The influence of natural selection on brachycephalization in Poland. Studies in physical anthropology 2: 3-19

Hillson S 1986 Teeth. Cambridge University Press, Cambridge

Huss-Ashmore R, Goodman AH and Armelagos GJ 1982 Nutritional inference from paleopathology, in (eds) Advances in archaeological method and theory. Vol 5. Academic Press

Iscan MY, Loth SR and Wright RK 1984 Age estimation from the rib by phase analysis: white males. J Forensic Sci 29: 1094-1104

Iscan MY, Loth SR and Wright RK 1985 Age estimation from the rib by phase analysis: white females. J Forensic Sci 30: 853-63

Julkunen H, Heinonen OP, Pyorala K 1971 Hyperostosis of the spine in an adult population. Ann Rheum Dis 30: 605-12

Judd M 1994 Fracture patterns in 2 populations from Medieval Britain. Unpublished MSc dissertation. Bradford University

Katz D and Suchey JM 1986 Age determination of the male os pubis. Amer J Phys Anthropol 8: 65-79

Lewis ME, Roberts CA and Manchester K. 1995 Comparative study of the prevalence of maxillary sinusitis in later Medieval urban and rural populations in Northern England. Amer J Phys Anthrop 98:497-506

Lilley JM, Stroud G, Brothwell DR and Williamson MH 1994 The Jewish burial ground at Jewbury, in Addyman PV (ed) The archaeology of York. The Medieval cemeteries. Vol 12/3. CBA Publications, York

Lovejoy CO, Meindl S, Przybeck TR and Mensforth BP 1985 Chronological metamorphosis of the auricular surface of the ilium. A new method for the determination of adult skeletal age at death. Amer J Phys Anthropol 68: 15-28

Manchester K 1992 The palaeopathology of urban infections, in Bassett S (ed) Death in towns: urban responses to the dying and the dead, 100-1600. Leicester University Press, Leicester

Mays S 1993 Infanticide in Roman Britain. Antiquity 67: 883-8

Molleson T and Cox M 1993 The Spitalfields project. The middling sort. Vol 2. The anthropology. CBA Research Report

86, CBA, York

Moore WJ and Corbett E 1973 The distribution of dental caries in ancient British populations. II. Iron Age, Romano-British and Medieval periods. Caries Res 7: 139-55

Novotny V, Iscan MY and Loth SR 1993 Morphologic and osteometric assessment of age, sex and race from the skull, in Iscan MY and Helmer RP (eds) Forensic analysis of the skull. Wiley-Liss, New York

Perizonius WRK 1979 Non-metric cranial traits: sex difference and age dependence. J Hum Evol 8: 679-84

Phenice TW 1967 A newly developed visual method of sexing the os pubis. Am J Phys Anthrop 30: 297-302

Rose L 1975 Health and hygiene. Batsford, London

Sager P 1969 Spondylosis cervicalis. Munksgaard, Copenhagen

Saunders SR 1989 Nonmetric skeletal variation, pp 95-108, in Iscan MY and Kennedy KAR (eds) Reconstruction of life from the skeleton. Alan R Liss, Inc, New York

Scheuer JL, Musgrave JH and Evans SP 1980 The estimation of late fetal and perinatal age from limb bone length by linear and logarithmic regression. Ann Hum Biol 7: 257-65

Scott E 1991 Animal and infant burials in Romano-British villas: a revitalization movement, in Garwood P and Jennings D (eds) Sacred and profane. Proceedings of a Conference on Archaeological Ritual and Religion, Oxford 1989. Oxford University Committee for Archaeology Monograph 32

Stewart TD 1974 Nonunion of fractures in antiquity, with descriptions of 5 cases from the New World involving the forearm. Bull NY Acad Med 50: 875-91

Stewart TD 1979 Essentials of forensic anthropology. Charles C Thomas, Springfield, Illinois

Stones J (ed) 1989 Three Scottish Carmelite Friaries: excavations in Aberdeen, Linlithgow and Perth, 1980-84. Society of Antiquaries of Scotland, Edinburgh

Stroud G and Kemp RL 1993 Cemeteries of St Andrew, Fishergate, in Addyman PV (ed) The archaeology of York: the Medieval cemeteries. Vol 12/2. CBA Publications, York

Stuart-Macadam P 1991a Porotic hyperostosis: changing interpretations, pp 36-39, in Ortner DJ and Aufderheide AC (eds) Human paleopathology: current syntheses and future options. Smithsonian Institution Press, Washington

Stuart-Macadam P 1991b Anaemia in Roman Britain: Poundbury

Camp, pp 101-13, in Bush H and Zvelebil M (eds) Health in past societies, BAR International Series 567

Townsley W 1946 Platymeria. J Path Bact 63: 85-88

Trinkhaus E 1975 Squatting among the Neandertals: a problem in the behavioral interpretation of skeletal morphology. J Arch Sci 2: 327-51

Trotter M 1970 Estimation of stature from intact long limb bones, pp 71-4 in Stewart TD (ed) Personal identification in mass disasters. National Museum of Natural History, Washington, DC

Waldron T 1985 DISH at Merton Priory: evidence for a 'new' occupational disease? Brit Med J 291: 1762-3

Waldron T 1994 Counting the dead: the epidemiology of skeletal populations. John Wiley and Sons, Chichester

Watts DJ 1989 Infant burials and Romano-British Christianity. Archaeol J 149: 172-83

Wells C 1964 Bodies, bones and disease. Thames and Hudson Ltd, London

Wenham LP 1968 The Romano-British cemetery at Trentholme Drive, York. Ministry of Public Buildings and Works: Archaeological reports, no 5.

White W 1988 Skeletal remains from the cemetery of St Nicholas Shambles, City of London. The Museum of London and Middlesex Archaeological Society, London

Wiggins R, Boylston A and Roberts CA (unpub) The human skeletal remains from Blackfriars, Gloucester

Williams P and Warwick R 1980 Gray's Anatomy. 26th edition. Churchill-Livingstone, London

Wiltse LL, Newman PH and MacNab I 1976 Classification of spondylolisis and spondylolisthesis. Clin Orthop Rel Res 117: 23-29

Workshop of European Anthropologists 1980 Recommendations for age and sex diagnosis of skeletons. J Hum Evol 9: 517-49

ACKNOWLEDGMENTS

Dr Keith Manchester is thanked for giving opinions on some of the palaeopathological diagnosis, particularly the gastrointestinal tuberculosis. The recording forms were designed by Sarah King from a model prepared by Dr Charlotte Roberts. The authors are grateful to Ms Jean Brown for the photography.

APPENDIX 1

The Sample

1. Wigford Sites

Medieval

St Mark's Station (White Friars' cemetery - Z86 and Z87)
Graves 1 - 9/86, context 87
BR85 (watching brief)
Watching brief (WB 1 - 5/87)

Romano-British
806, 807 (ZE87)

Romano-British Infant Burials
CZY, DAC, BJA, BVD, CJE, COU/KF (St Mark's church SM76)

348 (359), 348 (360), 2018 (St Mary's Guildhall SMG82)

DW, EB, FW, KI, KU (High Street HG72)

638, 641, 656 (St Mark's Station - ZE87)

2. Upper City Sites

Medieval

St Bartholomew's cemetery (LH84, LH85, L86)
AS3, BS1, BS2, CS4, CS6, CS7, CS9, ES8, FF15, KS12, KS18, KS20, KS21, unknown context (UC), discrete burial from MB85 (MB), L86 graves 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 16, 17, 18, 19, 20

Romano-British Infant Burials
KS19, 295 (L87)

3. Lower City Sites

Medieval

Silver Street
LIN73 Area A 10, 11, 15, 17, 17A
Area B 111A, 111B, 111C, 111D, 111E

Postmedieval

Silver Street
422

Anglo-Saxon

Saltergate
17, 187, 188, 189

Romano-British
BE73 VI

Roman infants
SPM 129, 423

APPENDIX 2

TABLE 1: Minimum Number of Individuals

			Male*	Female**	Subadult
Petrous temporal bone		- left	16	15	7
		- right	14	13	6
Mandible		- left	15	14	7
		- right	14	15	6
Maxilla		- left	15	14	4
		- right	14	11	4
Humerus	- proximal	- left	17	12	9
	- distal	- left	13	15	9
	- proximal	- right	14	12	7
	- distal	- right	16	15	7
Radius	- proximal	- left	12	12	8
	- distal	- left	14	14	6
	- proximal	- right	14	14	6
	- distal	- right	16	11	6
Ulna	- proximal	- left	11	12	8
	- distal	- left	12	16	5
	- proximal	- right	16	14	7
	- distal	- right	14	10	6
Femur	- proximal	- left	21	17	11
	- distal	- left	17	16	10
	- proximal	- right	22	16	10
	- distal	- right	19	15	10
Tibia	- proximal	- left	17	13	8
	- distal	- left	17	16	0
	- proximal	- right	17	16	10
	- distal	- right	17	15	8
Fibula	- proximal	- left	11	6	7
	- distal	- left	13	8	8
	- proximal	- right	10	10	6
	- distal	- right	14	9	7
Acetabulum		- left	18	15	8
		- right	20	13	8
Calcaneus		- left	14	10	6
		- right	13	8	6
Talus		- left	13	11	5
		- right	12	8	4

* Includes ? Male
** Includes ? Female

TABLE 2: Age Distribution

Age Category	Number of Individuals
Subadult (<20 years)* <1 year 1 4 - 6 years 1 7 - 10 years 1 11 - 14 years 4 15 - 19 years 6	14
Young adult (21 - 25 years)	8
Young/middle-aged adult (26 - 35)	15
Middle-aged adult (36 - 45)	9
Mature adult (46 years onwards)	13
Adult	6
TOTAL	65

*All ages are approximate and are intended as a guide

TABLE 3: Sex Distribution

Sex estimation	Number of individuals
Male	19
Female	17
? Male	9
? Female	4
Adult	2
Subadult	14

TABLE 4: Stature (cm)

Sex	Range	Mean	Cases
Male	157.6 - 183.7	173.1	17
Female	149.4 - 163.8	158.9	8

TABLE 5: Cranial Measurements (mm)

		Range	Mean	Cases
Maximum cranial length				
Male		172-196	185.0	3
Female		167-174	170.5	4
? Female		174	174	1
Maximum cranial breadth				
Male		145-154	148.7	3
Female		136-151	144	4
? Female		149	149	1
Basion-bregma height				
Male		138-146	142.0	2
Female		129-137	133.7	3
? Female		136	136	1
Minimum frontal breadth				
Male		95-106	101.2	5
Female		93-100	96.5	4
? Female		107	107	1
Facial height				
Male		108-118	113.0	2
Female		114-122	118	2
? Female		127		1
Upper facial height				
Male		66-67	66.7	3
Female		63-71	66.7	3
? Female		73		
Nasal height				
Male		48-58	53.0	3
Female		51-52	51.5	2
? Female		53	53	1
Nasal breadth				
Male		22-25	23.3	3
Female		23		3
? Female		23	23	1
Orbital height				
Male	right	30-32	31.3	4
	left	33	33	2
Female	right	31-34	32.3	3
	left	32-35	33.5	2
? Female	right	34	34	1
	left	32	32	

Orbital breadth		Range	Mean	Cases
Male	right	38-42	40.0	3
	left	36-40	38.0	2
Female	right	35-43	39.3	3
	left	37-42	39.5	2
? Female	right	42	42	1
	left	43	43	1
Palatal length				
Male		45-49	47.0	4
Female		41-46	43.7	3
? Female		48	48	1
Palatal breadth				
Male		41-44	42.5	4
Female		37-41	39.7	3
? Female		45	45	1

Mandible

Bicondylar breadth			
Female	118-134	126	2
? Female	122	122	1
Bigonial breadth			
Female	100-101	100.5	2
? Female	94	94	1
Height of ascending ramus			
Male	63-76	68.3	4
Female	59-70	63	3
? Female	69	69	1
Minimum breadth of ascending ramus			
Male	29-38	33.4	9
Female	29-34	31.8	4
? Female	29	29	1
Symphyseal height			
Male	23-33	28.1	8
Female	27-31	29.0	4

TABLE 6: Postcranial Measurements (mm)

		Range	Mean	Cases
Clavicle				
Maximum length				
Female	right	117-140	128.5	2
	left	121-145	136.5	4
Male	left	143-156	151	8
Humerus				
Maximum length				
Male	right	301-351	332.4	8
	left	295-336	320.3	7
Female	right	311-317	314.0	2
	left	248-315		3
Humeral head diameter				
Male	right	43-52	47.8	11
	left	42-50	47.4	12
Female	right	40-44	42.5	4
	left	39-45	42.0	4
Bicondylar width				
Male	right	58-74	65.8	11
	left	58-68	64.7	10
Female	right	46-60	53.1	4
	left	47-61	54.0	6
Radius				
Radial length				
Male	right	215-277	249.9	9
	left	210-256	236.5	4
Female	right	224	224	1
	left	213-232	222.3	3
Ulna				
Ulnar length				
Male	right	229-297	278.0	7
	left	224-280	261.8	6
Female	right	210-245	232.3	3
	left	212-246	233.3	3
Femur				
Maximum length				
Male	right	401-503	463.9	9
	left	404-483	445.8	5
Female	right	416-434	424.5	4
	left	417-428	421.7	3

Femoral head diameter		Range	Mean	Cases
Male	right	44-55	50.2	14
	left	43-55	49.8	13
Female	right	41-45	42.6	5
	left	41-44	42.4	5
Antero-posterior diameter				
Male	right	26-34	29.5	15
	left	26-34	29.3	14
Female	right	20-29	31.7	7
	left	20-28	25.2	6
Medio-lateral diameter				
Male	right	30-47	36.9	15
	left	30-46	36.5	14
Female	right	29-36	31.7	7
	left	27-37	32.5	6
Tibia				
Maximum length				
Male	right	319-405	369.4	12
	left	322-405	368.6	10
Female	right	303-344	328.0	5
	left	302-353	332.7	6
Antero-posterior diameter				
Male	right	35-43	38.3	7
	left	36-41	38.2	6
Female	right	30-34	31.3	4
	left	30-35	32.0	4
Medio-lateral diameter				
Male	right	26-28	26.6	7
	left	25-28	26.3	6
Female	right	20-24	22.8	4
	left	18-25	222.5	4
Fibula				
Maximum length				
Male	right	356-407	381.5	2
	left	339-358	348.5	2
Male	right	324-336	330.0	2
	left	326	326	1

TABLE 7: Cranial and Postcranial Indices

		Range	Mean	Cases
Cranial index				
Male		75-84	80.5	3
Female		79-89	90.4	1
? Female		85.6	85.6	1
Height/length index				
Male		78-80	79.2	2
Female		78-89	81.7	4
? Female		78.1	78.1	1
Height/breadth index				
Male		94-95	94.9	2
Female		89-96	92.6	4
? Female		91.2	91.2	1
Nasal index				
Male		42-48	44.2	3
Female		45-50	47.6	2
? Female		43.4	43.4	1
Orbital index				
Male	right	76-82	79.3	3
	left	83-92	87.1	2
Female	right	75-97	83.0	3
	left	76.97	86.4	2
? Female	right	80.9	80.9	1
	left	76.7	76.7	1
Palatal index				
Male		84-98	90.6	4
Female		89-93	90.8	3
? Female		93.8	93.8	1
Platymeric index				
Male	right	73-91	82.4	15
	left	74-94	82.4	14
Female	right	69-90	77.4	7
	left	73-88	77.5	6
Platycnemic index				
Male	right	65-77	69.6	7
	left	63-72	69.1	6
Female	right	69-90	71.8	4
	left	60-75	70.2	4

TABLE 8. Cranial non-metric traits

	Male		Female		Subadult
Ossicle at lambda	1 of 11		1 of 10		1 of 7
Lambdoid ossicles	3 of 11		4 of 11		5 of 7
Metopic suture	2 of 10		2 of 13		1 of 5
Ossicles in sagittal suture	0 of 9		0 of 11		1 of 7
	Right	**Left**	**Right**	**Left**	
Epipteric bone	2 of 7	1 of 6	1 of 9	1 of 8	
Parietal notch bone	1 of 7	0 of 9	2 of 9	1 of 7	
Ossicle at asterion	2 of 5	0 of 8	1 of 10	0 of 9	
Auditory torus	0 of 10	0 of 11	0 of 8	0 of 9	
Foramen of Huschke	1 of 10	2 of 12	1 of 8	0 of 9	
Mastoid foramen exsutural	4 of 11	3 of 10	3 of 10	4 of 10	
Mastoid foramen absent	3 of 11	1 of 10	3 of 10	3 of 10	
Posterior condylar canal open	3 of 9	4 of 9	5 of 8	3 of 8	
Double anterior condylar canal	2 of 10	4 of 11	1 of 7	0 of 7	
Double condylar facet	0 of 10	0 of 11	0 of 8	0 of 7	
Precondylar tubercle	0 of 9	0 of 9	1 of 7	1 of 7	
Incomplete foramen ovale	0 of 4	0 of 6	0 of 7	0 of 6	
Open foramen spinosum	3 of 3	4 of 4	5 of 5	4 of 4	
Accessory lesser palatine foramen	4 of 7	3 of 8	2 of 5	3 of 8	
Palatine torus	0 of 14	0 of 15	1 of 7	1 of 4	
Maxillary torus	1 of 14	0 of 15	0 of 8	0 of 7	
Zygomatico-facial foramen	5 of 10	5 of 7	5 of 8	5 of 7	
Bridging of supraorbital notch	3 of 11	1 of 11	3 of 10	4 of 9	
Accessory supraorbital foramen	4 of 11	1 of 12	3 of 8	2 of 8	

TABLE 9: Postcranial non-metric traits

	Male		Female		Subadult	
	Right	Left	Right	Left	R	L
Allen's fossa	1 of 14	0 of 13	0 of 4	0 of 5	1*	1
Poirier's facet	2 of 13	1 of 11	1 of 4	0 of 6		
Plaque	1 of 15	3 of 11	0 of 4	1 of 6		
Hypotrochanteric fossa	4 of 14	5 of 16	3 of 8	2 of 8		
Exostoses in " fossa	4 of 14	5 of 16	3 of 8	2 of 8		
Medial tibial squatting facet	0 of 14	0 of 13	3 of 9	3 of 9		
Lateral " " "	4 of 14	3 of 13	7 of 8	8 of 10		
Septal aperture	1 of 13	1 of 13	1 of 8	0 of 8		
Sternal foramen	1 of 7		0 of 4			
Bridging of suprascapular notch	1 of 6	0 of 7	1 of 6	0 of 2		
Vastus notch	3 of 8	2 of 8	0 of 5	0 of 3		
Os trigonum	1 of 7	0 of 9	0 of 5	1 of 7		
Single inferior talar facet	5 of 11	6 of 11	5 of 7	5 of 7	3	3
Double " " "	6 of 11	5 of 11	2 of 7	2 of 7	1	1
Single anterior calcaneal "	4 of 10	4 of 9	5 of 6	5 of 7	3	4
Double " " "	6 of 10	5 of 9	1 of 6	2 of 7	1	1
Absent " " "	0 of 10	0 of 9	0 of 6	0 of 6	1	1
Peroneal tubercle	5 of 9	4 of 10	1 of 5	2 of 7	3	2
Posterior atlas bridging	1 of 10	1 of 9	0 of 2	0 of 2		
Lateral atlas bridging	0 of 11	0 of 10	1 of 5	1 of 5		
Transverse foramen bipartite	3 of 8	3 of 10	3 of 4	3 of 6	4	4
Foramen transversarium anomaly					1	(C7)

* See Table 1 for frequencies

TABLE 10: Teeth available for observation (laterality not considered)

Permanent		1	2	3	4	5	6	7	8	Tot
Male	max	20	22	24	22	22	22	23	19	174
	mand	20	25	25	23	23	21	23	22	182
Female	max	11	11	12	11	11	8	9	9	82
	mand	11	14	17	14	14	12	16	15	114
?M	max	4	3	4	3	3	2	3	2	24
	mand	2	5	5	4	3	3	3	2	27
? F	max	0	0	0	0	0	0	0	0	0
	mand	0	0	0	0	0	0	0	0	0
Adult	max	3	2	3	2	2	2	2	3	19
	mand	2	2	3	2	3	2	3	3	20
< 20	max	7	8	10	9	9	11	10	8	71
	mand	8	10	9	8	9	15	14	10	83
Total		88	102	112	100	97	98	106	93	796

Deciduous	a	b	c	d	e	Total
Maxillary	0	3	0	2	6	11
Mandibular	1	0	1	1	0	3
Total	1	3	1	3	6	14

TABLE 11: Antemortem Tooth Loss (laterality not considered)

Permanent		1	2	3	4	5	6	7	8	Tot
Male	maxilla	1	0	0	2	2	4	3	5	17
	mandible	2	0	2	0	3	7	4	2	20
Female	maxilla	0	0	1	2	3	6	5	5	24
	mandible	0	0	0	0	0	5	1	0	6
?M	maxilla	0	0	0	1	0	2	2	2	7
	mandible	3	0	0	0	2	2	2	2	11
? F	maxilla	0	0	0	2	1	2	2	2	9
	mandible	0	0	0	0	0	0	0	0	0
Adult	maxilla	0	0	0	0	0	0	0	0	0
	mandible	0	0	0	1	0	1	0	0	2
TOTAL		6	0	3	8	11	29	19	18	94

TABLE 12: Postmortem Tooth Loss (laterality not considered)

Permanent	1	2	3	4	5	6	7	8	Tot
Male maxilla	5	4	2	2	2	0	0	0	15
mandible	6	3	2	5	2	0	1	3	22
Female maxilla	3	3	1	1	0	0	1	1	10
mandible	7	4	1	2	6	1	0	1	22
?M maxilla	2	2	0	0	1	0	0	0	5
mandible	1	0	0	1	0	0	0	1	3
? F maxilla	2	2	2	0	1	0	0	0	7
mandible	0	0	0	0	0	0	0	0	0
Adult maxilla	1	2	1	0	0	0	0	0	4
mandible	0	0	0	0	0	0	0	0	0
< 20 maxilla	6	3	3	2	2	0	1	0	17
mandible	5	3	4	3	2	0	0	0	17
TOTAL	38	26	16	16	16	1	3	6	122

Deciduous	a	b	c	d	e	Total
Maxillary	1	0	1	0	0	2
Mandibular	0	0	0	0	0	0
Total	1	0	1	0	0	**2**

TABLE 13: Dental Caries: Teeth Affected (laterality not considered)

Permanent	1	2	3	4	5	6	7	8	Tot
Male maxilla	1	1	0	0	1	1	3	0	7
mandible	0	0	0	0	1	4	2	1	8
Female maxilla	0	0	0	0	1	1	1	1	4
mandible	0	0	0	0	1	3	3	0	7
?M maxilla	0	1	2	0	0	0	0	0	3
mandible	0	0	0	0	0	1	0	0	1
<20 mandible	0	0	0	0	0	1	0	0	1
TOTAL	1	2	2	0	4	11	9	2	31

TABLE 14: Dental Caries: Site Frequency (laterality not considered)

Sex	Occl	Bucc	Ling	Mes	Dis	Multi	Tot
Male	2	1	0	6	4	3	15
Female	0	0	0	3	4	3	10
? Male	0	0	0	0	0	4	4
Subadult	0	0	0	0	0	1	1
Total	2	1	0	9	8	11	31

TABLE 15: Dental Caries: Age and Sex Distribution

Sex	**Young adult**	Young/ middle-aged adult	Middle-aged adult	Mature adult	Adult
Male	2	1	1	2	0
Female	0	4	1	1	2
? Male	0	0	0	1	1

TABLE 16: Dental Abscesses: Teeth Affected

Sex	1	2	3	4	5	6	7	8	Tot
Male maxilla	0	1	2	0	0	0	4	1	8
mandible	0	0	0	0	0	0	1	0	1
Female maxilla	0	0	0	0	0	2	0	0	2
mandible	0	0	0	0	1	2	0	0	3
Adult mandible	0	0	0	0	0	1	0	0	1
TOTAL	0	1	2	0	1	5	5	1	15

TABLE 17: Calculus: Teeth Affected (laterality not considered)

Sex	1	2	3	4	5	6	7	8	Tot
Male max	11	13	9	8	6	7	5	4	63
mand	20	19	20	8	7	12	12	5	103
Female max	2	2	3	3	3	7	8	3	31
mand	8	8	11	6	6	6	7	4	56
? M max	0	0	0	1	0	0	1	0	2
mand	0	2	1	1	0	0	1	1	6
? F max	0	1	0	1	1	2	1	0	6
mand	1	1	1	1	2	1	2	1	10
Adult max	3	1	1	1	1	2	2	1	12
mand	3	2	3	1	0	1	0	0	10
< 20 max	0	0	1	1	1	1	0	0	4
mand	6	3	2	0	0	5	2	0	18
Total	54	52	52	32	27	44	41	19	321

TABLE 18: Periodontal Disease (number of half jaws, grading based on Brothwell, 1981)

Age category	Slight	Medium	Considerable	Total
Maxilla				
Young adult	4	0	0	4
Young-middle aged adult	5	4	2	11
Middle-aged adult	2	0	2	4
Mature adult	0	0	10	10
Mandible				
Young adult	2	0	0	2
Young/middle-aged adult	9	5	2	16
Middle-aged adult	0	1	3	4
Mature adult	0	3	10	13
TOTAL	22	13	29	64

TABLE 19: Enamel Hypoplasia: Teeth Affected (laterality not considered)

Permanent	1	2	3	4	5	6	7	8	Tot
Male maxilla	2	0	3	0	0	0	0	0	5
mandible	0	1	4	0	1	0	1	2	21
Female maxilla	9	7	7	1	0	1	1	3	29
mandible	8	8	12	8	0	2	0	1	39
? M maxilla	1	0	0	0	0	1	1	0	3
mandible	0	2	2	1	0	0	0	0	5
? F maxilla	8	8	9	6	5	0	0	1	37
mandible	0	0	6	3	2	1	0	1	13
Adult maxilla	1	1	0	1	0	0	0	0	3
mandible	0	1	3	1	0	0	1	1	7
<18 maxilla	4	0	1	0	1	0	0	0	6
mandible	2	3	3	0	1	0	0	0	9
TOTAL	45	33	60	29	10	6	5	9	197

TABLE 20: Dental Disease: Individuals Affected

No	Sex	Age	Absc	Caries	Calc	AMLoss	Hypo	POD
Medieval								
Z86 1	M	MA	+	+	+	+	-	+
2	M	YMAA	-	-	+	-	-	-
3	I	SA	-	+	+	-	-	-
5	I	SA	-	-	+	-	+	-
6	I	SA	-	-	+	-	-	-
7	M	YA	-	-	+	-	+	-
8	M	YA	+	+	+	-	-	+
9	M	YMAA	-	-	+	-	+	+
BR13	M	YMAA	-	-	+	-	-	+
SM87	?M	MA	+	-	-	+	-	+
WB1	F	MA	-	-	-	+	-	+
WB4	F	YMAA	+	+	+	+	-	-
WB5	?F	MA	-	-	-	+	-	+
CS4	M	MAA	-	-	+	-	+	+
CS6	M	MA	+	+	+	+	-	+
CS7	I	SA	-	+	+	-	+	-
CS9	I	SA	-	+	+	-	-	-
ES8	F	Ad	+	+	+	+	-	+
KS12	F	MAA	-	+	+	-	-	+
KS18	I	SA	-	-	-	-	-	-
KS21B	I	YMAA	-	-	+	-	-	+
UC	F	YMAA	-	+	+	-	+	+
MB	F	YMAA	-	+	+	-	+	+
G12	M	YA	-	-	+	+	-	-
G13	M	YMAA	+	+	+	-	-	+
G17	?M	MA	-	+	+	+	-	+
G20	?M	Ad	-	+	+	+	+	+
62	I	MA	+	-	+	+	+	+
VIAC	F	YMAA	-	+	+	-	-	-
10	M	MAA	+	+	+	+	-	+
11	M	YMAA	-	-	+	+	-	+
15	F	MA	-	+	-	+	-	+
17	I	SA	-	-	+	-	-	-
111A	F	MA	+	-	-	+	-	+
111B	F	Ad	+	+	+	+	-	+
111C	M	YA	-	+	+	-	-	+
116D	?M	YMAA	-	-	+	-	+	-
Saxon								
17	?M	YA	-	-	-	-	-	+
187	F	YMAA	-	-	+	-	-	+
188	F	MA	-	-	+	+	-	+
189	F	YA	-	-	+	-	-	-

TABLE 21: Developmental abnormalities of the spine

Skel No	Abnormality	Vertebra affected	Comments
Z86 1	Spina bifida	S4 & S5	-
Z86 3	" "	S4 & S5	-
Z87 WB3	" "	S1 - S5	Subadult
CS7/84	" "	S2 - S5	Subadult Transverse foramen abnormalities
CS9/84	" "	S3 - S5	" " "
G3/86	" "	S1, S4 & S5	-
G5/86	" "	S1	Slit at apex
LC84	" "	S3 - S5	-
LIN73 111C	" "	S1	-
LIN73 A17	" "	S5	Slit in arch
LIN73 116D	" "	S5 & S6	-
Z86 8	Sacralization	L6	-
G6/86	" "	L5	Partial
LIN73 A11	6 sacral vertebrae	sacrum	-
LIN73 116D	" "	"	-
BS1 84	Spondylolysis	L5	1st coccygeal vertebra fused to sacrum
MB 85	Spondylolysis	L4	-

TABLE 22: Non-specific infection of the lower extremities

Skeleton no	Bone affected	Severity	Healed or recent
Z86 5	Left tibia	Slight	Recent
CS4/84	Both tibiae	Thickening of left shaft	Well-healed
CS6/84	Right tibia	Thickening of bone laterally	Recent
CS7/84	Both tibiae	Moderate*	Healing
KS20	Right femur	Thickening of shaft	Healed
KS21	Left tibia	Thickening of shaft	Healed
UC/85	Right tibia Left tibia	Slight Thickening of shaft	- Recent
G19/86	Both tibiae	Moderate	Well-healed
G20/86	Right tibia	Slight	Well-healed
LC84/72	Both tibiae	Considerable	Interosseous surface
LIN73 A11	Left tibia	Moderate	Recent and healing
LIN73 A17	Right tibia	Slight	Healed
LIN73 111C	Both femora, right tibia	Moderate	Recent and healing

* Slight = Up to one third of shaft affected
Moderate = Two thirds of shaft affected
Considerable = Entire length of shaft affected, although there may be only one surface of the bone involved.

