Ancient Monuments Laboratory Report 17/91

THE BURIALS FROM THE WHITEFRIARS FRIARY SITE, BUTTERMARKET, IPSWICH, SUFFOLK (EXCAVATED 1986-88)

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Summary
Fifteen burials (11 male adults, 3 female adults and 1 unsexed adult) are examined, thirteen of which date from the period c1278-1538 and represent burials within the Whitefriars friary complex. The remaining two may be of post-mediaeval date.

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Introduction to the site

The bones of 15 inhumations recovered from in and around the church of the Whitefriars, Buttermarket, Ipswich are studied. During excavations at this site further burials were noted but were not lifted. The friary was founded in about 1278 and was suppressed in 1538; with 2 possible exceptions the interments date from this period and probably represent interments of lay benefactors and friars. The exceptions are burials 3162 and 3163. These interments lay to the north of the church and their shallow nature suggests that they may post-date the Mediaeval period; in the 18th century a Wesleyan chapel was built in the vicinity and these 2 burials may be of this date.

The human remains

1. Bone preservation and demographic composition of the assemblage

Bone preservation was scored as good, moderate or poor on the basis of visual examination of the remains. The completeness of each skeleton was also assessed.

Sex was determined using aspects of skeletal dimorphism, particularly those of the pelvis and skull (Workshop of European Anthropologists 1980).

The principal method used to estimate age at death was dental wear; use is made of the chart of Brothwell (1981: Fig. 3.9). The state of the pubic symphyses (Suchey et al. 1987, 1988) and the closure of the cranial sutures (Perizonius 1984) were also taken into account).

Table 1: Composition of the assemblage

Skeleton	Sex	Age	Preservation	Completeness	Location	Date
0619	Male	22-25	Good	80%+	Chapter House	Mediaeval
0642	Male	30-50	Poor	80%+	Chapter House	Mediaeval
1077	Male	ADULT	Moderate	<20%	Chapter House	Mediaeval
3162	Male	21-24	Good	80%+	To north of Church Nave	?Post-Mediaeval
3163	Male	30-40	Good	60-80%	To north of Church Nave	?Post-Mediaeval
3412	Female	25-35	Good	80%+	Church Nave	Mediaeval
3803	Male	ADULT	Moderate	20-40%	To north of Chancel	Mediaeval
4737	Male	25-35	Poor	60-80%	Church Nave	Mediaeval
4745	Female	About 25	Poor	40-60%	Church Nave	Mediaeval
4765	Male	25-35	Moderate	80%+	Church Nave	Mediaeval
4776	Female	50+	Moderate	60-80%	Church Nave	Mediaeval
4789	Male	35-50	Poor	60-80%	Church Nave	Mediaeval
5117	Male	50+	Moderate	80%+	North Cloister	Mediaeval
5120	Unsexed	ADULT	Poor	<20%	Church Nave	Mediaeval
5121	Male	50+	Good	60-80%	Church Nave	Mediaeval

A skeletal element was scored as present if it was represented by a complete or incomplete bone. The results are shown below.

Table 2: Representation of skeletal elements

Skeletal element	Number present
Skull	11
Mandible	12
Hyoid	4
Cervical vertebrae	73
Thoracic vertebrae	129
Lumbar vertebrae	58
Sacrum	11
Sternum	10
L ribs	79
R ribs	80
L clavicle	12
R clavicle	12
L scapula	12
R scapula	13
L humerus	12
R humerus	12
L radius	13
R radius	12
L ulna	13
R ulna	11
L carpals	77
R carpals	58
L metacarpals	55
R metacarpals	57
L hand phalanges	90
R hand phalanges	98
U hand phalanges	4
L pelvis	12
R pelvis	13
L femur	10
R femur	15
L patella	8
R patella	10
L tibia	13
R tibia	13
L fibula	13
R fibula	12
L calcaneus	12
R calcaneus	13
L talus	12
R talus	13
L tarsals*	51
R tarsals*	57
L metatarsals	54
R metatarsals	59
L foot phalanges	52
R foot phalanges	63
U foot phalanges	15

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

Burials 0619 and 0642 show black staining mainly confined to the bones which make up the base of the skull. Those areas which show this staining tend to be rather more poorly preserved than neighbouring non-stained bone. Similar staining was noted in the Ipswich Blackfriars assemblage where it was thought that it might be associated with fungal activity during decomposition.

The pattern of relative representation of different skeletal elements is similar to that observed in the 250 burials from the Ipswich Blackfriars (Mays 1991) and in the 95 burials from the Ipswich School Street 10th-llth century cemetery (Mays 1989).

The presence of females in