TABLE 23: Maxillary sinusitis

Skeleton no	Bone affected	Severity	Comments
Z86 1	Both sinuses	Slight	Diffuse porosity
Z86 2	Right sinus	Slight	Porous new bone on floor of antrum
Z86 3	Both sinuses	Slight	Porous new bone
Z86 9	Both sinuses	Slight	Remodelled
Z87 WB4	Left sinus	Slight	? associated with dental disease
LH84 CS4	Right sinus	Slight	Porous new bone
LIN73 111B	Both sinuses	Slight	Remodelled

TABLE 24: Fractures

Skeleton no	Bone Affected	Type of fracture/injury
Z87 WB2	Left tibia	Probable fracture at distal end (fused to tibia)
LH84 CS6	Left clavicle	Loss of alignment
L86 G13	Cranium and 3rd cervical vertebra	Head and neck injuries
L86 G17	Left femoral neck	Oblique fracture
L86 G17	Left rib	Mid-shaft fracture
LIN73 A17	Left ulna	Ununited fracture

TABLE 25: Metabolic

Skeleton no	Lesion	Bone affected	Severity
LIN73 A17	Cribra orbitalia	Left orbit	Moderate (SM type III-IV)
LIN73 A10	" "	Both orbits	Slight (SM type II)
LIN73 116D	" "	" "	Slight (SM type II)

TABLE 26: Numbers of adult vertebrae, or parts of vertebrae observed

Vertebra		Male	Female
Cervical	1	11	8
	2	10	7
	3	10	8
	4	10	6
	5	11	7
	6	11	7
	7	9	6
Thoracic	1	14	8
	2	11	7
	3	13	9
	4	12	5
	5	12	4
	6	13	4
	7	13	5
	8	14	5
	9	15	5
	10	14	6
	11	13	4
	12	15	8
Lumbar	1	16	7
	2	17	8
	3	16	9
	4	15	11
	5	16	11

TOTALS: Cervical: male 72, female 49
Thoracic: male 159, female 70
Lumbar: male 129, female 46

TABLE 27: Spinal Preservation and Prevalence of Joint Disease

Grave cuts with no vertebrae available for observation

BR85 13, SM87 Cist burial, Z87 WB2 & WB5, LH84 CS6, LH85 Unknown Context, L86 G19 & G20, BE73 VIAC, LIN 73 111C, LIN 73 Area E 17 & 188.

Individuals with spines present but no pathology

ZE87 806, LH85 KS21B, LH85 mixed bones discrete burial, L86 G7, G10 and G12, LIN 73 116E, LIN 73 Area E 189.

TABLE 28: Individuals with Joint Disease of the Spine

Skel No	Sex	Age	Vertebral Body			Articular Process		
			OP*	PO	SN	OP	PO	EB
Z86 1	M	M	+	-	-	+	+	-
Z86 2	M	YMAA	+	-	+	+	+	-
Z86 6	I	SA	-	-	+	-	-	-
Z86 7	M	YA	-	-	+	-	-	-
Z86 8	M	YA	-	-	+	-	-	-
Z86 9	M	YMAA	-	-	+	-	-	-
CS4	M	MAA	+	-	+	-	-	-
KS20	M	MA	+	+	-	+	+	+
G3	M	YMAA	+	-	+	+	-	-
G4	M	MA	+	-	-	+	-	-
G5	?M	YMAA	+	-	+	+	+	-
G6	M	MAA	+	-	+	+	-	-
G11	?M	AD	+	-	+	+	-	-
G13	M	YMAA	+	+	+	+	-	-
G16			+	-	-	-	-	-
WB1	F	MA	+	-	-	+	+	-
WB4	F	YMAA	+	-	-	+	-	-
BS2	F	YMAA	+	-	+	-	-	-
ES8	F	AD	+	+	-	+	+	-
KS12	F	MAA	+	+	+	+	-	-
KS21A	?F	MAA	+	+	-	-	-	-
G14	F	MAA	+	-	+			

TABLE 29: Number of vertebral bodies affected by spondylosis

Vertebra		Osteophyte		Porosity		Schmorl's nodes	
		M	F	M	F	M	F
C*	1	1	1	0	0	0	0
	2	2	0	0	0	0	0
	3	0	2	0	2	0	0
	4	1	1	1	1	0	0
	5	2	2	1	3	0	0
	6	2	5	2	3	0	0
	7	1	2	0	1	0	0
T	1	2	1	0	0	0	0
	2	1	1	0	1	0	0
	3	5	3	0	1	0	0
	4	2	3	0	1	2	1
	5	4	2	0	0	4	0
	6	3	2	0	1	4	0
	7	5	2	0	1	7	1
	8	6	3	1	1	7	3
	9	5	4	0	1	7	1
	10	3	5	0	1	9	1
	11	4	3	0	0	5	1
	12	6	2	1	2	5	1
L	1	4	1	0	1	7	1
	2	5	3	1	1	5	0
	3	6	5	0	1	5	2
	4	4	7	1	1	4	1
	5	4	3	1	1	2	1

*C = cervical, T = thoracic, L = lumbar

Table 30: Comparison of percentage rates of spondylosis between the sexes

Type of lesion		Male		Female	
		No	%	No	%
Osteophytes	- cervical	9	12.5	13	26.5
	thoracic	46	28.9	31	44.2
	lumbar	38	29.5	19	41.3
Porosity	- cervical	4	5.6	10	20.4
	thoracic	2	0.6	10	14.3
	lumbar	3	2.3	5	10.9
Schmorl's nodes	- cervical	0	0	0	0
	- thoracic	50	31.4	9	12.9
	- lumbar	5	17.8	5	10.9

TABLE 31: Number of vertebrae whose articular facet joints are affected by osteoarthritic changes

Vertebra		Osteophytes		Porosity		Eburnation	
		M	F	M	F	M	F
Cervical	1	0	0	0	0	0	0
	2	2	0	1	0	1	0
	3	3	1	2	0	2	1
	4	2	0	2	1	2	0
	5	0	0	0	0	0	0
	6	1	0	0	0	0	0
	7	0	0	0	0	0	0
Thoracic	1	2	1	0	0	0	0
	2	0	1	0	1	0	0
	3	0	1	0	1	0	0
	4	0	1	0	1	0	0
	5	1	1	0	0	0	0
	6	2	0	0	1	0	0
	7	3	0	0	0	0	0
	8	3	1	1	0	0	0
	9	5	1	1	0	0	0
	10	5	2	0	0	0	0
	11	4	2	0	0	0	0
	12	3	3	0	0	0	0
Lumbar	1	2	1	0	0	0	0
	2	2	1	0	0	0	0
	3	2	3	0	0	0	0
	4	6	4	0	0	0	0
	5	5	3	0	0	0	0
Sacral	1	0	2	0	2	0	2

TABLE 32: Comparison of percentage rates of vertebrae with articular processes affected by joint disease between the sexes

Type of lesion		Male		Female	
		No	%	No	%
Osteophytes	- cervical	8	11.1	1	2.0
	thoracic	28	17.6	14	20.0
	lumbar	17	13.2	12	26.1
Porosity	- cervical	5	6.9	1	2.0
	thoracic	2	1.3	4	5.7
	lumbar	0	0	0	0
Eburnation	- cervical	5	3.9	1	2.0
	thoracic	0	0	0	0
	lumbar	0	0	0	0

ST MARK'S STATION (CARMELITE FRIARY)

Investigations at this site took place in 5 phases, the first of which consisted of a trial trench excavated following the closure of this station in 1985. A single skull was revealed (BR 85 context 13).

The following year a major excavation (code number Z86) took place between the platforms of the railway station and part of the friary cemetery was uncovered. Human remains were found near one of the friary buildings (building 12) and date to the 13th to 15th centuries when the graveyard was truncated by two large buildings with stone buttresses.

There was a group of fairly complete burials (labelled Graves 1 to 9), one of which (Grave 4) was partly encased in masonry, a less complete burial (context 87) and four small contexts containing human bone. The remains of 3 infants were found in association with structures dating to the Roman period.

During 1987, two trenches were excavated: one running north-south and located to the east of the previous year's investigations. This recorded a complete stratigraphic sequence down to the earliest evidence of settlement in the area and included three Roman burials (ZE87). The other took the form of a watching brief situated to the north of the previous excavation where some of the friary foundations were uncovered (Z87). The remains of at least five individuals were incorporated in this context.

Site Z86 (Graves 1 - 9, context 87)

The material from this site was in a very good state of preservation which enabled a complete record of each burial to be made including age, sex and stature estimation, metric and non-metric observations, dental and skeletal palaeopathology. Demographic data is included in the present short report. Methods used, non-metric and pathological results are discussed in the introductory section.

1. Preservation (Table 1)
Seven of the ten burials examined were in the good or very good categories.

TABLE 1: Degree of Preservation

Grade	Number of Individuals	Context Numbers
1 (>75%)	3	79, 83, 161
2 (>50%)	4	19, 24, 184(8), 184(9)
3 (>30%)	0	0
4 (>10%)	3	30, 74, 87
5 (<10%)	3	16, 121, 234

Three of the adolescents were less well preserved and there were three small contexts which fell into the least well preserved group; the fourth consisted of an animal bone.

2. Sex (Table 2)

All the adult individuals were males and the three adolescents who were in the process of acquiring their secondary sexual characteristics were probable males. The two subadults could not be accorded a sex since their physical development was not sufficiently advanced.

TABLE 2: Sex

Sex	Number of Individuals	Context Numbers
Male	5	19, 24, 161, 184(8), 184(9)
? Male	3	30, 83, 87
Indeterminate - subadult	2	74, 79
Total	10	10

3. Age (Table 3)

Of the 5 adults in this small sample, two were young adults whose late-fusing epiphyses (e.g. the medial clavicle) were still visible as separate entities, two were young/middle-aged adults and one was a mature adult with a completely ossified thyroid cartilage (suggesting an age exceeding 60 years: Krogman and

TABLE 3: Age

Age	Number of Individuals	Context Numbers
11 - 14 years	2	74, 79
15 - 20 years	3	30, 83, 87
Young adult (21 - 25 years)*	2	161, 184(8)
Young/middle adult (26 - 35 years)	2	24, 184(9)
Middle-aged adult (36 - 45 years)	0	0
Mature adult (over 46 years)	1	19

* approximate age

Iscan, 1986), although in a bone-forming individual ossification could occur at a slightly younger age. The five subadults were

divided into the two age categories 11 - 14 and 15 to 20. There were no younger children or infants in this small subset of the population.

4. Stature
Stature estimation was undertaken by measuring the maximum lengths of the long bones and applying the regression formulae calculated by Trotter (1970). The standard error is smallest where both femur and tibia are used and this was possible in most cases. The results correspond very closely with those obtained by Waldron (unpub) with 21 males from Merton Priory whose mean stature was also 174 cm.

TABLE 5: Stature

Sex	Mean (cm)	Range	Cases
Male	174.8	163.0 - 180.0	5

There was no evidence of cribra orbitalia, which is thought to be related to iron-deficiency anaemia, in this sample. However, stress indicators and other palaeopathology and physical anthropology will be discussed in detail in the final report.

Only one individual demonstrated any major pathological abnormalities of the skeletal system. This was the mature male buried in Grave 1 (context 19). He had ankylosis or fusion of both sacroiliac joints. However, this was not associated with the spinal changes of ankylosing spondylitis and it seems more likely that the ankylosis was linked with enthesopathies at various sites such as the triceps insertion on the left ulna and the iliac crest of both innominates. Since all his costal cartilages and the thyroid cartilage were also ossified, it seems plausible that this is an example of early DISH (diffuse idiopathic skeletal hyperostosis) which affects up to 10% of elderly males in modern times and may have some connection with diet and maturity onset diabetes (Julkunen et al, 1971).

Three small contexts (2, 16, and unstratified) consisted of animal bone, a rib, some pelvic bones and long bone shaft fragments from a late adolescent (although the right innominate was duplicated) and part of a right adult mandible respectively. Context 234 consisted of a right parietal bone in two parts which was much darker in colour than the other remains and had a leathery appearance.

It is difficult to draw many conclusions from such a small sample. Nevertheless, the fact that all those individuals who could be assigned a sex were male or probably male confirms that this is likely to be a monastic cemetery. The young age at death contrasts with findings at other similar cemeteries (Wiggins et al, unpub) where the majority of adults survived at least into middle age.

However, the period of ascendancy of the mendicant orders in this

country was short-lived. They were fully established by the year 1250 but by the latter half of the fourteenth century, war and pestilence had taken their toll on the population as a whole. The friars, living as they did in the cities at close quarters with the population and ministering to the sick, were particularly vulnerable to epidemic diseases such as plague (Lawrence, 1989). The presence of subadults in the community may be explained by their attachment to the priory as child-oblates.

Z86 (Infants)

Gestational age was calculated by measuring the long bone diaphyses and applying the regression formulae of Scheuer et al (1980) which were derived from modern British populations. Skeletal development was also assessed from photographs of various parts of the foetal and neonatal cranium (e.g. the basi-occipital and sphenoid) published by Fazekas and Kosa (1978) and Weaver's (1979) method for the tympanic ring. All three infants from this site were compatible with a diagnosis of stillbirth or death in the immediate perinatal period. Context 641 gave an age of 37 weeks, 638 and 656 were aged 39 weeks (see discussion below).

Z87 (Watching Brief)

This single context contained the remains of at least 4 adults and one adolescent. Skeletal elements were well-preserved and very little fragmentation had taken place. The bones were tentatively sorted on the basis of colour, size and pathology but it was not possible to associate skulls reliably with postcranial remains. Two individuals had almost intact rib cages but the others included only skulls, pelvic and long bones suggesting that this may have been a charnel deposit. There was one pair of hands and a few foot bones.

The deposit appeared to include the remains of two mature adults (one female and one probable female), a middle-aged adult who was probably male, a female in early middle-age (25 - 35 years approximately) and an adolescent aged between 15 and 20 years. The mature female (WB1) showed evidence of severe trauma to the lower thoracic and lumbar spine. The spinous process of the second lumbar vertebra was wedged at an angle between the superior articular processes of the third lumbar vertebra. She also had osteoarthritis of the left acromioclavicular joint and some of the manifestations of early DISH.

The probable male (WB2) had probably fractured his left ankle at some point since the distal tibio-fibular ligament had ossified and there was a large bony exostosis on the distal tibia. Unfortunately, most of the fibula was missing.

The presence of individuals of both sexes in this part of the friary burial ground is not surprising since in 1250 the friars obtained permission from Pope Innocent IV to bury lay members of the community in their cemeteries (Lawrence, 1989). This brought

them into conflict with the parish priests who were thus deprived of a source of valuable income.

ZE87

Context 806 consisted of one box containing the remains from two burials: an almost complete inhumation of a female aged between 15 and 20 years and the right arm (and both scapulae) of an individual in early middle-age (25 - 35 years) who was probably male.

Only the skull was preserved in context 807. This had mainly masculine characteristics and wear on the teeth was slight suggesting an adult in young middle-age but it would be unwise to age the individual on dental attrition alone. The coronal suture was completely open which also points to a similar age range although cranial suture closure has limitations as an ageing method since there is considerable variation between individuals. There was hypoplasia consisting of grooves in the enamel of three maxillary incisors.

CHAPLIN STREET 1973 (CS73)

The only human remains emanating from this site consisted of an adult left femoral shaft, medial tibial condyle and fibular shaft. The bone was dark in colour and leathery in texture. The femur was distinctly platymeric, i.e. the upper part of the femoral shaft was flattened antero-posteriorly and there was a marked subtrochanteric fossa.

ST MARK'S CHURCH (SM76)

The graveyard from this site was utilized from the 10th century AD onwards. The majority of burials have already been reported (Gilmour and Stocker, 1986). For the purposes of the present study, a few residual contexts were examined in order to complete the archive.

Four contexts consisted only of pairs of femora and tibiae. One of these (429) was an adolescent aged between 15 and 20 years. The other three were from adults. One context (405) included only the sacrum and left leg. The only criteria available for attempting sex estimation were the transverse diameters of the femoral heads (Stewart, 1979). One individual was in the male range (405) and another in the female range (402); the other two (408 and 419) were in the intermediate zone where there is a degree of overlap between the sexes. No definitive estimation of sex was therefore possible in these cases and age could only be given as adult or subadult.

One of these individuals (419) had very extensive deposits of recent periostitis covering the shafts of both tibiae and the posterior aspects of both femora. These appear to be the result of a syndrome termed 'pulmonary hypertrophic osteoarthropathy' which is caused by primary disease of the lungs, e.g. bronchiectasis or congenital heart disease. There is low oxygen

tension in the bloodstream which stimulates osteoblasts to lay down new bone. However, it is difficult to differentiate this condition in dry bone from a very extensive infectious process of recent origin (since the new bone has not been incorporated into the bone cortex) involving the bones of the lower extremities.

SM77

Three infants dating from the Roman period were examined: all were poorly preserved incorporating only lower limb bones and a few cranial vault fragments. Calculation of total body length from the length of the femur gave an age of 38 weeks' gestation for CJE and BVD. DAC was aged 39 weeks (see introductory section).

SM87

A cist burial was recovered from this site which consisted of the cranial and maxillary bones of a mature adult (over 45 years of age) who was probably male. There was very considerable attrition of the premolars and first molar and recession of the alveolar bone. In addition, the individual had suffered from an abscess which had perforated the maxilla both internally (through the hard palate) and externally. The only other skeletal remains consisted of a left scapula, left tibia and the right maxilla from a separate individual.

ST MARY'S GUILDHALL (SMG82)

Excavations on the site of the Norman guildhall included investigation of the Roman levels antedating structure 7. Two infant burials (359 and 360) had been inserted beneath the floor of structure 4. A third infant (2018) was found buried in association with structure 6 but it was not possible to ascertain whether it was definitely a foundation deposit at the time of excavation. The burial lay crouched on its right side with its head facing towards the north-west.

Upon examination, context 359 was shown to consist of at least three infant burials since three right and three left femora were present and other skeletal elements were duplicated. Two of these infants were aged 40 weeks (gestational age) and the other 41 weeks (Scheuer et al, 1980). Context 360 was a younger infant aged approximately 37 weeks and the conformation of the basi-occipital and sphenoid bones was late foetal rather than neonatal. Context 2018 contained a 39 week old infant.

HIGH STREET (HG72)

A further infant burial was found in the Roman levels of this excavation (context EB). A tibia and fibula labelled DW appeared to come from the same burial. The infant appeared to have died at about 38 weeks' gestation. Three other small contexts contained single human bones.

DISCUSSION OF INFANT BURIALS

Since the twelve infants documented in this report came from the same time period, they have been treated as one sample for the purposes of the discussion and combined with three other infant burials, one from the Upper and two from the Lower Cities respectively. Five contexts came from the St Mary's Guildhall site (359A, B and C, 360 and 2018), three came from St Mark's Station (638, 641 and 656), three from St Mark's Church 1977 excavation (BVD, DJE and DAC) and one from the High Street (EB). Figure 1 shows the gestational age at death of the twelve infants in chart form. They all appear to have died in the late foetal or perinatal period which poses the question whether they were stillborn, died at birth or suffered from an acute illness in the immediate perinatal period (see discussion in the introductory section).

BIBLIOGRAPHY

Bass WM 1987 Human osteology: a laboratory and field manual. Missouri Archaeological Society, Missouri

Brothwell DR 1981 Digging up bones. 3rd edition. British Museum (Nat Hist), London

Fazekas IG and Kosa F 1978 Forensic fetal osteology. Akademiai Kiado, Budapest

Gilmour BJJ and Stocker DA 1986 St Mark's church and cemetery, in Jones MJJ (ed) The archaeology of Lincoln. Vol XIII. Council for British Archaeology, London

Iscan MY, Loth SR and Wright RK 1984 Metamorphosis at the sternal rib end: a new method to estimate age at death in white males. Amer J Phys Anthropol 8: 65-79

Julkunen H, Heinonen OP and Pyorala K 1971 Hyperostosis of the spine in an adult population. Its relation to hyperglycaemia and obesity. Ann Rheum Dis 30: 605-12

Katz D and Suchey JM 1986 Age determination of the male os pubis. Amer J Phys Anthropol 8: 65-79

Krogman WM and Iscan MY (eds) The human skeleton in forensic medicine. 2nd edn. Charles C Thomas, Springfield, Illinois

Lawrence CH 1989 Medieval monasticism: forms of religious life in Western Europe in the Middle Ages. 2nd edition. Longman, London

Lovejoy CO, Meindl S, Przybeck TR and Mensforth BP 1985 Chronological metamorphosis of the auricular surface of the ilium. A new method for the determination of adult skeletal age at death. Amer J Phys Anthropol 68: 15-28

Mays S 1993 Infanticide in Roman Britain. Antiquity 67: 883-8

Scheuer JL, Musgrave JH and Evans SP 1980 The estimation of late fetal and perinatal age from limb bone length by linear and logarithmic regression. Ann Hum Biol 7: 257-65

Schour I and Massler M 1941 The development of the human dentition. J Amer Dent Assoc 28: 1153-60

Stewart TD 1979 Essentials of forensic anthropology. Charles C Thomas, Springfield, Illinois

Trotter M 1970 Estimation of stature from intact long limb bones, pp 71-4 in Stewart TD (ed) Personal identification in mass disasters. National Museum of Natural History, Washington

van Beek GC Dental morphology: an illustrated guide. 2nd edition. Wright, Oxford

Waldron T (unpub) A report on the human bones from Merton Priory.

Watts DJ 1989 Infant burials and Romano-British Christianity. Archaeol J 149: 372-83

Weaver DS 1979 Application of the likelihood ratio test to age estimation using the infant and child temporal bone. Amer J Phys Anthropol 50: 263-70

Wiggins R, Boylston A and Roberts C (unpub) Report on the human skeletal remains from Blackfriars, Gloucester.

Williams P and Warwick R 1980 Gray's Anatomy. 26th edition. Churchill Livingstone, London

Workshop of European Anthropologists 1980 Recommendations for age and sex diagnosis of skeletons. J Hum Evol 9: 517-49

CATALOGUE

Abbreviations

/	*lost post-mortem*
X	*lost ante-mortem*
B	*broken post-mortem*
NP	*not present*
---	*jaw not present*
R	*root only*
A	*abscess*
E	*erupting*
U	*unerupted*
PU	*pulp exposed*

BR85
13

Male
Young/middle-aged adult

Preservation: Poor, only skull remains although this is fairly well preserved.

Bones present: Frontal, right parietal, temporal, zygomatic and maxillary bones, most of left parietal and occipital bones, mandible.

Dentition:

8 7 6 5 / / / / - - - - - - - -
---
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

Non-metric traits: Posterior condylar facet open (right).

Dental pathology: Calculus.

Skeletal pathology: Osteoma in centre of left parietal bone.

Grave 1 (context 19)

Male
Mature adult
Stature: 163.0 - 2.99 (femur and tibia)

Preservation: Good. Approximately 70% of skeleton remains.

Bones present: All of skull apart from left zygomatic bone and right mandibular ramus; all postcranial bones apart from right scapula, humerus, ulna and ribs, most left hand bones, two lumbar vertebrae, part of sacrum, both patellae, right foot and some left foot bones.

Additional bones: 6 animal bones.

Dentition:

```
    A A
    X X 6 5 4 3 2 X   1 2 3 4 5 6 7 X
    ---------------------------------
    - 7 6 5 4 3 2 1   / 2 X 4 5 6 7 8
```

Non-metric traits: Left parietal foramen, right ossicle at asterion, double anterior condylar canal, bilateral Poirier's facets, single left inferior talar (and anterior calcaneal) facets.

Dental pathology: Caries, abscesses, calculus and periodontal disease.

Skeletal pathology: Ankylosis of both sacro-iliac joints, enthesopathies of left clavicle (costoclavicular ligament), left ulna (triceps), both innominates (iliac crests), left femur (iliofemoral), left calcaneus (Achilles tendon) and both tibiae (tibialis posterior). Osteophytosis of vertebral bodies, left medial clavicle, right distal femur, right proximal tibia, left third metatarsal, both acetabula, sternum and facet joints of left calcaneus. Bilateral maxillary sinusitis. ? early DISH but no ossification of anterior longitudinal ligament on thoracic vertebrae.

Grave 2 (context 24)

Male
Young/middle-aged adult
Stature: 175.48 - 2.99 (femur and tibia)

Preservation: Good. Approximately 70% of skeleton remains.

Bones present: Complete skull (fragmentary parietal and occipital bones); all postcranial bones apart from a few hand bones, left leg, right patella and a few right foot bones.

Additional bones: 5 animal bones.

Dentition:

```
    8 7 6 5 4 3 2 1   1 2 3 4 5 6 7 8
    ---------------------------------
    / 7 6 5 4 3 2 1   1 / 3 4 5 6 7 8
```

Non-metric traits: Lambdoid ossicles, bridging of supraorbital notch bilaterally, accessory supraorbital foramen, bridging of suprascapular notch on right, right os trigonum (fusing), right single inferior talar (and anterior calcaneal) facets.

Dental pathology: Calculus, rotation of left second incisor.

Skeletal pathology: Exostosis at insertion of tibial collateral

ligament on right tibia (myositis ossificans), Spinal trauma with crushing of 11th thoracic vertebra associated with prominent Schmorl's nodes, osteophytosis of 1 left and 2 right rib tubercles and around articular margins of right calcaneus. Right maxillary sinus infection.

Grave 3 (30)

? Male
15 - 20 yrs

Preservation: Fair to poor. Approximately 30% of burial remains. Fragmentary skull; legs and pelvis are missing but feet are present.

Bones present: Most of frontal and right parietal bones, fragments of left parietal and occipital bone, both temporal and zygomatic bones, maxilla and mandible, both clavicles, scapulae, humeri and right proximal radius and ulna, sternum and manubrium.most ribs, cervical and thoracic vertebrae, both feet.

Dentition:

	/	7	6	5	4	3	/	/		/	/	3	4	5	6	7	8
8	7	6	5	/	/	2	/		1	2	/	4	5	6	7	8	
U		C														U	

Non-metric traits: Metopism, ossicles in sagittal and lambdoid sutures, left parietal foramen, zygomatico-facial foramina, right accessory supraorbital foramen, bilateral single anterior calcaneal (and inferior talar) facets and peroneal tubercles, transverse foramina bipartite (C5 and C6).

Dental pathology: Calculus, caries.

Skeletal pathology: Bilateral maxillary sinusitis.

Grave 4 (74)

Indeterminate
11 - 14 yrs

Preservation: Fair-to-poor. Postcranial bones from the left side of the body present; some vertebrae, pelvis and hand bones are encased in concrete and are impossible to recover.

Bones present: Left clavicle, part of scapula, humerus, proximal radius and ulna and a few hand bones, some left ribs and two vertebrae, left innominate, femur, tibia, fibula and both feet (missing right talus, both naviculars and most phalanges).

Additional bones: Two shaft segments from an adult femur, 14

animal bone fragments.

Non-metric traits: Bilateral absent anterior calcaneal facets, right peroneal tubercle.

Skeletal pathology: Deltoid enthesopathy on left clavicle, cortical defect at insertion of costoclavicular ligament.

Grave 5 (79)

Indeterminate
12 - 14 yrs

Preservation: Very good. >75% of skeleton present.

Bones present: Skull fragmentary but complete apart from left zygomatic bone; all postcranial bones apart from some hand bones, patellae and most right foot bones.

Dentition:

U			E		E					E					U
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
U																U

Non-metric traits: Bridging of left supraorbital notch, double right zygomatico-facial foramen, foramen transversarium anomaly of 7th cervical vertebra, bilateral single inferior talar (and anterior calcaneal) articular facets.

Dental pathology: Calculus, hypoplasia, crowding of right maxillary teeth.

Skeletal pathology: Non-specific infection on medial surface of left tibia; spina bifida of fourth and fifth sacral vertebrae (possibly also third).

Grave 6 (Context 83)

Indeterminate
15 - 18 yrs

Preservation: Very good. >75% of skeleton remains.

Bones present: All except cranium, 4th and 5th sacral vertebrae and some epiphyses.

Additional bones: 5 animal bones and dens of human subadult vertebra.

Dentition:

no maxilla

8	7	6	/	/	/	/	/		/	/	/	/	5	6	7	8
U												B			U	

Non-metric traits: Bilateral single inferior talar (and anterior calcaneal) articular facets.

Skeletal pathology: Enthesopathies (cortical defects) of both clavicles (costoclavicular ligament). Schmorl's nodes.

Grave 7 (context 161)

Male
Young adult
Stature: 178.86 - 2.99 (femur and tibia)

Preservation: Very good. >75% of skeleton remains.

Bones present: Skull and ribs complete but fragmentary; all postcranial bones apart from left distal humerus, proximal radius and ulna, some hand bones, right patella and a few foot bones.

Additional bones: 2 animal bone fragments.

Dentition:

NP

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

Non-metric traits: Double right zygomatico-facial foramen, accessory lesser palatine foramen, bridging of left supra-orbital notch, double right accessory supra-orbital foramen, left accessory infra-orbital foramen, right lateral tibial squatting facets, left vastus notch, bilateral double inferior talar (and anterior calcaneal) articular facets, bilateral peroneal tubercles and double right atlas facets. Posterior atlas bridge present bilaterally but incomplete.

Dental pathology: Hypoplasia, absence or non-eruption of right maxillary third molar, reduced third molar on left.

Skeletal pathology: Enthesopathy of right clavicle (costoclavicular ligament).

Grave 8 (context 184)

Male
Young adult
Stature: 176.13 - 2.99 (femur + tibia)

Preservation: Fair. >75% remains but ribs, vertebrae, skull and pelvis are very fragmentary.

Bones present: Fragmentary skull; all postcranial bones apart from some tarsal bones, part of innominates and a few foot bones. Ribs and vertebrae are also fragmentary.

Additional bones: Left distal foot phalanx, 3 animal bones.

Dentition:

		A												A	
8	7	6	5	4	3	2	1	/	/	3	4	5	6	7	8
8	7	6	5	4	3	2	/		1	2	3	4	5	6	7	8

Non-metric traits: Accessory lesser palatine foramen (right), bridging of supra-orbital notch (right), bilateral zygomatico-facial foramina, sternal foramen, left plaque, bilateral peroneal tubercles, bilateral single inferior talar (and anterior calcaneal) articular facets.

Dental pathology: Caries, abscesses, calculus.

Skeletal pathology: Probable sacralization of 6th lumbar vertebra, prominent Schmorl's nodes, enthesopathies of both humeri (cortical defect at insertion of pectoralis major - right and teres major - left), right clavicle (cortical defect at insertion of costoclavicular ligament), osteophytes of one right rib tubercle.

Grave 9 (context 184)

Male
Young/middle-aged adult
Stature: 180.68 - 3.37 (tibia)

Preservation: Fair. Approximately 70% of skeleton preserved.

Bones present: Fragmentary skull missing part of occipital bone and left zygomatic, all postcranial bones apart from left clavicle, scapula, humerus, ulna, proximal two thirds of radius, ribs, some hand bones, 11th and 12th thoracic vertebrae, part of left innominate and sacrum, a few foot bones.

Additional bones: 3 animal bones.

Dentition:

8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8
8	7	6	5	4	3	2	/		/	2	3	4	5	6	7	8

Non-metric traits: Right and left lateral tibial squatting facets, bilateral medial talar facets, double inferior talar (and anterior calcaneal) facets, posterior atlas bridge (left).

Dental pathology: Hypoplasia, calculus, right mandibular third molar is rotated clockwise.

Skeletal pathology: The inferior articular surface of the talus is expanded medially creating a new facet which articulates with an extension of the sustentaculum tali. Small areas of remodelling on the floor of each maxillary sinus. Some remodelling of inferior nasal aperture without resorption of nasal spine.

87

Male
15 - 20 yrs

Preservation: Very poor. <10% of skeleton remains.

Bones present: Right humerus, ulna and two fragments of radius, left proximal ulna (without olecranon), a few ribs and 3 lumbar vertebrae, sacral fragment, part of left innominate and right ischium, right proximal femur and distal tibia, left proximal tibia and part of tibial shaft.

Small contexts
2
Piece of animal skull

16
Head and neck of right rib with unfused head, body of sacral vertebra, fragment of tibial shaft (? right), parts of 2 right innominates (one consisting of 2 large fragments), both including part of the acetabulum and anterior inferior iliac spine, epiphysis of ischium (right), 1 long bone shaft fragment (cortical bone), 2 animal bone cortical shaft fragments.
These bones appear to be those of a late adolescent, although it is difficult to be certain about the tibia and the fragments of innominate.

234
Most of right parietal bone in two large fragments. Sutures are open apart from at the posterior part of the sagittal suture. These bones are dark in colour and leathery in texture.

Unstratified
Right mandibular ramus. Condyles show considerable osteophytes anteriorly.

638

Indeterminate
Late foetal/neonatal

Preservation: Fair. Little of skull is preserved. Left femur missing and ribs fragmented.

Bones present: Maxillary fragment, left mandible, both humeri, radii and ulnae, some ribs, right ilium and femur, both tibiae and fibulae.

Additional bones: 1 animal bone fragment.

641

Indeterminate
Late foetal/neonatal

Preservation: Very good. >80% of burial is present and condition of bones is good. Fragmentary cranium.

Bones present: All except hand and foot bones and some ribs.

Additional bones: 1 animal first phalanx.

656

Indeterminate
Late foetal/neonatal

Preservation: Fair-to-poor. Fragments of cranium, a few ribs and some long bones.

Bones present: 14 cranial vault fragments, part of mandible, humeral shaft, right radius, some ribs, both femora and left tibia.

Z87

Watching Brief (2 boxes)

Preservation: Well preserved remains from at least 4 adults and one subadult. The bones have been tentatively sorted on the basis of colour, fit and pathology but it is acknowledged that there may be some intermingling. They have been numbered WB1-5. In some cases skulls cannot be reliably associated with postcranial remains. Two individuals retained moreorless intact rib cages; the others included only skulls, pelves and long bones. There was one pair of hands and a few foot bones.

Additional bones: 4 animal bones.

Watching brief 1

Female
Mature adult

Bones present: Frontal, most left parietal, right maxilla, left petrous temporal, parts of both scapulae, left clavicle, both humeri, left ulna, a few ribs and two hand bones, manubrium fused to first sternal vertebra, a few cervical, 3 lower thoracic and 4 lumbar vertebrae, both innominates, part of sacrum, both femora and tibiae.

Dentition:

					R	R			R	R				
X	X	X	X	X	3	2	/	/	3	4	5	X	X	X

no mandible

Non-metric traits: Right accessory lesser palatine foramen, bilateral accessory supraorbital foramina, bilateral tibial squatting facets, transverse foramen bipartite (C5 and C6).

Dental pathology: Periodontal disease, antemortem tooth loss.

Skeletal pathology: Severe trauma to lower thoracic and lumbar spine. The articular processes of the second lumbar vertebra are wedged at an angle between the superior processes of the third lumbar vertebra. Hyperostosis frontalis interna of cranium. Osteoarthritis of left acromioclavicular joint. Rotator cuff disease of both humeral heads, osteophytosis of both glenoid cavities, the left proximal humerus and one left rib tubercle. Possible DISH with ossification of the anterior longitudinal ligament on most vertebra and enthesopathies of the linea aspera and greater trochanter on the right femur.

Watching brief 2

? Male
Middle-aged adult

Bones present: Frontal bone, right humerus (missing proximal end), left humerus, both innominates and sacrum, both femora and tibiae,

Additional bones: Part of left parietal.

Non-metric traits: Plaque on left femoral head.

Skeletal pathology: The distal left fibula is fused to the tibia suggesting that there has been a fracture in this region. Unfortunately, the rest of the fibula is missing. Enthesopathies of both linea aspera, left iliac crest, soleal lines on both

tibiae and patellar ligament insertions on tibial tuberosities. Cortical defect on teres major insertion of left humerus.

Watching brief 3

? Female
15 - 20 years

Bones present: 5th lumbar vertebra, sacrum, most of right innominate, part of left ilium and pubic bone, both femora (missing distal epiphyses), right tibia (missing condyles), both fibulae (without epiphyses), right 5th metatarsal, left humerus (? from same individual).

Skeletal pathology: Complete spina bifida of sacrum. There is a slit in the laminae of the first and second sacral vertebrae and the neural arches are deflected laterally.

Watching Brief 4

Female
Young/middle-aged adult
Stature:

Bones present: Frontal, left parietal, most of left parietal, occipital, both petrous temporals, mandible and left maxilla, both clavicles, part of right scapula, manubrium, both humeri, left radius and ulna, right distal radius and ulna, most hand bones, most ribs, all vertebrae, both innominates, sacrum, both femora, right patella, both tibiae, right fibula, left calcaneus and talus.

Dentition:

```
                                    A
- - - - - / / 1   1 2 3 4 5 6 7 8
---------------------------------
/ 7 X / 4 3 / /   / / 3 4 / X 7 8
  C
```

Non-metric traits: Ossicle at lambda, lambdoid ossicles, posterior condylar canal open, left accesory lesser palatine foramen, bridging of left supraorbital notch and right accessory supraorbital foramen, right Poirier's facet, bilateral medial tibial squatting facets, bridging of right suprascapular notch, left peroneal tubercle, bilateral lateral atlas bridging, double left inferior talar (and anterior calcaneal) articular surfaces.

Dental pathology: Caries, abscess, calculus, antemortem tooth

loss, radicular cyst? anticlockwise rotation of right mandibular canine.

Skeletal pathology: Inflammation of left maxillary sinus ? associated with dental disease, Enthesopathies on left patella and left Achilles tendon. Some crushing of 4th thoracic vertebra.

Watching Brief 5

Female
Mature adult

Bones present: Right facial bones, parietal and temporal bones, part of left parietal, occipital bone, right humerus and ulna, one lumbar vertebra, left innominate, right tibia.

Dentition:

X X X X X / X / / X / X / X X X
---
no mandible

Non-metric traits: Lambdoid ossicles, foramen of Huschke, zygomatico-facial foramen, right septal aperture.

Dental pathology: Periodontal disease, antemortem tooth loss.

Skeletal pathology: Severe erosion of endplate of lumbar vertebra with osteophytes and porosity, osteophytosis of right proximal ulna.

ZE87

806

(A) Female
15 - 20 years

(B) ? Male
25 - 35 yrs

Preservation: Parts of two individuals: A is almost complete.

Bones present: 806A: All except hand and foot bones and both patellae. 806B: Parts of both scapulae, right humerus and proximal ulna, right hand and some ribs, most vertebrae.

Additional bones: 8 animal bones.

(A) Dentition

```
                                    C
- - - - - - - - -   / 2 3 / / 6 7 /
-----------------------------------
8 7 6 5 4 3 2 1   1 2 3 4 5 X 7 8
E   C                           E
```

(A) Non-metric traits: Bilateral septal apertures, bilateral third trochanters, bipartite transverse foramina (C5 - C7).

(A) Dental pathology: Caries, calculus.

(A) Skeletal pathology: Spina bifida of fifth sacral vertebra. Well-healed periostitis on medial aspect of left tibia.

(B) Skeletal pathology: Costoclavicular ligament and deltoid enthesopathies of right clavicle.

807

? Male
Young/middle-aged adult

Preservation: Poor. Only skull and some cervical vertebrae remain.

Bones present: Almost complete cranium missing part of both temporal bones and right zygomatic bone.

Additional bones: Animal rib.

Dentition:

```
8 7 6 5 4 3 2 1   1 2 3 4 5 6 7 8
---------------------------------
8 7 6 5 4 3 2 /   1 2 / 4 5 6 7 8
```

Dental pathology: Enamel hypoplasia, calculus, rotation of right maxillary premolar nearly 90 degrees anticlockwise.

SM76

ATU (402)

? Female
Adult

Preservation: Poor. Only long bones of lower extremity are preserved.

Bones present: Both femora and tibiae.

APD (405)

? Male
Adult

Preservation: Poor. Only long bones from left leg and sacrum remain.

Bones present: Sacrum, left femur, tibia and fibular shaft.

Non-metric traits: Left Allen's fossa, hypotrochanteric fossa and exostoses in trochanteric fossa.

Skeletal pathology: Recent periostitis on posterior aspect of left tibia. Soleal line and tibialis posterior enthesopathies.

AUF (408)

Indeterminate
Adult

Preservation: Poor. Only long bones of lower extremities remain.

Bones present: Right femur and left distal femur, both tibiae.

Non-metric traits: Bilateral medial tibial squatting facets.

AUY (419)

Indeterminate
Adult

Preservation: Poor. Only long bones of lower extremity remain.

Bones present: Both femora and tibiae.

Non-metric traits: Bilateral hypotrochanteric fossae and lateral tibial squatting facets.

Skeletal pathology: Recent periostitis covering entire posterior aspect of both femora and medial and posterior surfaces of both tibiae, particularly near the distal articulation. ? pulmonary hypertrophic osteoarthropathy.

APT (429)

Indeterminate
15 - 20 years

Preservation: Poor. Only long bones of lower extremities remain.

Bones present: Both femora (without distal epiphyses) and both tibiae.

Small contexts

SM76 COU Adult right humeral head.

SM76 KF Infant squamous temporal bone.

SM76 BJA 2 animal bones, one juvenile.

SM77

CJE

Indeterminate
Late foetal/newborn

Preservation: Poor. Only some long bone shafts remain.

Bones present: Right humerus, both femora, left tibia.

BVD

Indeterminate
Newborn

Preservation: Poor. Upper part of body is missing.

Bones present: Right ilium, both femora, tibiae and fibulae and a few cranial vault fragments.

Small contexts

SM77 CZY Animal rib, infant distal humerus ? side and long bone fragment.

SM77 DAC Infant femur in 2 halves (probably right), infant femur (almost complete) in 2 halves, 2 fibular shafts, radial shaft, left proximal tibia.

SM87

Cist burial

? Male
Mature adult

Preservation: Very poor. Only cranium, left scapula and tibia

remain.

Bones present: Most of frontal, parietal and occipital bones, right temporal, right zygomatic and maxillary bones, part of left maxilla, left scapula and left tibia.

Additional bones: Right maxilla.

Dentition:

```
                A A
X X 6 5 / / 2 /   / / 3 4 / - - -
---------------------------------
no mandible
```

Non-metric traits: Left medial tibial squatting facet.

Dental pathology: Caries, abscess perforating both internally and externally, periodontal disease, antemortem tooth loss.

Skeletal pathology: Osteophytosis of margin of left glenoid cavity. Right maxillary sinusitis ? due to severe dental disease.

CS73

AR

Indeterminate
Adult

Preservation: Very poor. Only three bones from the lower extremity are present. These are of a dark colour and appear leathery in texture.

Bones present: Left femoral shaft (missing both ends), left medial tibial condyle and fibular shaft (in 2 pieces).

The femur is distinctly platymeric (index of 67.56) with a deep subtrochanteric fossa which is completely smooth with no muscle attachments.

SMG82

348(359)

Indeterminate
Late foetal/neonatal
Minimum numbers: 3

Preservation: Fairly well preserved infant burial which appears to include more than one inhumation: some elements are duplicated and even triplicated (eg femora and clavicles). All the femora are the same size.

Bones present: 2 left mandibles, 2 left petrous temporals, 2 right petrous temporals, 2 basi-occipital bones, 2 left ulnae, 2 left radii, 3 right and 3 left femora, 2 right and one left tibiae, 3 right clavicles 20 right and 14 left ribs, 18 vertebral bodies and 35 neural arch halves.

348(360)

Indeterminate
Foetal (7 - 9 months)

Bones present: Frontal bone and fragmentary parietals, right maxilla and both half mandibles, body of sphenoid and left greater wing, both petrous temporals, both humeri, radii, ulnae, femora, tibiae and one fibula, 3 vertebral bodies and 2 neural arch halves, 4 metacarpals, some ribs and both ilia.

2018

Indeterminate
Late foetal/neonatal

Preservation: Good. Fragmentary skull and ribs.

Bones present: Part of right frontal, both maxillary and mandibular halves, petrous temporal bones and right squamous temporal, basi-occipital bones, both clavicles and scapulae, all long bones, both ilia, ischia and pubic bones.

HG72
EB
Indeterminate
Late foetal/neonatal

Preservation: Fair. Only long bones from forearm and lower extremities are present along with some pelvic bones.

Bones present: Both ulnae and radii, both ilia, right femur and left proximal femur, both tibiae and fibulae, the left tibia and fibula (both marked DW).

DW
Left infant tibia and fibula (? from same individual as EB).

KU
Shaft of adult right tibia (missing both ends).

KI
Fibula shaft (probably right) missing both ends.

FW
Right infant rib.

APPENDIX 4

EXCAVATIONS ON THE UPPER CITY SITES 1972 - 1987

Interim Report on the Human Skeletal Remains

by

Anthea Boylston and Charlotte Roberts

Calvin Wells Laboratory
Department of Archaeological Sciences
University of Bradford
BRADFORD
BD7 1DP

October 1994

THE LAWN HOSPITAL (LH84, LH85, L86, L87, L89)

I. INTRODUCTION

Three major excavations were carried out during 1984, 1985 and 1986 in the grounds of the Lawn Hospital during which a number of human remains were revealed. During 1984 and 1985 two main trenches were cut which bisected each other in addition to a number of boxes in outlying areas. Most of the burials were found in area III. The burials were dated by pottery found in the fill to the 13th and 14th centuries AD, although there were also a few contexts containing human remains found in the Roman and Postmedieval levels (these are signified in the catalogue).

The following year (1986) a further trench was excavated to the north-east of the CLAU headquarters revealing a number of mass graves, a double burial and a few discrete burials, most of which were truncated by the section. A few contexts are dated to 1987 since the excavation continued into the New Year. There was also a watching brief carried out in 1989. Almost every context from each of the sites included a few fragments of animal bone and some contained substantial faunal assemblages, particularly the boxes of mixed bone from 1984 and 1985.

II. PHYSICAL ANTHROPOLOGY

1. **PRESERVATION**

The state of preservation of the bones was highly variable, both between sites and between individual burials. LH84 and LH85 consisted mainly of discrete contexts, some of them found within stone cists. As a result, even though some contexts were poorly preserved, each contained only one individual, apart from several boxes of mixed bone. L86, by contrast, included many contexts consisting of disarticulated human bone. There was one mass grave in the LH84 excavation which consisted of four adult skulls and a few postcranial remains. Four mass graves featured in the L86 excavation, namely graves 1 - 4, graves 5 - 7, grave 8, and grave 15. In addition, there were three contexts containing large quantities of miscellaneous human bone (contexts 3, 4 and unstratified material).

The seven individuals in the well-preserved category consisted of an adult and two subadults from Area I of the L84 excavation, a male, a female and two subadults from the LH85 area and a Roman infant (295/87). Burials from Area III came into the fair and poor categories and the 20 grave contexts from L86 fell into the poor, very poor or disarticulated categories (Table 1). There had been problems associating skeletal elements from some of the mass graves which led to their being boxed as one context (e.g. Grave 15, context 37). Many burials extended beyond the edge of the section.

Two burials from the 1984 excavations in Lincoln Cathedral were examined. One of these (72) was in a good state of preservation but the skull, upper arms, ribs and vertebrae were missing. The other (62) showed crystallization on the surface of the lower extremities which were badly crushed and there was some purple staining of bone fragments.

Preservation of individual bones from the Lawn sites was good in most cases with cortical and joint surfaces remaining largely intact. However, observation of pathological distributions are undoubtedly affected by the fact that skulls and lower extremities often did not survive or fell outside the area of excavation. Some categories of pathology, e.g. developmental, which often affect the lower spine may be abnormally well represented since this part of the body was often present.

TABLE 1: Degree of Preservation

Grade	Number of Individuals	Context Numbers
1 (>75% of burial preserved)	7	CS4, CS7, CS9, KS12, KS18, KS19, KS20, 295/87
2 (>50%)	5	BS2, CS6, ES8, G4, 72
3 (>30%)	9	AS3, BS1, FF15, KS21A, G3, G11, G19, G20, 267
4 (>10%)	8	C29, G5, G6, G7, G9, G12, G13, G16, G18
5 (<10%)	10	8/85, KS21B, 11/85, 15/85, G10, G14, G17, 48/86, 50/86, 61/86
Disarticulated	15	MB84*, MB85, G1/86, G2/86, G8/86, G15/86, G17/86, G21/86, 3/86, 4/86, 5/86, 13/86, 40/86, 44/86, US/86

* Mixed bones

2. MINIMUM NUMBERS

A count was made of certain skeletal elements, such as the ends of the long bones, which are easily recognizable even when fragmentary, in order to try to obtain an idea of how many individuals are represented by the three main excavations. The left mandible and right proximal ulna scored highest and there were 57 of the former and 58 of the latter. Where the graves are as tightly packed as they were in the L86 cemetery there is always the possibility of bones from one individual straying into an adjacent context so an overall minimum numbers count is probably more accurate in this case than counting the minimum numbers for each context separately and then adding them all together.

TABLE 2: Minimum Numbers of Individuals

Skeletal element	Adult	Subadult
Right petrous temporal	35	6
Left petrous temporal	35	5
Right maxilla	21	4
Left maxilla	22	4
Right mandible	54	6
Left mandible	57	6
Occipital	26	*
Right medial clavicle	29	*
Left medial clavicle	34	*
Right proximal humerus	25	12
Left proximal humerus	25	13
Right distal humerus	36	15
Left distal humerus	41	14
Right proximal ulna	58	12
Left proximal ulna	39	9
Right distal ulna	25	8
Left distal ulna	25	8
Right proximal radius	41	6
Left proximal radius	37	7
Right distal radius	26	6
Left distal radius	25	6
Right proximal femur	56	10
Left distal femur	50	9
Right proximal tibia	37	10
Left proximal tibia	28	7
Right distal tibia	31	7
Left distal tibia	25	7
Right calcaneus	21	3
Left calcaneus	30	2

* Not counted because of fragmentary material.

3. SEX

The methods used in sex and age abnd stature estimation are discussed in the introductory section. In spite of problems with preservation and limited numbers of individuals, a very clear picture emerged from the distribution of sex in these cemeteries. Burials excavated in LH84 and LH85 had a fairly equal split between the sexes (Table 3) and subadults were well represented, suggesting that a normal community cemetery had been sampled (Waldron, 1994). However, the individuals interred in the area of the L86 excavation were almost entirely male, with only two exceptions, one of which occurred in an outlying context and the other in a mass grave, which had some unusual features (see below).

The nature of the burial practices also showed notable contrasts between LH84/L85 and L86. The former sites consisted of well-ordered graves, some of them in stone cists, where the individuals had been carefully laid out. The latter site (L86) consisted of a number of mass graves and one interment where the two incumbents were buried almost in a sitting position. Some explanation is demanded by these phenomena. Medieval burials are often found closely packed in churchyards but there are large spaces between the mass graves at this site.

Burials of subadults from LH84/L85 were fairly complete but subadults from L86 were represented by disarticulated remains alone.

TABLE 3: Sex

Site	L84	L85	L86
Male	4 (BS1, CS4, CS6, AA20)	1 (KS20)	8 (3, 4, 6, 12, 13, 15, 19, 22)
? Male	1 (AA20)	-	6 (5, 11, 15, 17, 18, 20)
Female	3 (BS2, ES8, AA20)	3 (KS12, MB, UC)	2 (14, 15)
? Female	1 (AA20)	2 (KS21A, 8)	-
Adult	1 (ES8)	2 (KS21B, 11)	15
Subadult	3 (AS3, CS7, CS9)	4 (FF15, KS18, KS19, 8)	4
Total	13	12	35

4. AGE

The age profile also showed contrasts between LH84/85 and L86. There was a fairly even distribution of ages at death between individuals buried in LH84/85 (Table 4). However, in L86 there were no subadults who were sufficiently well-preserved for age to be extimated, apart from two 12 - 14 year olds and a Roman baby. Moreover, by far the largest age categories were

represented by the 20 - 35 year old age group, all but two of whom were males or ? males. Diameters of humeral and femoral heads in the unstratified material were all 46 mm or more (n = 10) which is well above the female range (Stewart, 1979).

TABLE 4: Age

Age	L84	L85	L86
< 1 yr	-	1 (KS19)	1 (295/87)
1 - 3 yrs	-	1 (FF15)	-
4 - 6 yrs	-	1 (KS18)	-
7 - 9 yrs	1 (CS9)	-	-
12 - 14 yrs	1 (CS7)	-	2 (9, 15)
15 - 20 yrs	2 (AS3, AA20)	-	1 (18)
Young adult	-	-	3 (7, 12, 15)
Young/middle-aged adult*	1 (BS2)	3 (KS21B, MB, UC)	4 (3, 5, 13, 22)
Middle-aged adult	2 (BS1, CS4)	2 (KS12, KS21A)	4 (6, 14, 15, 19)
Mature adult	1 (CS6)	2 (KS20, 8)	2 (4, 17)
Adult	4 (AA20)	1 (11)	17
Subadult	1 (AA20)	1 (8)	2
Total	12	10	35

* Young adult = 20 - 25 years
Young/middle-aged adult = 26 - 35 years
Middle-aged adult = 36 - 45 years
Mature adult = over 46 years (All ages are approximate.)

Just east of wall 86-295, floor 86-297 was cut by a small pit with steep sides. It contained the skeleton of a young infant. The burial was in a very good state of preservation with almost all skeletal elements present. Calculation of age by regression analysis of long bone diaphyseal lengths gave an age of 37.4 weeks (Scheuer et al, 1980).

One of the two individuals from Lincoln Cathedral (LC84 62) was a mature adult. However, sex estimation proved difficult in this case. The lower extremities were very friable and only fragments of the skull and pelvis remained. Burial 72 was a young adult who was probably male, although the skull was not available for study.

5. STATURE

The male mean was slightly less than that calculated for the Wigford sites of 174.8 cm (Table 5).

TABLE 5: Stature

Sex	Mean	Range	Cases
Male	172.3	165.1 - 183.7	10
Female	159.3	149.4 - 163.5	5

6. METRICAL AND NON-METRICAL ANALYSIS

Metrical analysis was combined for the whole study (see Tables in the introductory section). It is of interest to note that three of the individuals buried in the mass grave (no. 15 context 37) displayed an unusual form of Inca bone which was not found anywhere else in the cemetery.

Non-metric traits have been used in an attempt to postulate possible family relationships in a cemetery sample but the genetics are insufficiently well-established for this to be a useful endeavour in most cases. However, Hauser and de Stefano (1989) estimated that Inca bones are inherited as a dominant trait with 50% penetrance. It is possible that context 37 represents a family group of some kind but this must remain entirely speculative.

III. PALAEOPATHOLOGY

1. **DENTAL HEALTH**

Dentitions were assessed for the presence of calculus, caries, abscesses, enamel hypoplasia and periodontal disease (see introductory section). However, there are certain individual dental anomalies which are worthy of comment.

Two subadult dentitions showed very severe wear of the second deciduous molars (CS7/84 and CS9/84). The former, a child of 12 - 14 years judging by epiphyseal fusion, had an anomalous dentition: one of the deciduous mandibular central incisors had been retained and the lateral incisor was congenitally absent or had been removed. The maxillary canines and premolars were very late erupting - hence the extreme wear on the deciduous molars (Plates 1A and B). The second left maxillary molar appeared to have become impacted. In the case of CS9, there was considerable crowding of the dentition and the right lateral mandibular incisor was erupting behind the other teeth.

2. DEVELOPMENTAL

The lower spine (including the sacrum) is the part of the human skeleton where minor developmental abnormalities occur most readily (Bradtmiller, 1984). Most of these do not have any functional implications. They include spondylolysis (separation of the neural arch of the vertebra at the pars interarticularis), spina bifida occulta (an interruption in the vertebral neural arch at its apex, most commonly found in the sacrum) and

sacralization (anomalous fusion of the 5th or 6th lumbar vertebra to the sacrum).

These conditions appear to have a partly hereditary and partly environmental causation. Spondylolysis is more common in males (Turkel, 1989) and is thought to be partly caused by hyperextension, e.g. in fast bowlers (Hardcastle et al, 1991).

However, in the present study, owing to the disarticulated nature of much of the material, estimation of sex could not be performed for two of the five individuals with spondylolysis. The other three included one male (BS1) and two females (MB/85 and G14/86). The prevalence was 4 of 18 fifth lumbar vertebrae (22.2%) and 1 of 15 fourth lumbar vertebrae (6.6%).

Spina bifida was present in 2 of 3 subadult sacra and in 4 of 22 adult sacra (18.2%). The 2 subadults also had bipartite transverse foramina, dental anomalies and very marked, unusual wear on the deciduous dentition (see above). They also came from adjacent graves in the LH84 excavation.

The prevalence of spina bifida occulta varies according to whether an opening at the apex of the fourth and fifth sacral vertebrae is considered within normal limits (Turkel, 1989). The prevalence may also decrease with advancing age, although the apices of the vertebral neural arches are normally fused by the age of 7 years.

Sacralization was seen in two individuals (G2 and G6): in the latter it was partial and in the former complete (Plate 2) and B). The individual buried in G2/86 also had congenital agenesis of the right transverse process on the first lumbar vertebra. One of the sacra from a mass grave (G15/86) showed partial lumbarization associated with spondylolysis of L5.

Lower spinal anomalies from the present sample appeared to be associated with anomalies elsewhere in the spine suggesting that hereditary factors were important.

TABLE 6: Developmental abnormalities affecting the spinal column

No.	Abnormality	Vertebra affected	Comments
BS1/84	Spondylolysis	L5	1st coccygeal vertebra fused to sacrum
MB/84	Spondylolysis	L5	Manubriosternal fusion also
MB/85	Spondylolysis	L4	Cervical anomalies
G14/86	Spondylolysis	L5	-
G15/86	Spondylolysis	L5	Lumbarization also (see below)
CS7/84	Spina bifida	S2, 3, 4 & 5	Transverse foramen abnormalities
CS9/84	Spina bifida	S3, 4 & 5	Transverse foramen abnormalities
G2/86	Sacralization	L6	Lumbar abnormality also
G3/86	Spina bifida	S1, S4 & S5	-
G5/86	Spina bifida	S1	slit in apex
G6/86	Sacralization	L5	partial
G15/86	Lumbarization	S1	with torsion
G21/86	Spina bifida	S4 & S5	-
3/86	Spina bifida	S3, S4 & S5	-
Unstrat	Spina bifida	S4 & S5	-
LC84 72	Spina bifida	S3, S4 & S5	-

Other minor developmental abnormalities were recorded and these consisted of two instances of os acromiale, both affecting the right scapula. The acromial epiphysis normally fuses to the scapula between the ages of 15 and 18 years (Stirland, 1984). Occasionally, fusion fails to occur and a pseudarthrosis remains. It may cause slight instability in the shoulder joint but has no other functional implications. Os styloideum has been reported at Fishergate (Stroud and Kemp, 1993) and is a minor anomaly affecting the styloid process of the third metacarpal.

TABLE 7: Other developmental anomalies

Skeleton number	Anomaly	Bone affected
KS12/84	Os acromiale	Right scapula
G2/86	Os acromiale	Right scapula
G3/86	Os styloideum	Right 3rd metacarpal
G6/86	Hook of hamate reduced in size	Right hand
G7/86	Hook of hamate reduced in size	Left hand

3. INFECTION

Infections in bone may be classified as specific or non-specific. The former include fungal infections which are seldom identifiable in skeletal material from this country, mycobacterial infections, such as tuberculosis and leprosy, and the treponematoses, e.g. syphilis (where the organism causing the infection is known). Often, however, infections can only be termed 'non-specific' when there is no evidence as to the causative organism.

a) Non-specific infection

The largest category under this heading is non-specific periostitis of the tibia. The lesions may be recent or well-healed and may be caused by localized infection (e.g. by Staphylococcus aureus) or by trauma. The prevalence in the Lawn Hospital sites was 7 of 27 right tibiae (25.9%) and 7 of 25 left tibiae (28%). Six individuals were male or ? male, 3 were female or ? female and one was a subadult.

Periostitis has also been identified on the visceral surfaces of ribs and is thought to be associated with chronic chest infections, e.g. tuberculosis (Kelley and Micozzi, 1984). One individual from the present study demonstrated recent periostitis, which is indicated by porous new bone formation, on two rib fragments. There was also one instance of osteomyelitis (blood-borne infection involving the medullary cavity of the bone) which affected a fourth right metatarsal.

New bone formation was seen in the right maxillary sinus of CS4 and in two right and one left maxillary sinuses from the disarticulated material in context 4/86. This is indicative of an episode of sinusitis.

TABLE 8: Non-specific infection

Skeleton Number	Bone affected	Severity	Healed or recent
CS4/84	Both tibiae	Thickening of left shaft	Well-healed
CS6/84	Right tibia	Thickening of bone laterally	Recent
CS7/84	Both tibiae	Moderate*	Healing
C29/84	Right fibula	Moderate	Recent and healing
KS20/85	Right femur	Thickening of shaft	Healed
KS21/85	Left tibia	Thickening of shaft	Healed
UC/85	Right tibia Left tibia	Slight Thickening of shaft	- Recent
G8/86	2 rib fragments	-	Very recent
G19/86	Both tibiae	Moderate	Well-healed
G20/86	Right tibia	Slight	Well-healed
3/86	Both tibiae	Slight	Well-healed
LC84/72	Both tibiae	Considerable	Interosseous surfaces
UC/85	Right 4th metatarsal	Osteomyelitis	? due to stress fracture

Slight = One third of shaft affected
Moderate = Two thirds of shaft affected
Considerable = Entire length of shaft affected, although there may be only one surface of bone involved.

b) Specific Infections: Tuberculosis: The two major disease entities which fall under this heading are pulmonary tuberculosis which is caused by the bacillus M. tuberculosis and gastro-intestinal tuberculosis caused by M. bovis. The former is by far the most common of the two diseases at the present time, although this may not have been the case in the Medieval period. It is normally caused by reactivation of a primary focus in the lung during young adulthood (the initial infection having occurred in childhood).

The pelvis illustrated in Plate 3 was retrieved during screening of the mixed bones from Area II of the LH 85 excavation.

The infection had perforated the colonic mucosa and invaded the iliac fossa of the left innominate. There was also proliferative

new bone formation on the ventral aspect of the sacrum which is intimate with the descent of the sigmoid colon into the rectum. On X-ray a mixed sclerotic and lytic picture emerged with radiodense new bone formation on the sacrum, particularly, merging with radiolucent areas indicating bone destruction.

Bovine tuberculosis may be caused in humans by ingestion of infected milk products or meat derived from herds in whom the disease is endemic. One type of lesion which is characteristic of this disease is known as tuberculous caecal tumour. It resembles cancer and affects the large intestine (Cappell, 1958), particularly the ascending colon which is close to the right sacroiliac joint. The ulcers can surround the colon and penetrate the surrounding tissues.

The differential diagnosis was considered. This included: 1) actinomycosis, infection by an anaerobic bacterium; 2) fungal infections; 3) osteomyelitis; and 4) mycobacterium tuberculosis. Actinomycosis was rejected on the grounds that the lesions were too destructive to be compatible with this diagnosis (Manchester, pers comm). Fungal infections have a very restricted geographical distribution and are normally not a problem in this country. A non-specific osteomyelitis is a possibility if the infection was associated with a paracolonic inflammation such as diverticulitis. However, any such infection would have to be present for a considerable period of time in order to produce such severe lesions.

It is the combination of the three lesions which suggests gastrointestinal tuberculosis. The sacroiliac destruction and cloaca in the right iliac crest, on their own, could indicate spread of infection to the joint from a psoas abscess or haematogenous spread to the sacroiliac joint by human tuberculosis. The new bone formation on the sacrum alone might suggest actinomycosis but the penetrative lesion in the left iliac fossa suggests formation of lesions in bone as a result of ulceration of the descending colon which is rarely involved in human tuberculosis (Muir, 1958). The latter often affects the ileum (or small bowel) but seldom travels further than the ileocaecal region.

4. **TRAUMA**

Traumatic episodes at the Lawn sites were represented by fractures, a dislocation and one instance of multiple head and neck injuries. Fractures are discussed individually since the disarticulated nature of much of the material ensured that prevalence and distribution between the sexes was hard to interpret.

a) Fractures: The mature male from burial CS6 had suffered a mid-shaft fracture of the left clavicle which had healed completely but in poor alignment so that the lateral third was displaced inferiorly. This had resulted in some instability affecting the left shoulder joint with osteoarthritic changes to the acromioclavicular part of the shoulder. The left humerus

appeared to be smaller than the right (left circumference at the level of the deltoid insertion was 73mm as opposed to 80 mm).

The elderly individual (probably male) buried in grave 17/86 had suffered a fracture of the right femoral neck (Plate 4). Such fractures happen quite frequently in modern times after the age of 60 years and are often caused by a fall (Adams, 1964). However, they are rare findings palaeopathologically. The femoral head and neck had been displaced infero-posteriorly and there was considerable new bone formation on the posterior aspect of the neck surrounding the trochanters. Since healing was complete it was probably a relatively old injury. This individual had also fractured one left mid-thoracic rib shaft.

Two distal radii from disarticulated contexts showed Colles' fractures which are normally caused by a fall on the outstretched hand. There were also two distal tibiae (also found among disarticulated material) which had been fractured obliquely and had healed well in good alignment.

There was a crush fracture of the 4th sacral vertebra in a young/middle-aged female (BS2/84). This was probably caused by a fall on this area and the 5th sacral vertebra was deflected laterally as a result.

b) Dislocation: There had been a dislocation of the distal radio-ulnar joint which had resulted in alteration in position of the right radial facet in one of the individuals from G15/86.

c) Head injury: Multiple injuries to the head and neck had been sustained by a male individual aged between 25 and 35 years approximately (G13/86 context 31) who was interred in a double grave, placed almost in a sitting position facing an adolescent male. There was a well-healed neck injury which had removed one of the bifurcations of the spinous process of the third cervical vertebra - probably caused by an attack with a sharp-edged weapon from behind.

The second wound was a deep, gaping cut 4 cm long passing horizontally from the occipital bone through left asterion (Plate 5A and B). There was a vertical fracture line 2.8 cm long from the point of impact with recent, porous new bone formation at its angle, suggestive of haematoma formation. This injury appears to have been sustained shortly before death - perhaps a few days - since some healing had taken place. Again, the injury had been sustained from behind and an axe seems the most likely weapon because of the width of the cut and the chatter marks (Wenham, 1987).

A third wound had been caused by a pointed object penetrating the left parietal from above without traversing the inner table (Plate 5C). There are slight signs of healing around this lesion which has rounded edges and is surrounded by an inflammatory reaction of the ectocranial surface. It was probably received shortly before death. An arrow perforating the cranium in this fashion would probably have glanced off the bone (Hazell, pers

comm).

An ellipsoid hole in the coronal suture (bevelled internally) was inflicted at the time of death since there is no evidence of healing (S. Novak, pers comm). The penetrating injury may have been caused by a projectile or a sharp weapon such as a polearm. ^S

TABLE 9: Trauma

Skeleton number	Bone affected	Type of fracture/ injury
G13/86	Cranium and 3rd cervical vertebra	Head and neck injuries
11/85	Two ribs ? side	Mid-shaft fractures
MB/85	Right tibia	Oblique fracture
CS6/84	Left clavicle	Loss of alignment
G15/86	Right radius	Partial dislocation distally
G17/86	Left femoral neck	Oblique fracture
G17/86	Left rib	Mid-shaft fracture
4/86	Left radius	Colles' fracture
4/86	Right tibia	Oblique fracture
Unstrat/86	Right radius	Colles' fracture
Unstrat/86	Ulna ? side	Mid-shaft

5. **METABOLIC**

Deficiencies of some nutrients necessary for healthy growth and development may be identified by examining the human skeleton. Extreme manifestations of rickets, scurvy and iron deficiency anaemia are easily recognizable. However, mild signs are more problematical.

Cribra orbitalia, indicated by porosity of the orbital roofs, is a frequent finding palaeopathologically. Often it is relatively slight in degree suggesting that the lesions have healed. It is thought that cribra may represent past episodes of iron deficiency anaemia in early childhood and, indeed, most severe cases, with expansion of the bone marrow and trabeculation, are seen in children (Stuart-Macadam, 1989). Only one of the individuals with cribra orbitalia from the Lawn sites exhibited severe porosity when classified according to the system of Stuart-Macadam (1991). This frontal bone came from a context containing disarticulated bone (3/86).

Porotic hyperostosis, or expansion of the diploe (bone marrow

cavity between the inner and outer table of the skull) with porosity of the parietal bones, is seen in parts of the world where manifestations of iron deficiency are extreme, particularly near to the Equator. However, porosity seen on the cranial bones in British populations does not appear to be associated with the characteristic 'hair-on-end' appearance (Wiggins, 1992). Its meaning is, therefore, difficult to interpret.

Most of the evidence for cribra orbitalia and porosity of the ectocranial surface at the Lawn sites occurred in disarticulated contexts and it is therefore impossible to relate to sex or age. The prevalence for cribra was 5 of 30 right orbits (16.6%) and 4 of 31 left orbits (12.9%). All were bilateral except for one right orbit (3/86) where the left side was not preserved and all occurred as healed lesions in adults.

TABLE 10: Metabolic

Skeleton number	Lesion	Bone affected	Severity
AA20/84	Cribra orbitalia	Both orbits	Slight (SM type II)
G8/86	Cribra orbitalia	Both orbits	Slight (SM type II)
G15/86	Cribra orbitalia	Both orbits	Slight (SM type II)
3/86	Cribra orbitalia	Both orbits	Severe (SM type V)
3/86	Cribra orbitalia	Right orbit	Slight (SM type II)
AA20	Cranial porosity	Parietals & occipital	Diffuse lesion
MB/84	Cranial porosity	2 parietal fragments	-
G11/86	Cranial porosity	Parietals & occipital	Diffuse lesion
4/86	Cranial porosity	Parietals & occipital	Diffuse lesion
4/86	Cribra orbitalia	Left orbit	Moderate (SM type III)
Unstrat/86	Cribra orbitalia	Left orbit	Moderate (SM type IV)

SM = Stuart-Macadam (Stuart-Macadam, 1991 classification)

6. NEOPLASIA

Bone tumours are rare findings in a palaeopathological context, particularly malignant neoplasms. However, it is not unusual to find examples of small, benign osteomata on the external surface of the cranial vault. There were two button osteomata on the right frontal bone of one of the crania from context AA20/84. There was another on a fragment of right parietal bone from the disarticulated material in context 4.

7. JOINT DISEASE

Joint disease may be proliferative in nature (with new bone formation at the joint margins) or erosive (involving loss of bone from articular surfaces). The major changes are formation of marginal osteophytes (bony outgrowths), alterations to the joint surface with (a) eburnation (polishing), (b) sclerosis (thickening of subchondral bone) and/or (c) changes in joint contour (Rogers et al, 1987). Small osteophytes were noted but may be age-related and do not necessarily indicate a disease process.

Spines were examined for the presence of osteophytes affecting the vertebral end plates, porosity of the vertebral body, osteoarthritic changes to the apophyseal joints and Schmorl's nodes. The latter result from herniation of intervertebral disc material through the vertebral endplates into the vertebral body. They are more common in men than women, are seen in healthy children who participate in contact sports (Resnick and Niwayama, 1988) and one cause is thought to be stress placed on the spine at an early age.

Most spines were fragmentary and many vertebrae were missing; others were found in contexts containing vertebrae from more than one individual. There was, therefore, too little material for statistical analysis of spinal disease in this population. However, some individuals from the L86 excavation had numerous vertebrae which were affected by deeply etched Schmorl's nodes, namely those from G1 (L9), G2 (T9 - L2), G3 (T4 - L5), G10 (T11), G11 (T5 - L11), G13 (T7 - L3), G14 (L3). Two individuals had osteoarthritis of the cervical spine (KS20/85 and G11/86).

The major joints of the body and small joints of the hands and feet were also examined for osteoarthritic changes. Here, the distribution was somewhat unusual. Joint disease is most often seen archaeologically in the shoulders and hips and represents a progressive degeneration of the joints with old age. Unilateral changes, particularly to the elbows and knees, may be related to previous trauma or repeated episodes of minor stress. However, in the present study the feet were most commonly affected, both by osteophytosis and by osteoarthritis. Small numbers and the paucity of elderly members of the population may be responsible for this unusual distribution.

Two individuals had osteoarthritis of both acromioclavicular joints (2 of 31 right clavicles; 2 of 38 left clavicles). In one

(CS6/84) this was associated on the left with a fractured clavicle (Table 12). In the case of KS20/85 the disease was associated with osteoarthritis of the cervical spine - a not-infrequent combination. Three individuals had osteoarthritis of one or more joints in the right foot. In one mature male (CS6) the eburnation was superimposed on an erosive lesion of the right first metatarsal on its distal inferior joint surface. This may represent a case of gout with osteoarthritis.

Another mature male (KS20/85) showed considerable osteophytosis of the metatarso-phalangeal joints and a female buried in the unknown context (LH85) had eburnation of two proximal foot phalanges associated with erosive lesions of the distal metatarsal articular surfaces (3 of 21 right feet - 14.3%, 3 of 26 left feet - 11.5%). Other feet showed osteophytic changes.

TABLE 12: Osteoarthritis

Skeleton No	Affected area	Comments
CS6/84	Both acromioclavicular joints	Severe on left associated with fractured clavicle
CS6/84	Right foot	Erosive lesion of 1st metatarsal with osteoarthritis
KS12/85	Right and left ribs	Osteoarthritis of one rib head and one tubercle
KS12/85	Right foot	Osteoarthritis of metatarso-phalangeal joints
KS20/85	Both acromioclavicular joints	Osteoarthritis
KS20/85	Cervical vertebrae	Osteoarthritis of C3 and C4
UC/85	Right foot	Osteoarthritis of metatarso-phalangeal joints
G11/86	Cervical vertebrae	Osteoarthritis of C2, C3 and C4

IV. DISCUSSION

Despite the limitations of small numbers and poor preservation, the information provided by human skeletal remains from the Lawn sites is sufficient to provide some insight into the population

of this part of Lincoln in the Medieval period.

The LH84/85 excavations were located at the western end of the Lawn Hospital grounds near the site of the erstwhile church of St Bartholomew and probably represent a sample of burials from the surrounding graveyard. Interments were neatly laid out, many of them in stone cists suggesting that much time and effort had gone into the funerary preparations. Both sexes and most age groups were represented, although there were not enough burials to permit inferences to be drawn about most common age at death, etc.

Burials excavated during 1986, by contrast, came from an area labelled 'entrenchments'of King Stephen on a 19th century map, at the northern boundary of a plot known as 'Battleplace', where trials by battle were held. It is thought to be connected with the dispute which arose between Stephen and Matilda in the 1140s, since the area in question lies opposite the West Gate of Lincoln Castle. Interments at this site were located in several mass graves with a few single and one double burial in addition. Ceremony was perfunctory with no evidence of shrouds or coffins and little thought had been given to the position of the body or arms, apart from a general east-west alignment. In mass grave 15 burials were even more densely packed than normal and placed on their right side.

The vast majority of individuals from this site appeared to be male and most were young adults. It appears probable, from these results, that this cemetery represents battle casualties rather than an outlying graveyard allocated to St Bartholomew's church. The male burial from Grave 13 with multiple injuries to the head and neck would appear to support this hypothesis. It is to be regretted that the crania from so many other burials did not survive.

The tightly-packed mass grave (G15/86) seems to include individuals of both sexes along with some children and may be the result of some cataclysmic event such as an epidemic of plague or some other infectious disease. Acute infections normally kill the individual before the disease has time to affect the skeleton and many do not affect bone.

Burial of neonates in pits and below the foundations of buildings occurs in this area of the city as in the Wigford district and burial 295 (L87) appears to be an example of this practice.

Pathological frequencies are probably distorted by the nature of the material from these sites, eg missing teeth and vertebrae. However, several individual cases were of considerable interest in their own right and indicate problems which may occur in an urban environment.

Infection rates are one way of assessing the health of a population (Goodman et al, 1991). In the case of non-specific periostitis of the tibia it may be difficult to separate changes due to local trauma or infection from those that are caused by

a systemic infection. However, specific infections such as tuberculosis provide evidence of serious and debilitating conditions, for which there was no cure before the introduction of effective antibiotic therapy in the 1950s.

Palaeopathological examples of tuberculosis affecting bone have been found as far back in time as ancient Egypt (2,000 years BC) and normally involve the spine or large joints such as the hip and knee. Manchester (1991) considers that domestication of cattle was an important factor in the first transmission of the disease to man. Pulmonary tuberculosis, however, is associated with urbanization and people living in crowded conditions. If their immunity was poor due to malnutrition, they may have been more susceptible. Public health measures such as routine pasteurization of milk helped to secure the disease's decline in the second half of the 19th century.

Unfortunately, the mixed bones context from LH 85 is not very securely dated since the burials had been disturbed by landscaping in the 18th century. It is therefore impossible to ascertain whether tuberculosis was present in the city during the 13th and 14th centuries or whether the disease was associated with more intensive urbanization in later centuries.

Fractures of the femoral neck occur in elderly women when their bones become osteoporotic after the menopause (Albanese et al, 1969) although this area of the skeleton appears to have been less subject to loss of bone density in antiquity. However, the elderly male from Grave 17/86 appears to have suffered a serious fall some time before death and may have fractured two left ribs at the same time.

Comparisons of trauma affecting the skull with the weapons known to have been in use at this period may provide useful information. One injury had been inflicted from above with a pointed object and the other from behind with a heavy weapon such as an axe. The old injury to the third cervical vertebra had healed completely.

Patterns of osteoarthritis were unusual with few changes noted in the major weight-bearing joints or those of the upper limb but an abnormal frequency of joint disease of the feet, in one case associated with erosive changes possibly caused by gout.

Examination of the human skeletal remains from the Lawn sites has posed as many questions as it has answered but it may be helpful in deciding future policy for cemetery excavation in Lincoln.

V. BIBLIOGRAPHY

Adams JC 1964 Outline of fractures. 4th editio. E & S Livingstone Ltd, Edinburgh

Albanese AA, Edelson AH, Lorenze EJ and Wein EH 1969 Quantitative radiographic survey technique for detection of bone

loss. J Am Geriatr Soc 17: 142-54

Bass WM 1987 Human osteology: a laboratory and field manual. Missouri Archaeological Society, Missouri

Berry AC and Berry RJ 1967 Epigenetic variants in the human cranium. J Anat 101: 361-79

Bradtmiller B 1984 Congenital anomalies of the lower spine in two Arikara skeletal series. Plains Anthrop 29: 327-33

Brothwell DR 1981 Digging up bones. 3rd edition. British Museum (Nat Hist), London

Cappell DF 1958 Muir's textbook of pathology. Edward Arnold, London

Finnegan M 1978 Non metric variation of the infra-cranial skeleton. J Anat 125: 23-37

Goodman AH, Thomas RB, Swedlund AC and Armelagos GJ 1988 Biocultural perspectives on stress in prehistoric, historical, and contemporary population research. Yearbook of Phys Anthropol 31: 169-202

Hardcastle P, Annear DH and Foster DH 1992 Spinal abnormalities in young fast bowlers. J Bone Joint Surg 74B: 421-5

Hauser G and De Stefano GF 1989 Epigenetic variants of the human skull. E Schweizerbart'sche Verlagsbuchhandlung, Stuttgart

Hillson S 1986 Teeth. Cambridge University Press, Cambridge

Iscan MY, Loth SR and Wright RK 1984 Age estimation from the rib by phase analysis: white males. J Forensic Sci 29: 1094-1104

Iscan MY, Loth SR and Wright RK 1985 Age estimation from the rib by phase analysis: white females. J Forensic Sci 30: 853-63

Katz D and Suchey JM 1986 Age determination of the male os pubis. Amer J Phys Anthropol 8: 65-79

Kelley MA and Micozzi MS 1984 Rib lesions in chronic pulmonary tuberculosis. Amer J Phys Anthropol 65: 381-6

Lovejoy CO Meindl S, Przybeck TR and Mensforth BP 1985 Chronological metamorphosis of the auricular surface of the ilium. A new method for the determination of adult skeletal age at death. Amer J Phys Anthropol 68: 15-28

Manchester K 1991 Tuberculosis and leprosy: evidence for interaction of disease, pp 23 - 35, in Ortner DJ and Aufderheide A (eds) Human palaeopathology: current syntheses and future options. Smithsonian Institution Press, Washington DC

Resnick D and Niwayama G 1988 Diagnosis of bone and joint

disorders. 2nd edition. WB Saunders Co

Rogers J, Waldron T, Dieppe P and Watt I. 1987 Arthropathies in palaeopathology: the basis of classification according to most probable cause. J Arch Sci 14: 179-93

Scheuer L Musgrave JH and Evans SP 1980 The estimation of late fetal and perinatal age from limb bone length by linear and logarithmic regression. Ann Hum Biol 7: 257-65

Schour I and Massler M 1941 The development of the human dentition. J Amer Dent Assoc 28: 1153-60

Stewart TD 1979 Essentials of forensic anthropology. Charles C Thomas, Springfield, Illinois

Stirland A 1984 A possible correlation between os acromiale and occupation in the burials from the Mary Rose. Proceedings of the 5th European meeting of the Palaeopathology Society, Siena

Stroud G and Kemp RL 1993 Cemeteries of St Andrew, Fishergate. The archaeology of York. The medieval cemeteries. Vol 12. Addyman P (ed). CBA Publications, York

Stuart-Macadam PL 1989 Nutritional deficiency diseases: a survey of scurvy, rickets and iron-deficiency anemia, pp 201-22, in Iscan MY and Kennedy KAR (eds) Reconstruction of life from the skeleton. Alan R Liss, Inc, New York

Stuart-Macadam P 1991 Anaemia in Roman Britain: Poundbury Camp, pp 101-13, in Bush H and Zvelebil M (eds) Health in past societies, BAR International Series 567

Trotter M 1970 Estimation of stature from intact long limb bones, pp 71-4 in Stewart TD (ed) Personal identification in mass disasters. National Museum of Natural History, Washington, DC

Turkel SJ 1989 Congenital abnormalities in skeletal populations, pp 109-27, in Iscan MY and Kennedy KAR (eds) Reconstruction of life from the skeleton. Alan R Liss, Inc, New York

Ubelaker DH 1989 Human skeletal remains: excavation, analysis, interpretation. 2nd edition. Taraxacum, Washington

van Beek GC Dental morphology: an illustrated guide. 2nd edition. Wright, Oxford

Waldron T 1994 Counting the dead: the epidemiology of skeletal populations. John Wiley and Sons, Chichester

Wenham SJ 1987 Anatomical and microscopic interpretations of ancient weapon injuries. Unpublished BSc dissertation, Leicester University

Wiggins R 1992 Porotic hyperostosis, cribra orbitalia, enamel

hypoplasia, periostitis and metopism: a correlation of their prevalence and an assessment of porotic hyperostosis in three British archaeological populations. Unpublished MSc dissertation, Bradford University

Williams P and Warwick R 1980 Gray's anatomy. 26th edition. Churchill Livingstone, London

Workshop of European Anthropologists 1980 Recommendations for age and sex diagnosis of skeletons. J Hum Evol 9: 517-49

GLOSSARY OF MEDICAL TERMINOLOGY

Dorland's Illustrated Medical Dictionary, 27th edition, published in 1988 by W B Saunders Co was consulted in compiling the following and is the source of the illustration on p 24:

APOPHYSEAL	Pertaining to an articular process (synovial joint between two vertebrae
ASTERION	Point on skull where lambdoid suture meets mastoid sutures
AURICULAR SURFACE	Articulation with sacrum on ilium
BIFURCATION	Division into two branches
CALCULUS	Mineralization of plaque which adheres to the teeth
CARIES	Progressive demineralization of tooth by bacteria causing cavity formation
CLOACA	Hole in bone for pus to drain from an area of infection
DECIDUOUS TEETH	First set of teeth that are shed in childhood
DIAPHYSEAL	Pertaining to the shaft of a long bone (without the epiphyses)
ECTOCRANIAL	Outer surface of skull
EPIPHYSEAL	Pertaining to the growing ends of a long bone
HAEMATOGENOUS	Blood-borne (as in spread of bacteria)
HAEMATOMA	Bruising
HYPEREXTENSION	Extreme extension of a limb
HYPOPLASIA	Lines or grooves in tooth enamel indicative of previous episodes of stress, eg disease or vitamin deficiency

ILEOCAECAL/SIGMOID	Parts of large intestine
INCA BONE	Small bone, or bones, situated in midline below lambdoid suture
LUMBARIZATION	Condition where first segment of sacrum does not fuse to second
MUCOSA	Membrane (e.g. the lining of the intestine)
NON-METRIC TRAIT	Minor skeletal variations which cannot be measured on an interval scale
OSTEOPOROSIS	Reduction in amount of bone mass leading to fractures after minimal trauma
PERIOSTITIS	Inflammation of periosteal membrane surrounding bone
PROLIFERATIVE	Reproduction or multiplication of similar forms
PUBIC SYMPHYSIS	Meeting of pubic bones in midline
SACRALIZATION	Anomalous fusion of 5th or 6th lumbar vertebra to sacrum
SPINA BIFIDA	Developmental anomaly characterized by defective closure of bony encasement of spinal cord
TRABECULATION	The formation of trabeculae (bony spicules) in cancellous - medullary - bone

CATALOGUE

Abbreviations
/ lost post-mortem
X lost ante-mortem
B broken post-mortem
NP not present
--- jaw not present
R root only
A abscess
E erupting
U unerupted
PU pulp exposed

L84

A S3

Subadult
15 - 20 yrs

Preservation: Poor. <50% preserved. There appears to have been some burning of the bones which are discoloured and split. Much of the bone is powdered and fragmentary.

Bones present: Posterior parietals and occipital bone, part of left mandible, parts of both scapulae, both humeri, right proximal radius, left proximal radius and ulna, a few rib and vertebral fragments, both femora, both proximal tibiae.

Dentition:

8 7 6 5 4 / 2 1	/ 2 3 4 / 6 7 8
8 7 6 5 4 3 2 1	1 2 3 4 5 6 7 8

Non-metric traits: Lambdoid ossicles, bilateral parietal foramina.

B S1

Male
Middle-aged adult
Stature: 167.8 - 3.27 (femur)
Preservation: Poor. <50% of burial remains. Individual bones are well preserved.

Bones present: Right radius and ulna, some hand bones, rib fragments, lumbar vertebrae, right innominate, fragment of left innominate and sacrum, both femora.

Additional bones: 2 animal bones.

Skeletal pathology: Spondylolysis of 5th lumbar vertebra, possible partial lumbarization of first sacral vertebra. Ankylosis of right sacroiliac joint at superior aspect, right iliac crest enthesopathy and triceps enthesopathy on right ulna, osteophytosis of lumbar vertebrae.

BS2

Female
Young/middle-aged adult
Stature: 160.5 cm - 3.55 (femur + tibia)

Preservation: Good. Approximately 70% of burial remains. Well preserved forearms, lumbar spine, pelvis and lower extremities.

Bones present: Both ulnae and radii, a few right hand bones, 12th thoracic and all lumbar vertebrae, sacrum and both innominates, both femora, tibiae and fibulae, most foot bones.

Additional bones: 1 animal bone fragment.

Non-metric traits: Left os trigonum (right talus missing), bilateral calcaneus secondarius, bilateral peroneal tubercles.

Skeletal pathology: Crush fracture of 4th sacral vertebra.

C S4

Male
Middle-aged adult
Stature: 169.2 cm - 3.27 (femur)

Preservation: Good. >75% of skeleton remains. Few foot bones. Fragmentary ribs and vertebrae.

Bones present: All except cervical and lower thoracic vertebrae and most foot bones. Innominates are fragmentary.

Additional objects: 2 pieces of pottery, 1 metal object, 1 animal tooth, 3 fragments of animal bone.

Dentition:

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

Dental pathology: Hypoplasia, calculus, crowding of left maxillary incisors with rotation of left maxillary lateral incisor.

Non-metric traits: Bilateral tibial squatting facets.

Skeletal pathology: Periostitis of both tibiae, right maxillary sinusitis, osteophytosis of one left rib tubercle, right supinator enthesopathy on ulna. Spina bifida of T11 and T12 (check).

C S6

Male
Mature adult
Stature: 173.63 - 4.05 (humerus)

Preservation: Fair. >50% of burial present. Most of ribs and vertebrae are missing.

Additional bones: 1 animal bone, left hamate.

Bones present: All except maxilla, ribs, vertebrae, sacrum, part of innominates, some hand and most right foot bones.

Dentition:

```
                                    C
- - - - - - - - -   / / / X / 6 7 -
---------------------------------
8 X X / / 3 / /   / / / / X X X -
  A
```

Dental pathology: Periodontal disease, some teeth obscured by calculus, abscess, caries.

Non-metric traits: Left posterior condylar canal open.

Skeletal pathology: Midshaft fracture of left clavicle which has led to some disuse atrophy of left arm. Periostitis of right tibia. Osteoarthritis of right acromioclavicular joint. Erosive arthropathy of right first metatarsal ? due to gout. Bilateral enthesopathies of triceps on ulna, deltoid on clavicle, right patellar ligament, left Achilles tendon, adductor enthesopathy on left femur.

C S7

Subadult
12 - 14 yrs

Preservation: Good. >75% of skeleton remains.

Additional bones: 25 animal bones, oyster shell.

Bones present: Parietal and occipital bones, maxilla and mandible, all postcranial bones apart from right scapula, some sternal vertebrae, thoracic and lumbar vertebrae, fragmentary left innominate.

Dentition:

	NP		NPC		U
7 6 e / / 2 /		/ 2 c 4 e 6 7			
7 6 e 4 3 / /		/ 2 3 4 5 6 7			

Dental pathology: Unusual attrition of all four second deciduous molars and retained deciduous canine. Three lateral incisors are missing ? due to a congenital condition or intervention. Severe crowding of maxillary dentition with ? impaction of second left permanent molar and non-eruption of of first molar (check).

Non-metric traits: Ossicle at lambda, lambdoid ossicles. Bilateral tibial squatting facets and vastus notches in patellae. Bilateral peroneal tubercles, transverse foramina bipartite.

Skeletal pathology: Spina bifida occulta of four sacral vertebrae. Periostitis of both tibiae.

C S9

Subadult
7 - 9 yrs

Preservation: Good. >70% of burial remains. Facial bones missing.

Bones present: All except frontal bone, maxilla, manubrium and foot bones.

Additional bones: 3 animal bones.

Dentition:

	U													
7 6 e / / b /							-	-	-	-	-	-	-	
7 6 e d 3 2 1							1	2	3	d	e	6	7	
U			U	E					U				U	

Dental pathology: Calculus, caries, anomalous wear of deciduous molars. Right lateral incisor appears to be partially impacted and is growing behind other teeth.

Non-metric traits: Lambdoid ossicles, posterior condylar canal open. Transverse foramina bipartite.

Skeletal pathology: Spina bifida of third and fourth sacral vertebrae.

C29

? Female
Adult
Stature: 163.5 - 3.66

Roman

Preservation: Approximately 25% of burial remains. Individual bones are well-preserved.

Bones present: Left patella, both tibiae and fibulae, almost all foot bones.

Non-metric traits: Bilateral tibial squatting facets, bilateral peroneal tubercles.

Skeletal pathology: Osteophytosis of both tali and right navicular. Periostitis on right fibula.

E S8

? Female
Adult

Preservation: Poor. >70% present. However, bones are much eroded and ends destroyed.

Additional bones: 3 animal bones.

Bones present: Almost complete skull, parts of both clavicles and scapulae, both humeri, right proximal radius, left proximal ulna, some hand bones, manubrium, some ribs and a few vertebrae, fragments of both innominates, both femora, tibiae and most foot bones.

Dentition:

```
- - - - 4 X 2 1   / / 3 / 5 X X X
---------------------------------
8 7 6 5 4 3 2 1   1 2 3 4 X X 7 8
```

Dental pathology: Calculus, caries, abscess, periodontal disease, partially impacted third mandibular molar.

Non-metric traits: Palatine torus, left tibial squatting facet.

Skeletal pathology: Spondylosis of vertebral bodies.

AA NW 20

MNI: 4 adults (1 Males, 1 Female, 1 ? Male, 1 ? Female), 1 subadult

Preservation: Poor. The comingled remains of six individuals, the five adults represented by skulls and the subadult by postcranial bones. There are also a few adult postcranial bones.

Inventory: Anterior skull including frontal bone, orbits, both zygomatics, maxillae and almost complete mandible, right temporal bone, parietal fragments; gracile mandible, left zygomatic bone, part of left orbital roof, mandible with 2nd and 3rd molars, 2 hyoid bones, 3 complete skulls, two with mandibles.

Pair of clavicles, left clavicle, right clavicle, 2 right and 2 left scapulae, right acromion and glenoid, 2 manubria, right humerus missing distal end and right humerus missing proximal end, right ulna and radius, left proximal humerus and humeral shaft. 2 atlas and 3 axis vertebrae, 5 cervical vertebrae from one individual and 3 from another, 8 thoracic vertebrae, 3 left first ribs, multiple rib shaft fragments.

Dentitions:

```
?NP                                  R   ?NP
 X X X 5 4 3 2 1   1 2 3 4 5 6 / X
 ---------------------------------
```

Hypoplasia, calculus, caries, periodontal disease.

```
                                   A A
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
```

Large abscesses perforating both internally and externally. Crowding of anterior maxillary incisors. Multiple caries and calculus on many teeth.

```
8 7 6 5 / / 2 /   / / 3 4 5 6 7 /
---------------------------------
```

Hypoplasia, calculus.

```
?NP  A                           A   ?NP
 8 7 6 5 4 3 2 1   1 2 3 4 5 6 7 8
 ---------------------------------
 8 7 6 5 4 3 2 1   / 2 3 4 5 6 7 8
 NP                                NP
```

Calculus, caries, hypoplasia, abscess.

Subadult bones: Pair of clavicles, right humeral head (fusing), left proximal humeral epiphysis, some vertebrae.

Skeletal pathology: Both orbital roofs from one skull show slight cribra orbitalia (type II; Stuart Macadam, 1991).

Mixed bones

MNI: 5 adults and 3 subadults

Preservation:

Inventory: Skull bones: Frontal bone, , glabella from another skull, multiple fragments of skull vault, right and left zygomatic bones, left maxilla and fragment of right, 4 left mandibles and 2 right mandibular rami.

Arm bones: 4 right clavicles, 1 left medial clavicle, 2 left lateral clavicles, parts of 4 right scapulae, 5 right proximal humeri and 1 distal humerus, 2 left proximal and 3 distal humeri, right radius and ulna, right proximal and distal radii, 2 left proximal ulnae, left distal ulna, 3 left radial heads and 1 distal radius, hand bones.

Ribs and vertebrae: Multiple rib shaft fragments, 3 cervical vertebrae, 5 lumbar vertebrae from one spine, 3 other lumbar vertebral bodies, 7 thoracic vertebral bodies, 3 lumbar vertebrae from a large individual (L5 with spondylolysis).

Pelvic bones: 2 sacra, 3 right innominates, left ischium and 3 pubic bones.

Leg bones: 2 left and 1 right distal fibulae, 2 almost complete right femora, 2 further right femoral heads, right femoral shaft and distal femur with shaft, 3 left proximal femora, 2 left distal femora, right proximal tibia, right distal tibia, 3 left distal tibiae, foot bones.

Dentitions:

```
- / 6 / / 3 2 1   1 2 3 4 5 6 7 /
---------------------------------
```

Enamel hypoplasia, calculus

```
---------------------------------
                  - - 3 4 5 6 7 8
                                NP
```

Calculus

```
---------------------------------
8 7 X 5 4 3 / /   / / 3 / / / / /
```

Calculus

```
---------------------------------
                  - - / 4 5 6 7 8
                                U
```

?Impacted third molar.

Subadult bones: 8 thoracic and 5 lumbar vertebrae, sacrum, right and left ischia, left pubis and ilium, both proximal femora, left tibia and right distal tibia, distal fibula, some foot bones; humeral and femoral shafts from a smaller subadult; fragment of sacrum and 2 lumbar vertebrae from another subadult.

L85

F F15

Subadult
1 - 3 yrs

Postmedieval

Preservation: Poor. Only long bones of lower extremities.

Bones present: Right ulna, right ilium, both femora, tibiae and fibulae, a few foot bones.

Additional bones: Adult: Right scapula, left tibia, 4 rib shafts, 1 long bone shaft fragment, 3 animal bones, 2 pieces of metal.

K S12

Female
Middle-aged adult
Stature: 162.6 - 3.55 (femur + tibia)

Preservation: Good. >75% complete. Vertebrae and ribs are fragmentary.

Bones present: Most of cranium apart from maxilla, right zygomatic and temporal bones; all postcranial bones apart from distal radii and ulnae, pubic bones, right distal and left proximal fibulae, some hand and foot bones. Ribs and vertebrae are fragmentary.

Additional bones: 2 animal bone fragments, 4 hand phalanges, 4th right and 5th left metatarsals.

Dentition:

no maxilla

```
---------------------------------
8 7 6 5 4 3 2 1   / 2 3 4 5 6 7 8
  C                           C C
```

Dental pathology: Calculus, caries, periodontal disease.

Non-metric traits: Bilateral ossicles at parietal notch (check), bilateral tibial squatting facets.

Skeletal pathology: Osteoarthritis of two metatarsophalangeal joints. Degeneration of 4th and 5th lumbar vertebrae with some slippage of one on the other. Osteoarthritis of one right and three left rib tubercles, also head of first left rib. Enthesopathies of biceps brachii on radial tuberosities, costotransverse ligaments on two right ribs, and on ischial tuberosities.

K S18

Subadult
5yr - 9mo

Preservation: Good. >70% complete. Bones are well preserved with smooth surfaces.

Bones present: Posterior parietals and occipital bone, both temporal bones, right scapula, left clavicle, right radius and ulna, left humerus, radius and ulna, ribs and a few vertebrae, both ilia, left ischium, all leg and most foot bones.

Additional objects:2 metal artefacts, 2 animal bones and 2 potsherds.

Dentition:

```
/ e d 3 2 1   1 2 3 d / /
-------------------------
- - - - - 1   - - - - - 6
```

K S19

Subadult
Newborn - 3 mo

Preservation: Good. Almost complete although ribs and skull are fragmentary.

Bones present: All apart from left mandible and right radius, hand and foot bones.

Additional bones: 3 animal bones.

K S20

Male
Mature adult
Stature: 175.6 cm - 3.37 (tibia)

Preservation: Good. >70% of skeleton remains. Only skull and some vertebrae missing.

Bones present: All postcranial bones apart from some thoracic and lumbar vertebrae.

Dentition: Only some loose teeth and tooth roots.

Dental pathology: Hypercementosis on all tooth roots., root caries.

Non-metric traits: Right Poirier's facet, left septal aperture.

Skeletal pathology: Osteoarthritis of the cervical spine and both acromioclavicular joints. Right femur is thickened on medial aspect with healed periostitis on the middle third. It also has an area of myositis ossificans. Sacrum has six segments. Osteophytosis of right first metatarsal, right cuboid and right patella. Enthesopathies of both patellar ligaments, Achilles tendons on calcanei, both iliac crests and costoclavicular ligament on right clavicle.

KS21 (double burial)

(a) ? Female
Middle-aged adult
Stature: 160.1 cm - 3.72 (femur)

(b) Adult
Young/middle-aged adult

Preservation: Poor. The comingled remains of two individuals who have been tentatively separated on the basis of colour of bones. Approximately 50% of burial (a) and 10% of burial (b) remains.

Additional bones: 2 animal bones.

Bones present: (a) Parts of frontal, parietal, occipital bones and mandible; both scapulae (right fragmentary), both humeri, right radial shaft, right proximal ulna, part of right radial shaft, most right and a few left hand bones, most ribs, cervical vertebrae, fragments of thoracic and lumbar vertebrae, sacrum and innominates; both femora, tibiae and fibulae, left talus.

Non-metric traits: Metopic suture, bilateral tibial squatting facets.

Skeletal pathology: Periostitis of left tibia, degeneration of

right first rib, enthesopathies of distal right tibia and left fibula, porosity of left rotator cuff.

(b) Most of frontal, parietal and occipital bones (occipital ? from a third individual), both temporal bones, maxilla and mandible, part of left humerus and right radius, cervical vertebrae, left ischium and proximal femur.

Dentition:

```
8 7 6 5 4 3 / 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
```

Dental pathology: Calculus, periodontal disease.

Non-metric traits: Metopic suture.

Skeletal pathology: Osteophytosis of left rotator cuff.

Context 8

Preservation: Poor. Very fragmentary remains from at least two individuals: one a mature and one a young adult.

Bones present: Adult: Part of mandible, left humeral shaft, left proximal femur, left femoral shaft, left innominate, right scapula, right proximal ulna, right lateral clavicle, right proximal femur, right proximal tibia. The bones appear to be from one individual.

Dentition:

```
no maxilla
---------------------------------
X X X X X 3 2 1   / 2 3 4 X X 7 8
```

Dental pathology: Antemortem tooth loss, calculus, periodontal disease.

Young adult: Left scapula, left humerus, part of sternum, left innominate, lower thoracic vertebrae.

Context 11

MNI: 1 adult

Preservation: Poor. No skull or lower body remain. Arm bones and rib cage fragmentary.

Bones present: Fragmentary. Part of left scapula, right medial clavicle and first rib, left proximal and distal humerus, both

proximal ulnae, left radial fragment, part of sternum, some left hand bones, some ribs, upper thoracic vertebrae.

Additional bones: Right proximal ulna, 11 animal bones

Skeletal pathology: Midshaft fractures of two ribs ? side.

Context 13

MNI: 1 adult

Bones present: Left clavicle shaft, 3 skull fragments, right ilium, left proximal ulna, left proximal radius, a few rib fragments.

Additional bones: 1 animal bone.

Context 15

MNI: 1 adult

Bones present: Left clavicle, left proximal humerus, 2 left rib shafts, left tibial shaft, fibular shaft, atlas vertebra, 4 cervical vertebrae, 1st lumbar vertebra.

Additional bones: 27 animal bone fragments.

Mixed bones (a)

MNI: 4 adults, 1 subadult

Preservation: Poor. The comingled remains of several individuals.

Bones present: Skull bones: Most of cranial vault, parts of right parietal from 2 further skulls, part of right mandible.

Arm bones: Gracile right clavicle, robust left clavicle, parts of 2 right scapulae, 2 left scapulae, right humerus, 2 further right distal humeri, left humerus, left distal humerus, right proximal ulna, left ulna and left proximal ulna, right proximal radius and left proximal radius, left disstal radius, hand bones.

Vertebrae: 3 cervical vertebrae, 10 thoracic vertebrae, 9 lumbar vertebrae.

Pelvic bonees: Sacrum and both innominates from one individual (see pathology section), a further sacrum, first sacral vertebra, 2 left innominates, 2 further ischia, most of right innominate.

Leg bones: 5 left proximal femora and 2 distal femora, right femoral head, 3 right distal femora, 2 right proximal tibiae, right distal tibia, foot bones.

Additional bones: 18 animal bones and 3 teeth.

Non-metric traits: Right suprascapular foramen complete, 1 right and 2 left Allen's fossae, right tibial squatting facet, foramen transversarium anomaly of C4 and C5, bilateral parietal foramina and lambdoid ossicles.

Skeletal pathology: Pelvis: The right sacroiliac joint has been totally destroyed by an infective process which has caused erosion of both articular surfaces and some destruction of the lateral portions of the first two sacral vertebrae. Infection has also caused a cloaca (34 mm in diamaeter) to perforate the iliac crest. Large area of new bone formation in iliac fossa of left innominate. The diagnosis of gastrointestinal tuberculosis has been proposed by Dr Keith Manchester.

Right tibia: Well-healed fracture in distal third of shaft.

Subadult bones: Distal right and left ulnar shafts and distal ulnar epiphysis, lumbar vertebra, 1st sacral vertebra.

Mixed bones (b)

Female (MNI 2 adults, 1 subadult)
Young/middle-aged adult
Stature: 162.5 - 4.45 (humerus)

Preservation: Poor. Approximately 30% of burial. Only upper body is present and some elements are duplicated.

Bones present: Complete skull and mandible, right scapula, left clavicle, right humerus and proximal radius, left distal humerus, radius and ulna, most hand bones, most ribs and vertebrae, both pubic bones.

Additional bones: Right clavicle, right humeral head, 2 first left ribs, 1st and second right ribs, right scapula blade, 12th thoracic, 1st and 2nd lumbar vertebrae from another individual, 3 subadult left ribs, 8 potsherds.

Dentition:

```
8 7 6 5 4 3 2 1   1 / 3 4 5 6 7 8
---------------------------------
8 7 6 / 4 3 / /   1 / 3 4 5 6 7 8
  C R                       R
```

Dental pathology: Hypoplasia, calculus, caries.

Non-metric traits: Lambdoid ossicles, bilateral epipteric bones, transverse foramen bipartite.

Skeletal pathology: Spondylolysis of 4th lumbar vertebra, left

os styloideum, slight abnormalities in shape of axis vertebra and 7th cervical vertebra. Osteophytosis of 2 tight rib tubercles and left distal radius medially.

Unknown context

Female
Young/middle-aged adult
Stature: 149.4cm - 3.66 (tibia)

Preservation: Fair. Approx 70% of burial remains. Skull and all long bones present but no ribs or vertebrae.

Additional bones: 3 animal bones and 1 tooth.

Dentition:

	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
?NP	C	C															NP

Dental pathology: Calculus, caries, periodontal disease, clockwise rotation of left lateral mandibular incisor.

Non-metric traits: Right ossicle at asterion, bilateral tibial squatting facets.

Skeletal pathology: Erosive lesions of posterior calcaneus, distal right 4th and 5th metatarsals and left 4th metatarsal. Osteoarthritic changes of two proximal foot phalanges. Periostitis of tibiae, particularly the left, and osteomyelitis of right fourth metatarsal.

L86

Grave 1 (context 13)

MNI: 1 adult, 1 subadult

Preservation: Very poor. A disarticulated collection of bone mixed with a quantity of animal bone.

Additional bones: 12 animal bones and one tooth.

Bones present: Left mandibular condyle, left medial clavicle, right proximal radius, right proximal tibial fragment, left distal tibia and fibula, some hand and foot bones, some ribs including two subadult ribs, several vertebral fragments.

Grave 2 (context 13)

MNI: 4 adults (2 males), 1 subadult

Preservation: Poor. The comingled remains of several individuals.

Bones present: Complete skull (apart from left squamous temporal), 2 pieces of frontal bone, left and right maxillae, mandible, fragment of occipital bone from another skull, pair of clavicles, right and 3 left scapulae, 4 right humeri, 2 left distal humeri, 3 right proximal ulnae, right radius, right proximal and distal radius, 2 left proximal ulnae, one left distal ulna, 2 left proximal radii and one left distal radius, hand bones, right first rib, 15 right rib heads, 16 left rib heads and multiple shaft fragments, manubrium and sternum, substantial parts of two spines and lower thoracic vertebrae from two more spines, sacrum, 2 right innominates, right and left femoral heads, proximal fibula, some foot bones.

Subadult bones: Left proximal humerus, right proximal radius and ulna, left scapula, 2 right and 5 left rib heads, sternal vertebra, some vertebrae, sacral vertebra.

Dentition:

															C
8	7	6	5	4	3	2	1		1	2	3	4	5	6	7	8
8	7	6	5	/	/	2	1		1	2	3	4	5	6	7	8

Dental pathology: Calculus, caries.

Non-metric traits: Right ossicle at parietal notch, right lateral atlas bridge.

Skeletal pathology: Os acromiale of right scapula, sacralization of 6th lumbar vertebra. Congenital agenesis of right transverse process of 1st lumbar vertebra. Cortical defect at pectoralis major of right humerus.

Grave 3 (context 13)

Male
Young/middle-aged adult
Stature: 164.4 - 4.05 (humerus)

Preservation: Poor. Approximately 30% of burial remains. No skull, vertebrae, forearms or lower legs. Good preservation of individual bones.

Bones present: Both scapulae (left almost complete), both humeri, left radius and ulna, some left and one right hand bones, most ribs, all thoracic and lumbar vertebrae, sacrum, parts of both innominates, both proximal femora, a few foot bones.

Additional bones: 2 animal bones.

Non-metric traits: Bilateral third trochanters.

Skeletal pathology: Schmorl's nodes, spina bifida occulta of first, fourth and fifth sacral vertebrae. Os styloideum of right third metacarpal. Healed clay shoveller's fracture of first thoracic vertebra.

Grave 4 (context 13)

Male
Mature adult
Stature: 165.1 - 3.37 (tibia)

Preservation: Fair. Approximately 50% of burial remains. Individual bones are well preserved. No small hand or foot bones.

Bones present: Right radius and proximal ulna, lumbar vertebrae, pelvis, both femora, tibiae and fibulae, both calcanei, left talus, navicular and cuboid.

Non-metric traits: Right and left third trochanter, left tibial squatting facet.

Skeletal pathology: Enthesopathy of ? medial head of gastrocnemius. Achilles tendon enthesopathies. Sacrum has six segments.

Grave 5 (context 15)

? Male
Young/middle-aged adult
Stature: 183.7 - 4.32 (radius)

Preservation: Poor. Only axial skeleton and some arm bones are preserved. <30% of burial remains.

Bones present: Right distal humerus, right radius and ulna, sternum, some ribs, lower thoracic and lumbar vertebrae, most of pelvis, both proximal femora.

Additional bones: Right proximal ulna and radius, left radius and ulna, some hand bones, 1 animal bone fragment.

Skeletal pathology: Spina bifida occulta of first sacral vertebra. Osteophytosis of two rib tubercles and on right distal ulna.

Grave 6 (context 15)

Male
Middle-aged adult
Stature: 170.1 - 4.32 (radius)

Preservation: Poor. <30% of skeleton remains.

Bones present: Right proximal humerus, right radius and ulna and most hand bones, 3 lumbar vertebrae, most of pelvis, both proximal femora, tibial shaft segment.

Additional bones: Right radius and most right hand bones, part of left innominate from a subadult.

Non-metric traits: Bilateral third trochanters.

Skeletal pathology: Partial sacralization of fifth lumbar vertebra with joint disease affecting third and fourth lumbar vertebrae. Abnormally shaped hamate bone.

Grave 7 (context 15)

Indeterminate
Young adult

Preservation: Poor. Approximately 25% of burial remains.

Bones present: Distal radius, ulna and left hand, one rib fragment, lower three lumbar vertebrae, sacrum, most of both innominates, right proximal femur.

Additional bones: Left distal radius, ulna and scaphoid, 1 animal tooth.

Skeletal pathology: Spina bifida occulta of fourth and fifth sacral vertebrae, hook of hamate is much reduced in size.

Grave 8 (context 17)

MNI: 2 adults (1 ? male, 1 ? female), 2 subadults (9 - 11 yrs and 12 - 14 yrs)

Preservation: Poor. Bones from at least 4 individuals.

Bones present: Right frontal, parietal and temporal bones, both maxillae and right mandible, left clavicle and scapula, right lateral clavicle and glenoid of scapula, both humeri, right proximal radius and ulna, upper thoracic vertebrae, both tibiae and fibulae, most foot bones. Most of cranium apart from left

inferior parietal, temporal and occipital bones, left maxilla and mandible, left clavicle and right medial clavicle, right scapula, proximal humerus, proximal ulna and entire radius, most ribs, 12th thoracic vertebra, fibula shaft and some foot bones.

Dentitions:

```
     8 7 6 5 4 3 2 /   / 2 3 4 5 6 7 /
     8 7 6 5 - - - -   - - - - - - - -
Calculus
       C
     X 7 / 5 4 3 2 /   - - - - - - - -
     ---------------------------------
     8 X X / 4 3 / /   / / / 4 - - - -
```

Periodontal disease, caries.

Bon-metric traits: Bilateral tibial squatting facets.

Skeletal pathology: Bilateral cribra orbitalia (Stuart Macadam type II) in one individual. Recent periostitis on visceral aspect of two rib fragments. Osteophytosis of articular surfaces on left foot bones and two left rib tubercles.

Subadult bones: Part of right parietal and frontal bones, right clavicle and scapula, right humerus, radius and ulna, left humeral shaft, manubrium and one sternal vertebra, most thoracic and lumbar vertebrae, some ribs, right tibia, talus and navicular. Right temporal bone, maxillae and right mandibular ramus, distal ulna and 2 lumbar vertebrae.

Dentition:

```
     7 6 / 4 / / /   / / / - - - -
     ----------------------------
     no mandible
```

Calculus, hypoplasia.

Grave 9 (context 19)

MNI: 1 adult, 1 subadult (12 - 14 yrs)

Preservation: Very poor. <20% of each of the two burials remains.

Bones present: 10th thoracic vertebra, rib fragment, most of right innominate, both distal femora, proximal fibula.

Subadult bones: Left distal femur and epiphysis, left tibia and epiphysis, both fibular shafts.

Grave 10 (context 21)

Indeterminate
Adult

Preservation: Very poor. Approximately 10% of skeleton remains.

Bones present: Left clavicle, parts of both scapulae, left humeral shaft, some ribs and vertebrae.

Grave 11 (context 29)

? Male
Adult

Preservation: Poor. Approximately 30% of skeleton remains.

Bones present: Left frontal, both parietals, left temporal and occipital bone, left zygomatic, both medial clavicles, parts of both scapulae, left proximal humerus, most ribs and vertebrae.

Additional bones: 1 animal tooth.

Non-metric traits: Left parietal foramen, left double anterior condylar canal.

Skeletal pathology: Osteoarthritis of cervical spine. Porosity on parietal and occipital bones. Cortical defect at insertion of costoclavicular ligament on left clavicle. Triceps enthesopathy of ? left ulna.

Grave 12 (context 31)

Male
Young adult

Preservation: Poor. <30% of burial remains.

Bones present: Almost complete cranium (missing only left squamous temporal), both clavicles and scapulae, right humerus, most ribs and vertebrae.

Dentition:

														?NP	
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
NP																NP

Dental pathology: Calculus, ? non-eruption of third mandibular molars.

Non-metric traits: Lambdoid ossicles, right epipteric bone, bilateral foramina of Huschke.

Skeletal pathology: Porosity affecting both parietal bones near the midline, inflammatory pitting on right maxilla. Cortical defect in pectoralis major insertion on right humerus.

Grave 13 (context 31)

Male
Young/middle-aged adult
Stature: 175.8 - 4.05 (humerus)

Preservation: Poor. Approximately 50% of burial remains. No pelvis or lower extremities. Duplication of left arm bones and 5 thoracic vertebrae.

Bones present: Complete skull and mandible, both clavicles, scapulae and humeri, right proximal radius and ulna, left radius and ulna, some hand bones, most ribs and vertebrae.

Additional bones: 5 thoracic vertebrae, left humerus, left proximal radius and ulna. Animal bone.

Dentition:

	A								R							
	8	X	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	C										C		C

Dental pathology: Calculus, caries, abscess, periodontal disease.

Non-metric traits: Right parietal foramen, bilateral epipteric bones, right septal aperture, transverse foramen bipartite.

Skeletal pathology: Blade injuries to posterior part of skull and third cervical vertebra. Old, probably post-mortem injury to left parietal bone. Schmorl's nodes. Osteophytosis of distal left ulna and one right rib tubercle.

Grave 14 (context 35)

Female
Middle-aged adult
Stature: (radius)

Preservation: Poor. <25% of burial remains. Right radius and ulna, left distal radius, 12th thoracic and lumbar vertebrae, a few ribs, sacrum, right innominate, right proximal femur, distal right fibula.

Skeletal pathology: Spondylolysis of 5th lumbar vertebra with

joint disease of lumbar vertebrae.

Grave 15 (context 37)

MNI: 6 adults, 4 subadults

Preservation: Poor. A group of burials packed in several boxes - one containing skulls, one long bones, one scapulae and pelves, etc.

Additional bones: 4 animal bones and 1 tooth.

Bones present: Skull bones: 6 adult cranial vaults, three with maxillae and two mandibles.

Arm bones: 3 left clavicles, left lateral clavicle, 4 right clavicles, 3 right lateral clavicles, 5 right scapulae, 3 left scapulae, right humerus, 2 right proximal humeri, 2 right distal humeri, left humerus, left proximal humerus, 3 left distal humeri, 3 right ulnae, 2 right proximal ulnae, 2 left ulnae, 3 left proximal ulnae, 2 right and 1 left distal ulnae, 3 right radii, right proximal radius, 3 left radii, left proximal radius, left distal radius, 3 sets of left and right metacarpals, carpals, phalanges, etc.

Ribs and vertebrae: 47 right ribs and 4 right ribs, 37 left ribs and 2 left first ribs, 112 rib shaft fragments, 13 cervical vertebrae, 38 thoracic vertebrae and 8 vertebral bodies, 22 lumbar vertebrae.

Pelvic bones: Parts of 4 sacra, 5 left innominates, 2 right innominates.

Leg bones: Four right proximal femora and 2 left proximal femora, right patella.

Dentitions:

```
     8 7 6 5 4 / / /   / 2 3 4 5 6 7 8
     ---------------------------------
     8 7 6 5 4 3 / /   1 2 3 4 5 6 7 8
                                   C
```

Calculus, caries, hypoplasia.

```
                                 A
     8 7 6 5 4 3 2 1   1 / / 4 5 6 7 /
     ---------------------------------
     8 7 6 5 4 3 2 1   1 2 3 4 5 6 7 8
         C
```

Calculus, caries, abscess, hypoplasia.

Non-metric traits: Three of these individual have unusual lambdoid ossicles, two consisting of multiple Inca bones and one an ossicle just above lambda in the sagittal suture, two sterna

show large sternal foramina.

Skeletal pathology: Colles' fracture of one right distal radius. Myositis ossificans of one left femur. Spondylolysis of 5th lumbar vetebra and lumbarization of first sacral vertebra. Cribra orbitalia in both orbital roofs from one individual (Stuart-Macadam type II). One skull shows porosity on both parietal bones near the midline and on the occipital bone.

Subadult bones: Cranial vault, left petrous temporal, maxilla and mandible, 3 right and 3 left scapulae and left clavicle, right medial and lateral clavicles, 2 left medial clavicles, 3 right and 2 left humeral head epiphyses, 2 right humeri, right distal humerus, 2 left humeri and 2 left distal humeri, right and left proximal ulnae, right and left distal ulnae, right radius and right distal radius, left proximal and distal radii, 3 manubria and 2 sternal vertebrae, 2 right first ribs and 22 other ribs, 2 left first ribs and 18 other ribs, atlas, axis and 8 cervical vertebrae, 29 thoracic vertebrae, 11 lumbar vertebrae, sacrum, calcaneus, 1 right and 2 left radial heads, left proximal ulna, hand bones, right ilium and right proximal femur.

Grave 16 (context 13)

Indeterminate
Adult

Preservation: Poor. <30% of skeleton remains. Only lower extremities and some foot bones remain.

Bones present: Both femora, patellae, tibiae and fibulae, left calcaneus, talus, navicular, cuboid, lateral cuneiform and 5th metatarsal.

Non-metric traits: Left vastus notch, left peroneal tubercle.

Grave 17 (context 41)

? Male (MNI: 2 adults, 1 subadult)
Mature adult

Preservation: Poor. Disarticulated remains from at least two individuals are represented.

Bones present: 2 right and one left zygomatic bones and left temporal bones, maxilla and mandible, part of right scapula, both distal humeri, right proximal and distal ulnae, some hand bones, a few ribs and vertebrae, fragment of sacrum and left innominate, right femur, both fibulae, most foot bones.

Additional bones: Right innominate, right femur (missing head) left femoral shaft, 4 animal bone fragment.

Dentition:

```
                C           C C
X X X 5 X 3 / /   1 2 3 4 / X X X
--------------------------------
8 7 X X 4 3 2 X   X 2 3 / X X X X
```

Dental pathology: Caries, calculus, antemortem tooth loss, periodontal disease.

Non-metric traits: Bilateral peroneal tubercles.

Skeletal pathology: Fracture of one left rib, 4th left metacarpal and right femoral neck. Osteophytosis of right distal humerus and right proximal ulna. Enthesopathies of both Achilles tendons on calcanei.

Subadult bones: Parts of 4 sacral vertebrae, fragment of ilium, left patella.

Grave 18 (context 13)

Subadult
15 - 20 yrs

Preservation: Poor. Only some bones from the lower extremities are present.

Bones present: Right femur and distal epiphysis, left proximal femur, left patella, right tibial condyle, right fibula and distal epiphysis, most right tarsals and metatarsals.

Additional bones: 3 animal teeth and 1 animal bone; first left proximal foot phalanx (subadult).

Non-metric traits: Bilateral Allen's fossa, left vastus notch.

Grave 19 (context 41)

? Male
Middle-aged adult
Stature: 168.2 - 2.99 (femur + tibia)

Preservation: Poor. Approximately 30% of burial present. Individual bones are well-preserved.

Bones present: Right ulna, left pubic bone, both femora, patellae, tibiae and right fibula.

Skeletal pathology: Periostitis on interosseous surfaces of both tibiae, osteophytosis of both femoral heads, patellar ligament enthesopathies of both patellae and around hip joints.

Grave 20 (context 50)

? Male
Adult
Stature: 165.3 - 3.37 (tibia)

MNI: 2 adults, 1 subadult

Preservation: Poor. Approximately 30% of burial remains.

Bones present: Right orbital roof, left mandible, right lateral clavicle, left clavicle, left proximal humerus and radial shaft, a few ribs and vertebrae, part of both innominates, left femoral head fragments, both distal femora, right tibia and fibula (missing proximal ends, left tibia and fibula, right metatarsals, left calcaneus, talus, most tarsals and metatarsals.

Additional bones: Adult: Right 1st, 3rd and 4th metatarsals, left 1st metatarsal and long 2nd metatarsal. Subadult: Left humerus, 3 left ribs, 2 proximal hand phalanges and a fibula fragment.

Dentition:

```
- - - - - - - 1   1 2 - - - - 7 -
---------------------------------
- - - - - - - -   / 2 3 4 5 6 X X
                                R
```

Dental pathology: Hypoplasia, calculus, caries, periodontal disease.

Skeletal pathology: Periostitis on right tibia. Schmorl's nodes. Osteophytosis of left navicular.

Grave 21

MNI: 3 adults, 1 subadult

Preservation: Poor. A disarticulated collection of human and animal bones.

Bones present: Right and left mandible, right medial clavicle, left clavicle, right distal humerus, radius and ulna, left scapula, left distal humerus, proximal left radius, hand bones, some ribs and vertebrae, left pubic bone, 2 right and 2 left ischia, parts of 3 sacra, right proximal femur, right femoral head, left proximal femur, foot bones.

Additional bones: 8 animal bones and 2 teeth.

Skeletal pathology: Spina bifida occulta of 4th and 5th sacral vertebrae.

Subadult bones: 1st metacarpal, 5 rib fragments.

Context 1

Right second metacarpal (missing distal end), proximal hand phalanx, rib fragment, 8 animal bones.

Context 2

Fragments from frontal bone, parietal bone, zygomatic arch, rib femur, fibula. One tooth. Small potsherd, 6 animal bones.

Context 3

MNI: 2 adults

Preservation: Poor. A collection of disarticulated human remains mixed with animal bone.

Additional bones: 40 animal bones and 5 teeth.

Bones present: Most of frontal bone (including both orbital roofs), part of further right orbital roof, 2 right petrous temporals, 2 right mandibular rami and part of right mandible.

Arm bones: 2 right scapulae, right lateral clavicle, left clavicle, right humerus (missing proximal end), right distal radius, right distal ulna, left ulnar shaft, hand bones.

Ribs and vertebrae: 50 rib shaft fragments, 2 thoracic and 2 lumbar vertebrae, sternal fragment.

Pelvic bones: 2 sacral fragments 5 fragments of right innominate.

Leg bones: Right and left femoral shafts, right distal femur, part of left distal femur, left and right proximal tibiae, right and left patella, left tibial shaft and distal tibia, fragment of left distal tibia, right distal tibia, foot bones.

Dentitions:

```
8 7 6 5 4 3 2 -   - - - - - - - - -
---------------------------------
/ 7 6 5 4 3 2 /   - - 3 - - - - -
```

Dental pathology: Calculus, hypoplasia, periodontal disease.

Non-metric traits: Right and left lateral tibial squatting facets, right vastus notch.

Skeletal pathology: Cribra orbitalia of both orbital roots and of a further right orbital roof. ? Fracture of one left rib. Spina bifida occulta of 3rd - 5th sacral vertebrae. Periostitis of right and left tibiae. Schmorl's nodes of one thoracic vertebral body. Costoclavicular ligament enthesopathy of left clavicle.

Context 4

MNI: 19 adults (mandible), 1 subadult

Preservation: Very poor. Collection of disarticulated bone.

Bones present: Skull bones: Most of frontal bone, 2 anterior frontal bones, 2 left parietal bones, pair of parietal bones attached to occipital, 3 other occipital bones, 179 cranial vault fragments, 1 right and 3 left orbital roofs, 10 right and 11 left petrous temporals, 5 right and 5 left zygomatic bones, 13 anterior mandibles, 9 right and 10 left mandibles, 2 right and 3 left maxillae.

Arm bones: 4 right and 4 left clavicle, right medial, 3 right and 5 left lateral clavicles, 7 right and 6 left scapulae, right proximal humerus, 5 right distal humeri, 6 left distal humeri, 14 right proximal ulnae, 9 left proximal ulnae, 3 right and 5 left distal ulnae, 10 right and 11 left proximal radii, left distal radius, hand bones.

Ribs and vertebrae: 6 right and 5 left ribs, 1 atlas and 1 axis vertebra, 16 thoracic vertebrae, 8 lumbar vertebrae, 8 vertebral body fragments.

Pelvic bones: 3 first sacral vertebrae, parts of 7 right and 2 left innominates.

Leg bones: 10 right and 6 left proximal femora, 2 right and 1 left distal femora, right patella, 2 left proximal tibiae, 6 right distal tibiae, 1 right and 3 left distal fibulae.

Foot bones: 4 right calcanei, 8 left calcanei, right talus, 6 left tali, tarsals and metatarsals.

Additional bones: 19 animal bone fragments.

Non-metric traits: Metopism. Right calcaneus secondarius. Squatting facets on 2 right distal tibiae.

Skeletal pathology: Button osteoma on one fragment of ? right parietal bone. Oblique fracture of right tibia with healing periostitis on interosseous surface. Colles' fracture of one right distal radius transecting distal articular surface. Cortical defect at insertion of pectoralis major on one left humerus. Porosity affecting both parietals of one skull near the midline and the left parietal of another. Similar lesion on 7 other skull fragments. Maxillary sinusitis of two right and one left maxillae. Cribra orbitalia of two left orbits (Stuart-Macadam type II and III).

Subadult bones: Most of subadult skull and mandible, right humeral shaft, left distal humerus, 2 first metacarpals, right ischium, fragment of proximal and distal femur, right and left tibial shafts, third right metatarsal.

Dentition:

/	7	6	5	4	3	2	1		1	2	3	4	5	6	7	-
-	-	-	-	-	-	-	-	-								
-	-	-	-	-	-	-	-	-	1	2	3	4	5	6	7	8
																U

Non-metric traits: Bilateral parietal foramina, left foramen of Huschke, right bridging of supraorbital notch.

Context 5

MNI: 1 adult, 1 subadult

Preservation: Very poor. A mixed group of human and animal bone.

Additional bones: 31 animal bones.

Bones present: 3 skull vault fragments, fragment of sphenoid. Left clavicle (medial end just fusing), 3 fragments of left scapula, 7th cervical vertebra, 1 left rib, right rib head, 11 rib shaft fragments, left proximal radius, most of right radius, parts of both tibial shafts, right distal tibia, right distal tibial epiphysis, parts of 2 lumbar vertebral bodies.

Non-metric traits: Both right distal tibiae show lateral squatting facets.

Skeletal pathology: Osteophytosis of both lumbar vertebrae.

Context 13

MNI: 2 adults, 1 subadult

Preservation: Poor. A collection of disarticulated human remains.

Additional bones: 3 animal bones.

Bones present: Skull bones: 4 cranial vault fragments, left zygomatic bone, 2 right mandibles.

Arm bones: Right and left lateral clavicles, right medial clavicle, part of right scapula, left distal humerus, right proximal ulna, right distal ulna, left proximal and distal radii, right metacarpals, left 3rd metacarpal.

Ribs and vertebrae: 2 atlas vertebrae, 1 axis vertebra, 3 cervical vertebrae, 2 thoracic vertebrae, some rib fragments.

Pelvic bones: Sacrum, right innominate.

Leg bones: Left femoral shaft, right distal femur, left proximal fibula, right tibia, fibular shaft, right calcaneus, both first metatarsals, small right 5th metatarsal, left 3rd metatarsal.

Subadult bones: Right clavicle shaft, medial clavicle ? side, distal ulna, first sacral vertebra, right distal femur and epiphysis, proximal tibial epiphysis.

Context 15

MNI: 2 adults

Preservation: Very poor. Miscellaneous collection of human bone.

Additional bones: 7 animal bones and 1 animal tooth.

Bones present: Skull bones: Most of occipital bone, posterior part of left parietal, 14 other skull vault fragments, right petrous temporal, part of left mandible.

Arm bones: Right ulna and distal end of a further right ulna, a few hand bones.

Ribs and vertebrae: 1 cervical and 2 thoracic vertebrae, first and second right ribs.

Pelvic bones: A few fragments.

Leg bones: Right proximal tibia and fibula, some tarsals and metatarsals from both feet.

Non-metric traits: Lambdoid ossicles.

Skeletal pathology: Porosity affecting large area of left parietal bone. Osteophytosis of one left rib tubercle and 11th thoracic vertebra.

Context 17

MNI: ? 3 adults, 2 subadults

Preservation: Very poor. A miscellaneous collection of bones which are different colours.

Additional bones: 4 animal bones.

Bones present: Most of frontal bone, part of left orbital roof, 8 skull vault fragments, 2 right temporal bones, right maxilla and mandible. Part of right scapula, right proximal humerus, manubrium and sternum, 2 thoracic vertebrae, left distal tibia, long bone shaft fragments. Collection of bones which are very pale in colour: part of right scapula, clavicle shaft, right ulnar shaft and left proximal ulna, part of right humerus.

Subadult bones: Right clavicle, left humeral shaft and proximal epiphysis, atlas vertebra, right ilium, 2nd sacral vertebra, left ischium, left proximal radius, humeral head epiphysis, distal femoral shaft ? side, right patella, some foot bones, right distal femur (from smaller individual).

Non-metric traits: Right calcaneus secondarius.

Context 40

MNI: 3 adults, 1 subadult

Preservation: Very poor. A group of disarticulated bones.

Additional bones: 3 animal bones and 1 tooth.

Bones present: Left femoral head, 2 left proximal femora, left distal femur, right proximal tibia, right distal humerus, left distal radius, right proximal ulna, 2 vertebral body fragments, 3 rib fragments, 3rd left metatarsal.

Subadult bones: Right tibial shaft.

Context 44

MNI: 1 adult, 1 subadult

Piece of left humeral shaft, left pubic bone, right talus, 1 right and 1 left rib fragment, right ischium, right 4th metatarsal, 1st metacarpal. Subadult right third metatarsal.

Context 48

Right 5th metatarsal, 10 animal bones.

Context 50

MNI: 2 adults, 1 subadult

Bones present: Left distal radius and ulna, a few ribs, left proximal femur, left proximal tibia, 2 right distal tibiae, right calcaneus, long bone shaft fragments.

Subadult bones: Left proximal femur, part of iliac crest, rib fragment.

Context 61

MNI: 1 adult, 1 subadult

Bones present: Part of frontal bone, right proximal ulna, right distal radius, 5th left metacarpal, 4 rib fragments.

Subadult bones: Proximal hand phalanx.

Unstratified material

MNI: 11 adults, 2 subadults

Preservation: Poor. A disarticulated collection of human and animal bone.

Additional bones: 32 animal bones and 3 teeth.

Bones present: Skull bones: 4 right petrous temporals, 3 left petrous temporals, 2 right and 3 left orbital roofs, left parietal bone and 64 skull vault fragments, 6 left mandibles, 3 right mandibular rami.

Arm bones: Parts of 3 right and 4 left scapulae, 4 right and 6 left clavicles, right proximal humerus, 4 left proximal humeri, right humeral shafts, 8 left distal humeri, 9 right and 4 left proximal ulnae, 1 right and 2 left distal ulnae, 2 right radii, 3 left proximal and 5 left distal radii, some metacarpals and hand phalanges.

Ribs and vertebrae: Sternum, 12 right and 15 left ribs, atlas vertebra, 5 thoracic and 13 lumbar vertebrae.

Pelvic bones: 2 almost complete right and 3 left innominates, parts of 2 further right and 3 further left innominates, 1 almost complete sacrum and some fragments.

Leg bones: 8 right proximal femora, 11 left proximal femora, 8 right and 5 left distal femora, 4 right and 5 left proximal tibiae, 5 right and 8 left distal tibiae, 2 right and 1 left

267

Indeterminate
Adult

Preservation: Poor. About 30% of burial remains. Individual bones are fairly well preserved.

Additional bones: 4 animal bones.

Bones present: Both femora, left patella, left tibia, right tibia (with fragmentary distal end), both calcanei and tali, most metatarsals, left navicular and medial cuneiform.

Skeletal pathology: Septic arthritis affecting proximal 2nd metatarsal and medial cuneiform. Left patellar ligament enthesopathy and bilateral capsular ligament enthesopathies.

Context 251

Adult first left mandibular molar.

Context 275

Proximal two thirds of left femur (in two parts).

Context 276

Part of femoral shaft ? right.

Context 295

Subadult
Newborn

Preservation: Very good. More than 90% complete. Only a few hand and foot bones are missing.

Unstratified

Right proximal femur.

L89

Context III

2 animal bones.

Context IV

1 animal bone.

Context V

10 animal bones.

Context VI

Adult rib fragment, 3 animal bones.

Context VIII

MNI: 1 adult, 1 subadult

Skull vault fragment, part of occipital bone, right distal fibula, 3 rib shaft fragments, 2 femoral shaft fragments, 2 sacral fragments, 6 miscellaneous bone fragments.

Subadult bones: Part of left scapula, left distal ulna (epiphysis fusing to shaft).

Additional bones: 5 animal bones.

Context IX

White fragment ? material. 55 animal bones and 4 teeth.

Context XI

Animal bone and tooth.

Context XV

Left proximal radius.

Context XVIII

Anterior mandible with first molars in situ. Small distal caries in right mandibular first molar.

Unstratified

Left femoral shaft (missing both ends).
2 animal bones and one tooth.

CWG87

Unstratified

Left clavicle, animal bone.

Lincoln Cathedral
LC84

62

Indeterminate
Mature adult

Preservation: Poor. Approximately 50% present. Lower limbs are crushed. Most other bones are fragmentary. There is crystallization on surface of lower extremities and some purple staining of fragments.

Bones present: Part of occipital bone and mandible, both clavicles, most of left scapula, left humerus and proximal ulna, right distal humerus and proximal ulna, some hand bones, some ribs, most cervical and thoracic vertebrae, fragmentary pelvis and femora, most of both tibiae and left fibula, most foot bones.

Additional bones: 3 animal bones, proximal hand phalanx.

Dentition:

8 7 - - - - 2 -	1 - 3 - - - - 8
8 7 X 5 X 3 - -	- - - - - - - -

Dental pathology: Abscess, periodontal disease, calculus, hypoplasia.

Skeletal pathology: Bilateral enthesopathies of triceps insertion on ulna and patellar ligament on patellae, particularly on right.

72

? Male
Young adult
Stature:40.0 cm

Preservation: Good. Approximately 70% of burial remains. Individual bones are well preserved. No skull, ribs, vertebrae or upper arms.

Bones present: Both radii, ulnae and all hand bones, sacrum, both innominates, femora, tibiae and fibulae, almost all foot bones.

Non-metric traits: Bilateral Allen's fossae.

Skeletal pathology: Spina bifida occulta, periostitis of both tibiae.

APPENDIX 5

EXCAVATIONS ON THE LOWER CITY SITES, LINCOLN 1972 - 1987

Interim Report on the Human Skeletal Remains

by

Anthea Boylston and Charlotte Roberts

Calvin Wells Laboratory
Department of Archaeological Sciences
University of Bradford
BRADFORD
BD7 1DP

January 1995

I. INTRODUCTION

A small number of burials were available for observation from various sites in the Lower City, some dating to the Saxon, and others to Medieval and Postmedieval periods. There was one inhumation and a number of cranial fragments from Broadgate East. The Silver Street excavations, which sampled the cemetery of the Franciscan monastery (Grey Friars), produced 11 burials and 5 disarticulated contexts. These were dated to the 13th - 16th centuries (Medieval period). The Anglo-Saxon site of Saltergate contributed 4 inhumations and 3 disarticulated contexts containing human bone to the present study. In addition, there were 2 infant burials from Springhill/Michaelgate.

II. PHYSICAL ANTHROPOLOGY

1. PRESERVATION

The Medieval and Postmedieval burials from Area A at Silver Street came into the best preserved categories (Table 1). Two of these were almost complete and a further two individuals were in good condition. The subadult burial in context 17 was found to incorporate part of another, much older individual. The suffixes (a) and (b) were assigned to distinguish the two burials.

The single interment from Broadgate East was well preserved and almost complete. The 4 burials from Area BI at Silver Street fell into the fair or poor preservation categories. Two contexts from this site were in a poor state of preservation: one was a Postmedieval context (RN422) from Area BII which only retained the upper part of the body including a spine with severe DISH (diffuse idiopathic skeletal hyperostosis); the other was context 55. There were four small contexts consisting of a few bones each.

Saxon burials from Saltergate were in a fair or poor condition. One of the infant burials from Springhill/Michaelgate retained over 90% of its skeletal elements (129), while the other (423) consisted only of some skull bones, a few ribs and part of the left side of the body. The third context (250) from this site contained only bird bones. They are discussed in the introductory section with the other Roman infants from other parts of the city.

Most individual bones from the Lower City sites had intact joint and cortical surfaces so it was possible to observe pathological conditions without difficulty.

TABLE 1: Preservation

Grade	Broad-gate East	Silver Street			Saltergate (Saxon)
		Area A	Area BI	Area B2	
1 (>90%)	-	10, 11	-	-	-
2 (>70%)	VI AC	15, 17a	111D	-	-
3 (>50%)	-	-	111C	-	187, 188, 189
4 (>30%)	-	55	111A, 111B	422	17
5 (<30%)	-	17b	116E	-	-
Disartic	QT	-	-	153, 423, 424, 425	166, 166a, 182

2. MINIMUM NUMBER OF INDIVIDUALS

There were a total of 17 adult burials, one subadult and 2 infants excavated from the sites in question, in addition to 5 contexts containing small amounts of human bone from adult individuals and 3 from subadults (166, 166a and 425). Hence, there were 27 separate contexts containing human bone, one of which (Area A context 17) included two individuals. The second was represented by the left forearm, pelvis and left lower extremity.

Table 2 lists the number of certain easily identifiable skeletal elements. Those most commonly found were the occipital bone, the mandible and the tibiae.

TABLE 2: Minimum Numbers

Skeletal element	Adult	Subadult
Occipital	13	1
Right petrous temporal	11	2
Left petrous temporal	12	1
Right maxilla	10	1
Left maxilla	9	1
Right mandible	13	1
Left mandible	13	1
Right distal clavicle	8	1
Left distal clavicle	8	1
Right proximal humerus	8	2
Left proximal humerus	10	2
Right distal humerus	10	2
Left distal humerus	11	2
Right proximal radius	9	2
Left proximal radius	10	3
Right distal radius	10	2
Left distal radius	11	3
Right proximal ulna	9	2
Left proximal ulna	8	2
Right distal ulna	7	2
Left distal ulna	7	1
Right proximal femur	10	3
Right distal femur	11	2
Right proximal tibia	13	2
Left proximal tibia	13	2
Right distal tibia	13	2
Left distal tibia	13	1
Sacrum	10	1

3. SEX

The methods used for age, sex and stature estimation are stated in the introductory report. Sex ratios were fairly evenly distributed in the Silver Street sites (Table 3). The interments from Area A included two males and two females. There was one male, one probable male, two females and one probable female from Area BI. Area BII revealed one female from the Postmedieval period (422) and three small contexts where there was too little material for estimation of sex to be undertaken.

However, the Saltergate excavation, dating to the Saxon period, had sampled a group of three females and three small contexts (two of which contained cranial vault fragments from a subadult and an infant - 166 and 166a). The sole relatively complete burial from Broadgate East was that of a female. The two infants from Steep Hill/Michaelgate were of indeterminate sex.

TABLE 3: Sex

Sex	Broad gate East	Silver Street			Saltergate (Saxon)
		Area A	Area BI	Area B2	
Male	-	10, 11	111C	-	-
Female	VI AC	15	111A, 111B	422	187, 188, 189
? Male	-	-	116E	-	17
? Female	-	17b	116D	-	-
Indeter-minate	QT	55	-	153, 423, 424	182
Sub-adult	-	17a	-	425	166, 166a
TOTAL	2	6	5	5	7

4. AGE

There was only one subadult interment in the Lower City sites (apart from the infants mentioned above). This individual was aged between 12 and 14 years and came from Area A (context 17) at Silver Street (Table 4). The two males from Area A were a young/middle-aged adult (11) and a middle-aged adult (10). The two females were both mature adults (15, 17b). Context 55 consisted of a badly eroded bone assemblage representing one individual but with insufficient material for age and sex estimation to be undertaken.

The male burial from Area BI was a young adult and the probable male came into the young/middle-aged category. The two females

were a mature adult (116A) and one who was insufficiently well preserved to be assigned an age category (111B); the probable female was a young/middle-aged adult. In Area BII there was a mature female (422), three contexts containing fragments of bone from adult individuals and a few cranial fragments from an infant (425).

The three Saxon females from Saltergate were a young adult, one in the young/middle-aged category and a mature adult. One context (182) contained a few arm and hand bones.

TABLE 4: Age

Age	Broad gate East	Silver Street			Saltergate
		Area A	Area B1	Area B2	
<1 yr	-	-	-	425	166a
12 - 14 yr	-	17a	-	-	-
Young adult*	-	-	111C	-	17, 189
Young/middle-aged adult	VI AC	11	116D	-	187
Middle-aged adult	-	10	-	-	-
Mature adult	-	15, 17b	111A	422	188
Adult	QT	55	111B, 116E	153, 423, 424	182
Subadult	-	-	-	-	166
TOTAL	2	6	5	5	7

* Young adult = 21 - 25 years approximately
26 - 35 " "
36 - 45 " "
46 " and over

5. STATURE

Only a limited number of stature estimations could be carried out and the results are listed in Table 5. The tallest female came from Broadgate East. However, with such small numbers it is difficult to draw any further conclusions.

TABLE 5: Stature

Sex	Broadgate East	Silver Street		Saltergate
		Area BI	Area A	
Male	-	173.1	157.6, 170.8	-
Female	163.8	160.9	158.1	-
? Male	-	-	-	172.6

6. **METRICS**

Cranial and postcranial measurements will be listed in detail in the final report. However, cranial morphology is worthy of comment. Four skulls from the Lower City sites were sufficiently complete for measurements to be taken. Their cranial indices, which denote the shape of the skull, are listed in Table 6. All 4 skulls fell into the medium, broad or very broad categories. This is a normal finding for the Medieval period in this country.

TABLE 6: Cranial Metrics

Skeleton no	Index	Class	Range
AI 15	78.6	Mesocrany	75.00 - 79.99
BI 111B	88.6	Hyperbrachycrany	85.00 - X
BI 111C	84.3	Brachycrany	80.00 - 84.99
BI 111D	85.6	Hyperbrachycrany	85.00 - X

The lengths and breadths were averaged in the three intact crania (15, 111C and 111D) to calculate a height index (Bass, 1987) and all three were high skulls (acrocrany) with indices of 83.8, 87.3 and 84.5 respectively.

7. **NON-METRIC TRAITS**

These minor abnormalities of the cranial and postcranial skeleton are discussed fully in the introductory section. The most common cranialtraits were lambdoid ossicles which were found in 4 out of 13 crania (30%) available for observation. The metopic suture, which bisects the frontal bone, had failed to fuse in two adults (of 13, 15.4%). Two mandibles (of 13; 15.4%) demonstrated bilateral tori (bone formation on the lingual surface of the mandible).

III. PALAEOPATHOLOGY

1. **DENTAL HEALTH**

Thirteen adult and 1 subadult dentitions were recorded and scored for the presence of caries (cavities), calculus (tartar), enamel

hypoplasia, periodontal disease and abnormalities in number or location of the teeth. The results are included in the tables in the introductory section. Five individuals (of 13) had caries in one or more teeth (38.5%). A total of 9 teeth were carious out of a possible 253 teeth representing a low rate of 3.6%. A further 3 individuals had no cavities but had lost some teeth before death, probably due to destruction of the tooth by caries. The first permanent molar is most likely to be affected. One male (AI 10), a young/middle-aged adult, had lost all four first molars.

There was little evidence of crowding of the teeth in this small sample nor had any third molars failed to develop. In two cases there was some degree of rotation of one tooth, a third mandibular molar in context 153 and a second mandibular premolar in context 188.

2. DEVELOPMENTAL ABNORMALITIES

The vertebrae of the spine and sacrum were most often affected by these abnormalities, as is often the case. Two sacra of 10 (A 11 and BI 116D) consisted of 6 vertebrae instead of the normal 5 and 3 (of 10) exhibited spina bifida occulta. Of these, context 111C was bifid at the apex of S1, context 17 (Area A) had a slit in the neural arch of S5 and context 116D had spina bifida of S4 and S5. The subadult from context 17 also had an abnormality in the development of one of the unfused sternal segments which was only half formed.

The mature female from context 422 with DISH, which involves ossification of the anterior longitudinal ligament of the spine, demonstrated fusion at the manubrio-sternal synchondrosis. This is a condition which occurs in 10 - 15% of adults over 30 years of age (Resnick and Niwayama, 1988).

Two more unusual spinal abnormalities originated in the foetal development of the spine. These anomalies occur at the interface between different parts of the spinal column which may shift either cranially or caudally (Barnes, 1994). The first was indicated by a right lumbar rib in association with an abnormality of the lumbo-sacral junction. There was either sacralization or lumbarization of the 5th lumbar vertebra. (As the sacrum was incomplete it was difficult to ascertain which process was involved).

The second affected the junction between the atlas vertebra and the cranium. There were bilateral precondylar tubercles in context 17 (Area DII) which were previously scored as non-metric traits but seem more likely to represent a minor abnormality in differentiation of the skeletal elements connected with the central nervous system (Barnes, 1994).

The only other developmental abnormality was os acromiale of the left scapula from the male burial in Area A (context 11). The

tip of the acromion had failed to fuse creating a pseudarthrosis.

3. **INFECTION**

This category of disease was represented in this sample by non-specific infection (periostitis) affecting the surface of the long bone shafts and infection of the maxillary sinuses (Table 7).

TABLE 7: Infection

Skeleton number	Bone affected	Severity	Healed or recent
Area A 11	Left tibia	Moderate	Recent and healing
Area A 17	Right tibia	Slight	Healed
Area BI 111B	Both sinuses	Slight	Healed
Area BI 111C	Both femora, right tibia	Moderate	Recent
Area BII	Left tibia	Moderate	Recent and healing
Area EI 189	Both sinuses	Very severe	Healed
Area EI 189	Both tibiae	Slight	Healed

a) Periostitis of the tibiae: The severity of the lesion was judged by how much of the bone was affected and the degree of alteration of the bone contour, e.g. a slight lesion would involve less than one third of one surface of the tibial shaft, whereas a severe lesion would affect more than two thirds of one surface. Three of 13 right tibiae displayed periosteal new bone formation (23%) and 3 of 14 left tibiae (21.4%).

b) Maxillary sinusitis: The maxillary sinuses are antra (or chambers) within the bone of the maxilla which connect with the nose and other sinuses and act as the first line of defence against inhaled organisms (Lewis et al, 1995). Inflammation of the sinuses may result in new bone formation on the walls of the antra which must be distinguished from infection due to dental disease. The aetiology of maxillary sinusitis is multifactorial. Chronic infections may be due to pollution or allergies, among other causes.

Eight right and 6 left maxillae were examined for this condition. Two right and two left showed new bone formation. In one case (189) it was extremely severe with thick layers of lamellar bone covering the entire surface of both chambers (Plate 6).

4. TRAUMA

This category includes fractures, dislocations and weapon injuries. There was only one example of trauma from the Lower City sites and this came from an additional burial in Area A context 17. Only the left forearm, left innominate and leg were preserved but these came from a mature adult who was probably female. The left ulna had sustained a fracture which had failed to unite and the distal half of the bone was not retrieved during excavation. The end of the bone was rounded and sclerotic (thickened).

The failure of fractured bones to unite is quite common in modern times, although few archaeological examples have been found. In a study of a large collection from the United States and Egypt, Stewart (1974) found only a small number of ununited fractures and these were mainly in forearm bones. The ulna was the most frequently fractured bone (3 cases) followed by the clavicle. Jurmain (1991) reported three ununited ulnar fractures in a prehistoric population of 440 individuals from California.

The cause may be an interruption to the blood supply, interposition of soft tissue between the fractured ends of the bone, an excessive shearing force between them or just a lack of apposition (Crawford Adams, 1983) or the person dies before healing can occur. There was a notch on the medial aspect of the radial shaft where the fractured end had impinged on it. The injury may have been caused by a direct blow to the forearm. A fall would probably have caused the radius to fracture before the ulna.

5. METABOLIC

a. Osteoporosis: This is charactized by a diminution in the amount of bone per unit volume although the bone itself is normal chemically (Nordin et al, 1966). The cancellous bone is more severely affected than cortical bone with reduced numbers of thinned trabeculae. The disease is particularly common in postmenopausal women, although the imbalance between bone formation and resorption appears to begin during the fourth decade of life and not to be entirely hormonally mediated (Steinbach, 1964).

The spine of a mature female from context 15 Area A showed advanced osteoporotic changes with the characteristic biconcave 'cod fish' vertebrae, particularly in the thoracic spine (Plate 7). The disease is very difficult to quantify in archaeological bone, since 30% of bone mass must be lost before there is a visible change by X-radiography.

b. Cribra orbitalia: This is indicated by porosity of the orbital roof and is thought to be associated with past episodes of iron deficiency anaemia experienced during childhood. The subadult buried in context 17 displayed a mixture of healing and porous trabecular bone in the left orbit (grade 3 or 4 - Stuart-Macadam, 1991). Three right (of 12, 16.6%) and 3 left (of 10; 20%) adult

orbits had healed lesions (grade 2, Stuart-Macadam, 1991). These were all bilateral changes and occurred in one male (context 10), one probable female (116D) and one female (187).

7. NEOPLASIA

Osteomas are benign tumours which present as hard bony masses and are smooth or nodular to the touch. They occur mainly on those bones which are formed in membrane, notably the frontal and parietal bones of the cranium (Resnick and Niwayama, 1988). They may also be found within the sinuses. Males are more commonly affected than females and the lesions tend to be identified in the fourth or fifth decades of life. Small, button osteomas are quite common.

One of the females buried in Area BI at Silver Street (context 111B) displayed a large growth on the right parietal bone measuring 30 mm in diameter rising to 7mm above the surface of the outer table of the skull (Plate 8). The diagnosis of ivory osteoma was proposed (Manchester, pers comm). Lesions of this size have rarely been described in the palaeopathological literature and it is considerably larger than that illustrated by Ortner and Putschar (1981).

8. JOINT DISEASE

Spines and diarthrodial joints were examined for the presence of osteophytes, porosity, eburnation and contour change. Osteoarthritis was only diagnosed when there was definite evidence of bone-to-bone contact indicated by eburnation (polishing), except in cases where there were definite subchondral cysts. Clinical diagnosis of osteoarthritis, which relies heavily on X-rays, is based on joint space narrowing in addition to signs and symptoms, factors which cannot be considered in palaeopathology.

Three mature females had osteoarthritis of the facet joints of the spine (Table 8). In all cases, this was associated with a similar condition in other synovial joints of the body. The Postmedieval burial from context 422 (Area BII from Silver Street), which was very incomplete, also had osteoarthritis of the left acromioclavicular joint and of two left rib heads (costo-vertebral joints). Burial 111A, from Area BI of Silver Street, also had osteoarthritis of the right hip, indicated by eburnation of the right femoral head. This context was also very incomplete. Burial 188, from Saltergate, had osteoarthritis of both knees and two costo-vertebral joints.

TABLE 8: Spinal Osteoarthritis

Skeleton number	Vertebrae affected	Other spinal pathology
422	C3 - C6	DISH affecting T4 - T6 and T8 - T12
111A	C3	'Bird-beak' osteophytes on L2 - L5
188	1 thoracic and 2 lumbar vertebrae	Fragmentary spine

Table 9 lists other manifestations of joint disease in this small group. Minor osteophytes at the joint margin are a natural part of the ageing process and are not necessarily indicative of a disease process. The middle-aged adult male from context 10 (Area A) had osteoarthritis of the right acromioclavicular joint and degenerative changes of the joints between the manubrium and the first ribs. One individual was suffering from osteoarthritis of the 5th metatarso-phalalangeal joint in the left foot. This was associated with an erosive arthropathy.

Osteoarthritis is caused by wear and tear on the joints. The cartilage becomes brittle with age and is not able to regenerate. Nowadays, it is a disease of middle age and by the age of 60 or 70 years almost everybody has at least one joint which is affected. The distribution of osteoarthritis in this study suggest that the condition is age-related rather than occupational.

TABLE 9: Diarthrodial Joint Disease

Joint affected	Osteophytes or porosity only	Osteoarthritis
Acromioclavicular		
- right	-	10, 188
- left	-	188
Shoulder - prox humerus		
- right	116D	-
- left	15, 116E	-
Wrist - distal ulna		
- left	188	-
Hip - acetabulum		
- right	15	-
- left	15, 17	-
Hip - femoral head		
- right	-	111A
- left	116D	-
Knee - distal femur		
- right	15, 111B, 111D	188
- left	15, 17	188
Knee - proximal tibia		
- right	-	188
- left	15	188
Feet		
- right	111B	-
- left	111B	116D
Ribs		
- right	116D	188,
- left	116D	422, 188

a: Diffuse idiopathic skeletal hyperostosis: This condition involves ossification of the connective tissues associated with the spine, particularly the anterior longitudinal ligament (Plate 9). There is often ossification of ligamentous insertions and joint capsules, e.g. on the pelvis, patella, etc. The disease is rare before the age of 40 years but up to 10% of males and 7% of females over 70 years of age in a modern population are affected (Waldron, 1985). Although the cause is unknown, there appears to be an association with maturity onset diabetes in some studies (e.g. Julkunen et al, 1971) and with high status individuals.

The mature female from a Postmedieval context (422) in Area BII mentioned above, had osteoarthritis of the third to sixth cervical vertebrae and fusion of the eighth to twelfth thoracic

vertebrae. The fourth and fifth thoracic vertebrae were also fused.

IV. DISCUSSION

Adults of all ages and both sexes were represented in this sample but there was only one juvenile, apart from two infants dating to the Roman period. Although the Silver Street excavation was on the site of Franciscan friary in Lincoln, there did not appear to be a predominance of males in this small sample. In fact, the distribution between the sexes was very even. This is not surprising since, after the year 1250 AD, the Orders of Friars were given permission to bury members of the local community in their cemeteries. Elderly females may also have been benefactresses of the institution. All the mature adults in this study were female. The three males were a young adult, a young/middle-aged adult and a middle-aged adult.

The prevalence of non-specific infections and metabolic disease was similar to that found in the upper city sites.

VI. BIBLIOGRAPHY

Barnes E 1994 Developmental defects of the axial skeleton in paleopathology. University Press of Colorado, Boulder

Bass WM 1987 Human osteology: a laboratory and field manual. Missouri Archaeological Society, Missouri

Crawford Adams J 1983 Outline of fractures. 8th edn. Churchill Livingstone, Edinburgh

Julkunen H, Heinonen OP Pyorala K. 1971 Hyperostosis of the spine in an adult population. Ann Rheum Dis 30: 605-12

Jurmain RD 1991 Paleoepidemiology of trauma in a prehistoric central California population, in Ortner DJ and Aufderheide AC (eds) Human paleopathology: current synthesis and future options. Smithsonian Institution Press, Washington

Lewis ME, Roberts CA and Manchester K 1995 A comparative study of the prevalence of maxillary sinusitis in later Medieval urban and rural populations in Northern England. Amer J Phys Anthropol 98:

Nordin BEC, MacGregor J and Smith DA 1966 The incidence of osteoporosis in normal women: its relation to age and the menopause. Quart J Med 35: 25-38

Ortner DJ and Putschar WGJ 1981 Identification of pathological conditions in human skeletal remains. Smithsonian Institution Press, Washington

Resnick D and Niwayama G 1988 Diagnosis of bone and joint disorders. 2nd edn. WB Saunders Co, Philadelphia

Steinbach H 1964 The roentgen appearance of osteoporosis. Radiol Clin N Amer 2: 191-207

Stewart TD 1974 Nonunion of fractures in antiquity, with descriptions of 5 cases from the New World involving the forearm. Bull NY Acad Med 50: 875-91

Stuart-Macadam P 1991 Anaemia in Roman Britain: Poundbury Camp, pp 101-13, in Bush H and Zvelebil M (eds) Health in past societies, BAR International Series 567

Waldron T 1985 DISH at Merton Priory: evidence for a 'new' occupational disease? Brit Med J 291: 1762-3

CATALOGUE

Abbreviations

/	lost postmortem
X	lost antemortem
B	broken postmortem
NP	not present
---	jaw not present
R	root only
A	abscess
E	erupting
U	unerupted
PU	pulp exposed

BROADGATE EAST (BE73)

I-QT

16 cranial vault fragments; 6 animal bone fragments.

VI-AC

Female
Young/middle-aged adult
Stature: 163.8 - 4.45 cm (hum)

Preservation: Good. >70% of burial present. Skull, ribs and vertebrae are fragmentary.

Bones present: Parts of frontal, parietal and entire occipital bone, left temporal, most of mandible; all post-cranial bones present apart from a few vertebrae, remaining vertebrae are fragmentary as are ribs and sternum.

Additional bones: 1 animal bone.

Dentition:

no maxilla
---
8 7 6 5 4 3 2 1 1 2 3 4 5 6 7 8

Loose teeth: Left maxillary third molar

Dental pathology: Caries, calculus.

Non-metric traits: Posterior condylar canal open, bilateral mandibular tori, bilateral tibial squatting facets.

SILVER STREET (LIN73)

AREA A

Burial 1 (Context 10; RN418)

Male
Middle-aged adult
Stature: 157.6 - 2.99 (femur + tibia)

Preservation: Very good. >90% of burial preserved.

Bones present: All except part of sacrum and some hand bones.

Additional bones: 1 animal bone, 1 lumbar vertebra.

Dentition:

```
        C               C C
  8 7 6 5 4 3 2 1   1 2 3 4 X 6 7 X
  ---------------------------------
  / X 6 5 4 3 2 1   1 2 3 4 5 6 7 X
      C B                       C
```

Dental pathology: Caries, abscess, calculus, periodontal disease.

Non-metric traits: Lambdoid ossicles, posterior condylar canal open, left double anterior condylar canal, transverse foramen bipartite, bilateral peroneal tubercles.

Skeletal pathology: Bilateral cribra orbitalia (type II), osteoarthritis of right acromioclavicular joint, severe degeneration of articulation between manubrium and first ribs, Schmorl's nodes, sacralization of 5th lumbar vertebra, lumbar rib.

Burial 2 (Context 11; RN419)

Male
Young/middle-aged adult
Stature: 170.8 - 2.99 (femur + tibia)

Preservation: Very good. >90% of burial remains. Ribs are fragmentary.

Bones present: All except some hand and most foot bones.

Additional bones: Left distal humerus, 1 animal bone.

Dentition:

```
  8 7 X / 4 3 2 1   1 2 3 4 5 X 7 8
  ---------------------------------
  8 7 X 5 4 3 2 1   1 2 3 4 / X / 8
```

Dental pathology: Calculus.

Non-metric traits: Metopism, Bilateral double anterior condylar canal, right tibial squatting facets, bilateral vastus notches, right peroneal tubercle, right posterior atlas bridging.

Skeletal pathology: Os acromiale of left scapula, 6-segmented sacrum, periostitis of left tibia.

Burial 3 (Context 15; RN420)

Female
Mature adult
Stature: 158.1 - 3.66 (tibia)

Preservation: Good. >70% present. A few ribs and some vertebrae remain.

Bones present: All except sternum, sacrum, parts of scapulae, some ribs and vertebrae, some hand and foot bones.

Additional bones: 2 animal bones.

Dentition:

/ 7 6 5 4 3 2 /	1 2 3 4 X X X 8
8 7 6 5 4 3 2 /	/ 2 3 4 5 6 7 8

Dental pathology: Caries, periodontal disease, rotation of second left maxillary and mandibular incisors.

Non-metric traits: Left parietal foramen, posterior condylar canal open, bilateral bridging of supraorbital notch, bilateral tibial squatting facets. Transverse foramen bipartite.

Skeletal pathology: Osteoporosis of all vertebrae, osteophytosis of left proximal humerus, both distal femora, left proximal tibia and left first metatarsal.

Burial 5 (Context 17)

(a) Indeterminate
12 - 14 years

Preservation: Good. >70% of burial present. Some ribs are fragmentary.

Bones present: All except parts of maxilla, mandible and scapulae, most hand and a few foot bones. Some upper thoracic vertebrae are missing.

Dentition:

	U														U
	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
	U																U

Dental pathology: Calculus, crowding of second left maxillary premolar which is behind other teeth.

Non-metric traits: Lambdoid ossicles, bilateral parietal foramina.

Skeletal pathology: Periostitis of right tibia, spina bifida of 5th sacral vertebra, sternal hemivertebra, cortical defects in both clavicles; cribra orbitalia of left orbit (type III or IV).

(b) ? Female
Mature adult

Preservation: Poor. <30% of burial remains.

Bones present: Left radius and ulna, left innominate, femur, fragmentary tibia and fibula.

Skeletal pathology: Ununited fracture of left ulna. Osteophytosis of left acetabulum and left distal femur. Bones appear light and osteoporotic.

Burial 6 (Context 55)

Indeterminate
Adult

Preservation: Poor. Approximately 30% of burial present. Bones are much eroded and ends destroyed.

Bones present: Right humerus, radius, ulna and a few hand bones, right innominate, both femora, tibiae and fibulae, left patella and some foot bones.

AREA BI

Burial A (Context 111; RN1756 and 1750)

Female
Mature adult

Preservation: Poor. Bone ends are eroded. <50% of burial

remains. Most vertebrae and ribs missing.

Bones present: Almost complete cranium missing part of frontal bone and most of maxilla, right clavicle, both humeral shafts, right ulnar and radial shafts, a few hand bones, one cervical and four lumbar vertebrae, fragments of sacrum and both innominates, both femora, patellae, tibiae and fibulae, most foot bones.

Dentition:

```
- - - - - - - -   - - - X X X X X
---------------------------------
/ 7 X / / / / /   / / / / 5 X 7 /
                              A
```

Dental pathology: Abscess, periodontal disease.

Non-metric traits: Lambdoid ossicles, left parietal foramen, right ossicle at parietal notch, right posterior condylar canal open, right bridging of supraorbital notch, bilateral tibial squatting facets.

Skeletal pathology: Osteophytosis of lumbar spine, osteoarthritis of right hip, enthesopathy of left patellar ligament.

Burial B (Context 111; RN 1756 and 1750)

Female
Adult

Preservation: Poor. <30% of burial present.

Bones present: Complete skull, right scapula, left humerus, left radius, a few hand bones, a few vertebrae, part of left innominate, both femora, distal right fibula and left tibia, a few foot bones.

Dentition:

```
8 7 X 5 4 3 2 1   1 2 3 4 5 6 7 8
---------------------------------
8 7 6 5 4 3 2 1   / 2 3 4 5 X X 8
```

Dental pathology: Caries, calculus, periodontal disease.

Skeletal pathology: Ivory osteoma on right parietal bone, maxillary sinusitis, osteophytosis of right distal femur, erosive arthropathy affecting right proximal foot phalanx.

Burial C (Context 111; RN1754)

Male
Young adult
173.1 - 2.99 cm (femur + tibia)

Preservation: Fair. >50% of burial remains. Some arm bones and ribs missing as are all vertebrae, hand and foot bone.

Bones present: Complete cranium, right proximal humerus, left humerus, right ulna, both innominates and sacrum, both femora, tibiae and patellae, right fibula.

Dentition:

```
      C
8 7 6 5 / / 2 1   / 2 3 4 5 6 7 8
---------------------------------
8 7 6 5 / 3 2 1   1 2 3 / 5 6 7 8
```

Dental pathology: Caries, calculus.

Non-metric traits: Ossicle at lambda, right ossicle at asterion, posterior condylar canal open, right accessory supraorbital foramen, right Allen's fossa.

Skeletal pathology: Periostitis of both femora and right tibia, spina bifida of first sacral vertebra, cortical defects at pectoralis major insertions on both humeri.

Burial D (Context 116; RN1755)

? Female
Young/middle-aged adult
160.9 - 3.55 cm

Preservation: Good. >70% present. No ribs or feet.

Bones present: Complete cranium, all postcranial bones apart from some hand bones, pubic symphyses, both patellae and both feet.

Dentition:

```
8 7 6 5 4 3 2 1   / / 3 4 5 6 7 8
---------------------------------
/ 7 6 5 4 3 2 1   1 2 3 4 5 6 7 8
```

Dental pathology: Hypoplasia, calculus.

Non-metric traits: Bilateral parietal foramina, bilateral posterior condylar canal open, bilateral accessory supraorbital foramina, bilateral mandibular tori, transverse foramina bipartite.

Skeletal pathology: Bilateral cribra orbitalia, deflected septum,

osteoarthritis of 5th metacarpo-phalangeal joint with possible erosive arthropathy, sacrum has 6 segments.

Burial E (Context 116; RN 1753)

? Male
Adult

Preservation: Very poor. <10% of burial remains. Bones are difficult to associate with one another.

Bones present: Part of right scapula, left medial clavicle, left proximal humerus, manubrium and most of sternum, some hand bones, fragmentary ribs and vertebrae, sacrum, part of left innominate, left tibia.

Skeletal pathology: Spina bifida of S4 and S5, porosity of left rotator cuff.

AREA BII

Context 1 (RN422)

Postmedieval

Female
Mature adult

Preservation: Poor. <30% of burial remains. Pelvis and leg bones are missing.

Bones present: Fragmentary skull missing part of maxilla, right distal humerus, proximal radius and ulna, left scapula, and most of humerus, manubrium, sternum and some ribs, most vertebrae, fragments of sacrum.

Additional bones: 2 animal bones.

Dentition:

```
- - - - - - - -   / / 3 4 X X X X
---------------------------------
8 7 X / / / X X   X / 3 / 5 X X X
```

Dental pathology: Hypoplasia, periodontal disease.

Non-metric traits: Metopism, bilateral foramina of Huschke.

Skeletal pathology: Diffuse idiopathic skeletal hyperostosis of spine, osteoarthritis of cervical spine, costovertebral and left acromio-clavicular joints. Biceps enthesopathy of right radius. Fused manubriosternal joint.

Context 5 (RN425)

5 infant skull vault fragments (foetal or newborn)
1 animal epiphysis.

Context 8 (RN423)

Left medial and intermediate cuneiforms, left first phalanx (proximal), right 4th metatarsal.

Context 9 (RN 423)

Part of occipital bone, left distal femur, right femoral shaft, left tibial shaft.

Skeletal pathology: Periostitis of left tibia.

AREA CI

Context 153 (RN1792)

Mandible missing part of right side

Dentition:

no maxilla

/ 7 6 / 4 / / / / 2 3 4 5 6 7 8

Dental pathology: Calculus, third left mandibular molar is rotated clockwise.

SALTERGATE

AREA DI

Context 72 (RN2396)

One animal tooth

AREA DII

Context 17 (RN3743 and 3744

? Male
Young adult
Stature: 172.6 - 3.37 cm

Preservation: Poor. <50% of burial remains. Long bones and right ilium only. No ulnae.

Bones present: Both humeri (right missing proximal and left distal end), right distal radius, most of left radius, most of right innominate, both proximal femora, both tibiae, fibula shaft.

Additional bones: 1 animal bone.

Dentition:

8 7 6 5 4 - - - - - - 4 / 6 7 8
---
no mandible

Non-metric traits: Right parietal foramen, precondylar tubercle, bilateral double anterior condylar canals.

Skeletal pathology: Cortical defect at pectoralis major insertion.

AREA EI

Context 166 (RN3639)

2 cranial fragments (parietal) from a subadult.

Context 166a (RN4058)

Left proximal ulna.

Context 166a (RN3844)

8 cranial vault fragments from an infant.
One animal bone.

Context 182 (RN4059)

Right radius and ulna, each in 3 pieces; right first metacarpal.

Context 187 (RN4060)

Female
Young/middle-aged adult

Preservation: Fair. >70% of burial present but very fragmentary.

Bones present: Fragmentary skull, both clavicles, right humeral shaft, left distal humerus, right radius, left radius and ulna, some hand bones, fragmentary ribs, most vertebrae, fragmentary innominates and sacrum, both femora (missing distal ends), right tibia and fibula, fragmentary left tibia and fibula, most foot bones.

Additional bones: Proximal left humerus.

Dentition:

8 7 6 5 4 3 2 1	/ 2 3 4 5 6 7 8
8 7 6 5 4 3 2 /	/ / 3 4 5 6 7 8

Dental pathology: Calculus.

Non-metric traits: Right posterior condylar canal open, bridging of left supraorbital notch, right tibial squatting facets.

Skeletal pathology: Bilateral cribra orbitalia.

Context 188 (RN4239)

Female
Mature adult
Stature: 164.9 - 4.30 cm

Preservation: Fair. Over 50% of burial remains but it is fragmentary. No cervical vertebrae and few ribs.

Bones present: Fragmentary skull, both clavicles, parts of scapulae, fragmentary humeri and right ulna, left ulna and both radii, a few hand bones, fragmentary ribs and vertebrae, most of right innominate, fragments of left innominate and sacrum, both femora, tibial and fibular fragments, some foot bones.

Dentition:

X 7 6 5 / / / X	X / / / / - - -
X X X / / 3 / X	X 2 3 X 5 X X X

Dental pathology: Periodontal disease, rotation of 2nd left mandibular premolar.

Non-metric traits: Double condylar facets, bilateral tibial

squatting facets.

Skeletal pathology: Osteoarthritis of thoracic and lumbar vertebrae, both acromioclavicular joints, 2 costovertebral joints and both knees. Fracture of right transverse process of 11th thoracic vertebra.

Context 189 (RN4715)

Female
Young adult

Preservation: Fair. >70% of burial present but all bones are fragmented.

Bones present: Fragmentary skull, both clavicles, parts of scapulae, both humeri (missing proximal ends), radii and ulnae, most hand bones, some ribs, most vertebrae, fragmentary innominates and sacrum, both femora (distal ends fragmented), most of both tibiae, fragmentary fibulae, most foot bones.

Additional bones, etc: Left first rib, large right calcaneus, 4 animal bones, piece of metal, piece of pottery.

Dentition:

E
8 7 6 5 4 3 / / / / 3 4 5 6 7 8
---
8 7 6 5 4 3 / / / 2 3 4 5 6 7 8

Dental pathology: Calculus, right mandibular first molar has an extra root.

Non-metric traits: Lambdoid ossicles, transverse foramina bipartite, right tibial squatting facets.

Skeletal pathology: Very severe maxillary sinusitis, periostitis of both tibiae.

Context 192: RN4716)

Left tibia

SPRING HILL/MICHAELGATE

Context 129

Infant
Newborn - 3 months

Preservation: Very good. >90% present.

Bones present: All except maxilla, mandible, right temporal left zygomatic and right ilium.

Context 250

10 bird bones.

Context 423

Infant
36 - 40 weeks

Preservation: Poor. <30% of burial present.

Bones present: 24 cranial vault fragments, both petrous temporals, both zygomatics, right mandible, a few ribs, left radius, left femur, both tibiae (left missing distal end), fibula shaft (? side)

Additional bones: 7 animal bone fragments.

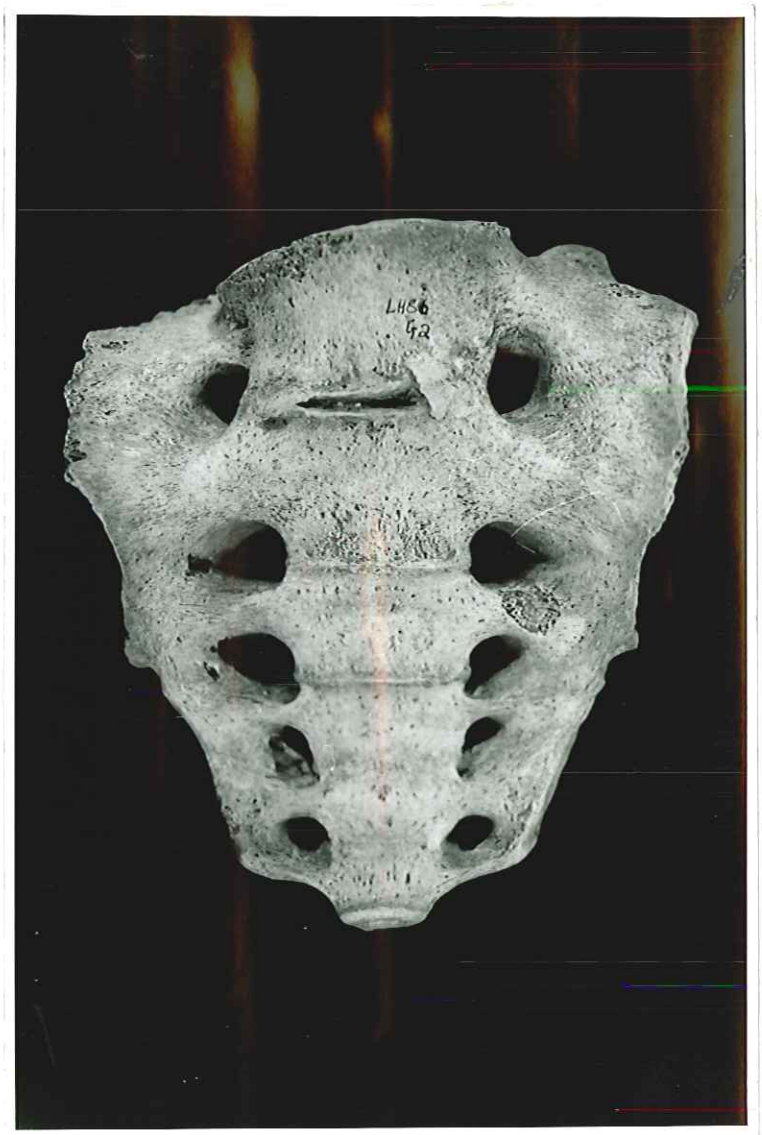

Plate 2: Complete sacralization of 6th lumbar vertebra in one of the individuals from Grave2 (L86)

Plate 3: Pelvis showing infective changes of the right sacro-iliac joint, sacrum and both ilia, probably indicative of tuberculosis.

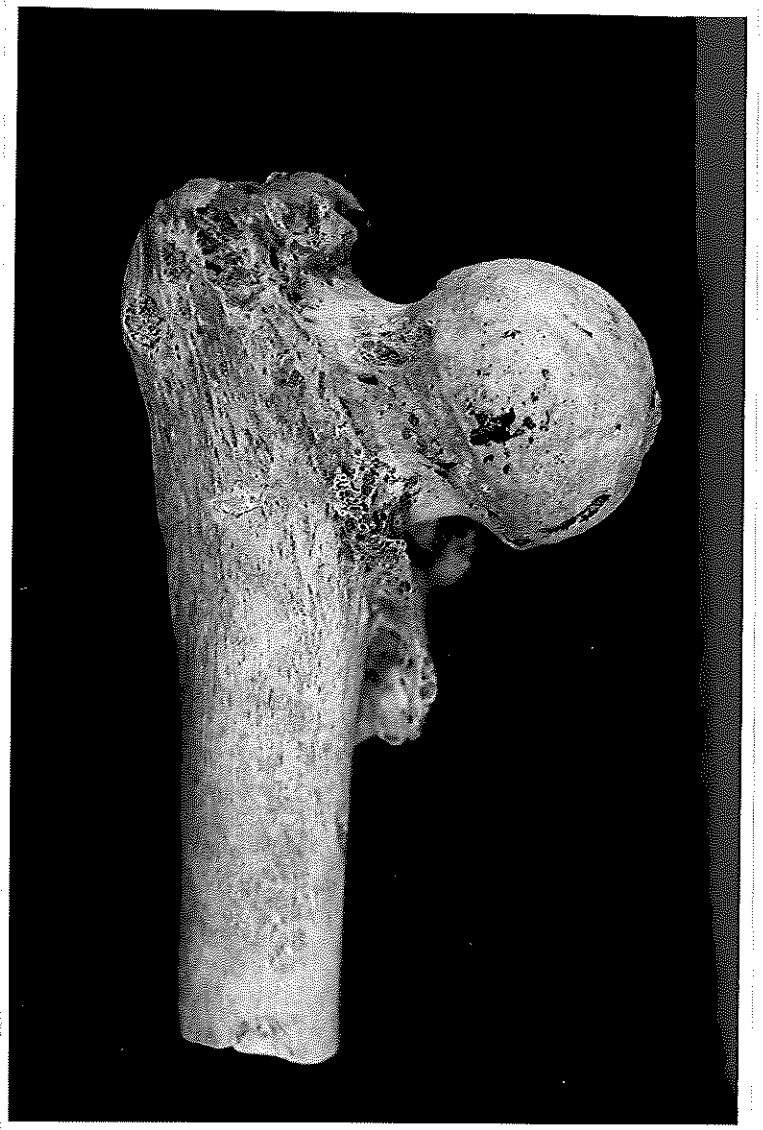

Plate 4: Fracture of the femoral neck in an elderly probable male (Grave 17 from L86).

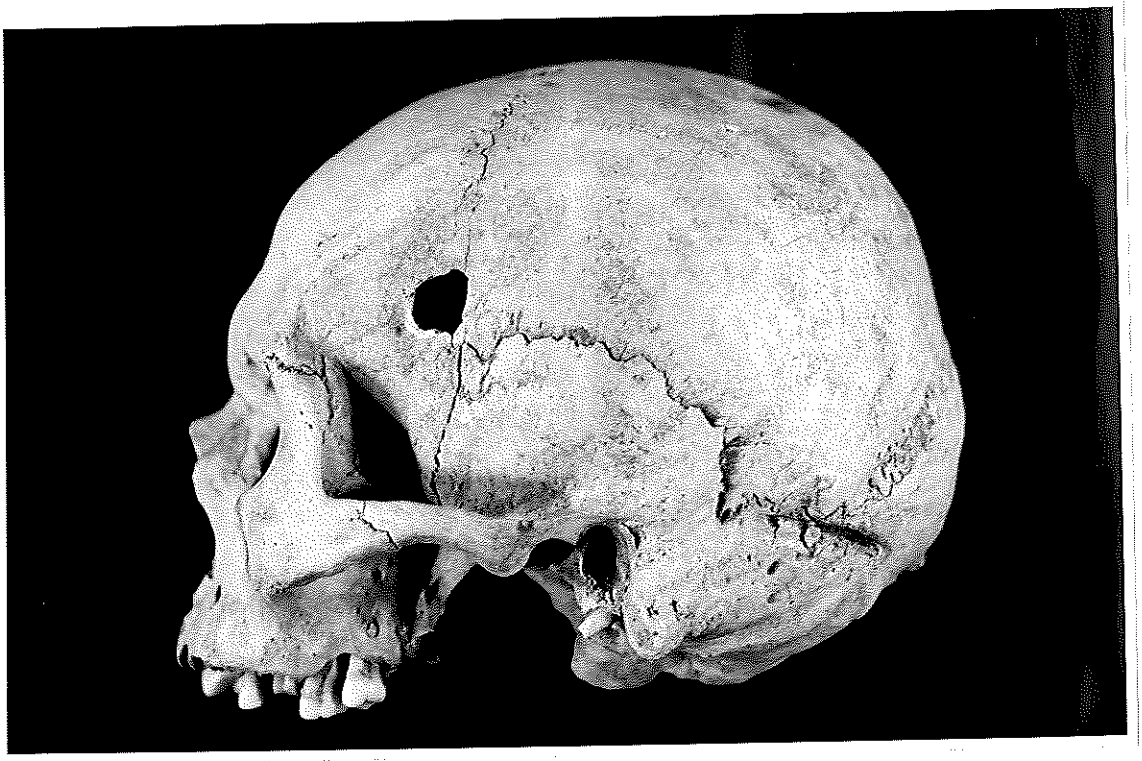

Plate 5a: Blade wound to posterior cranium in a male from Grave 13 (L86).

Plate 5b: Close-up view of injury showing evidence of healing in the form of new bone formation.

Plate 5c: Superior view of same skull showing two wounds, one of which has penetrated the cranium and the other has pierced the outer table.

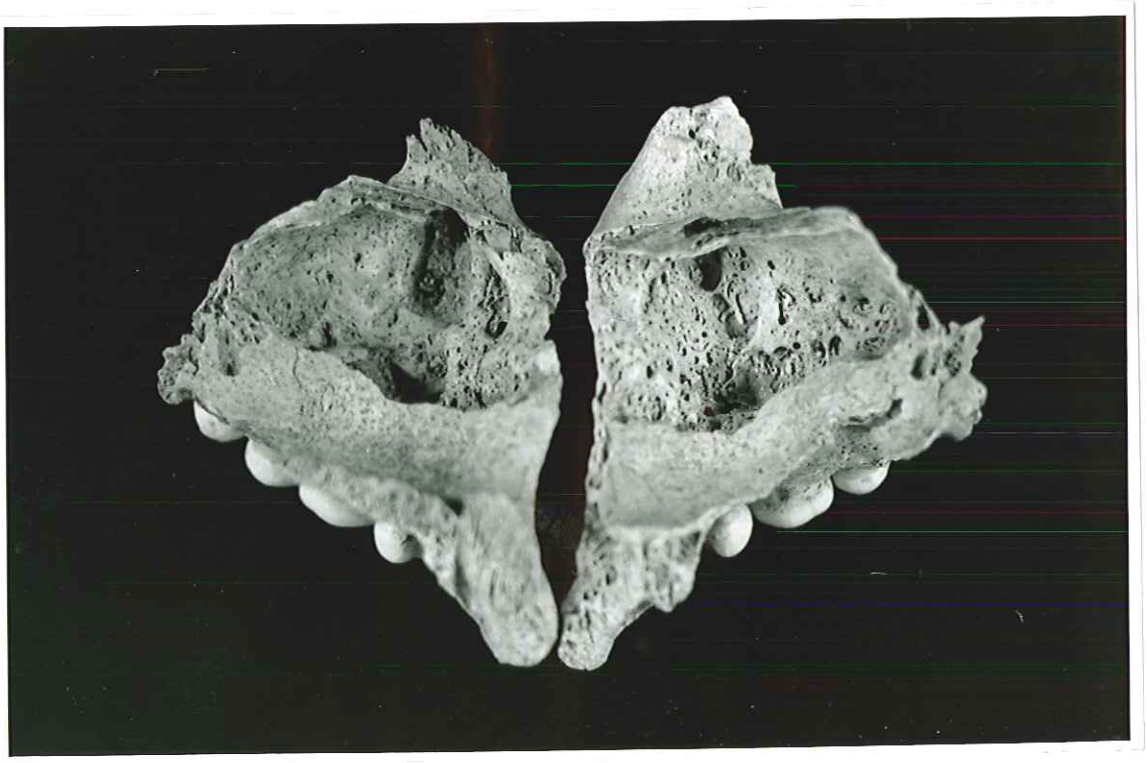

Plate 6: Very extensive new bone formation affecting both maxillae and indicative of sinusitis in a young adult female from context 189 at Saltergate.

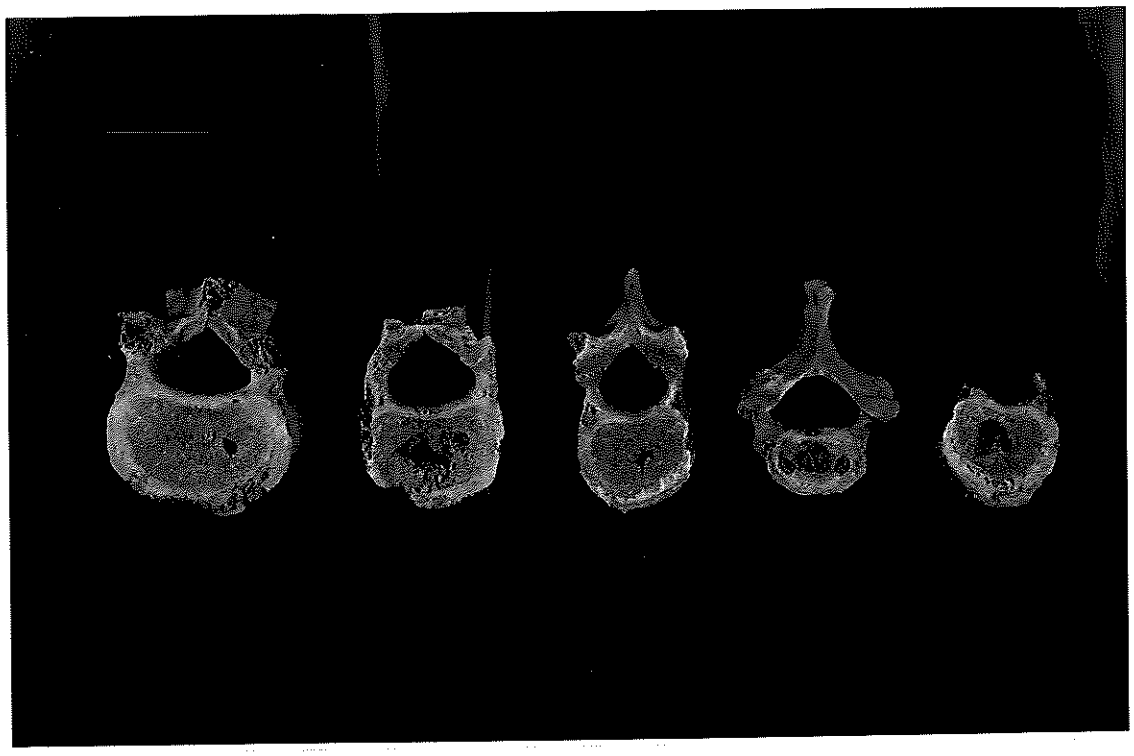

Plate 7: Osteoporotic vertebrae in an elderly female from context 15 at Silver Street.

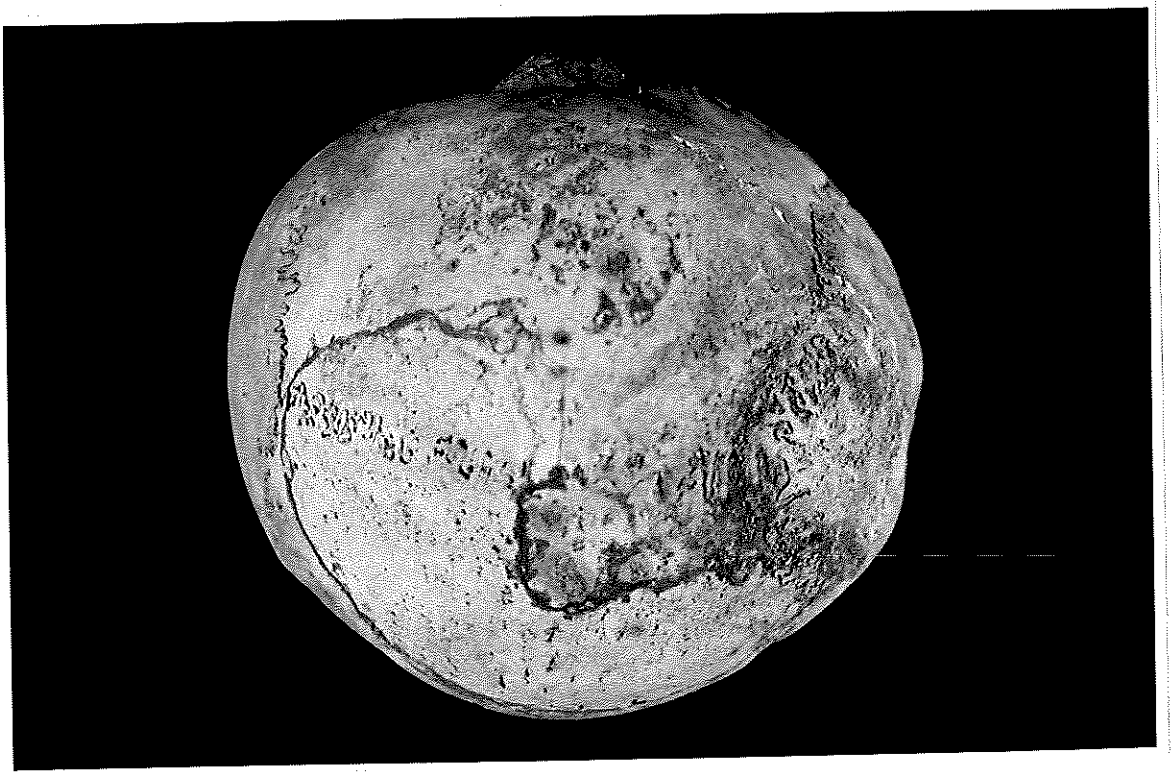

Plate 8: Large benign osteoma on the right parietal bone of the female from context 111B at Silver Street.

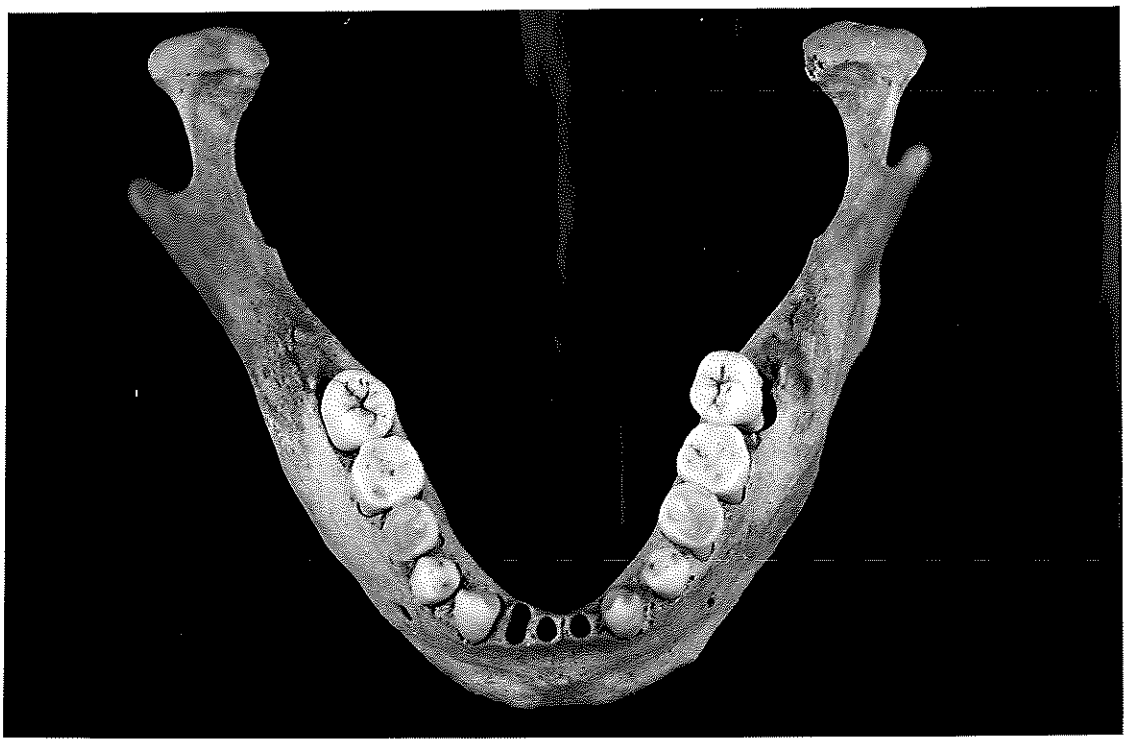

Plate 1a: Unusual wear pattern on the second deciduous molars of a 12 - 14 year old child (CS7)

Plate 1b: Unusual wear pattern on all deciduous molars and impaction of left lateral incisor in a 7 - 9 year old child (CS9).

Plate 9: Diffuse idiopathic skeletal hyperostosis (DISH) affecting the thoracic vertebrae of an elderly female from the postmedieval levels (context 1) at Silver Street.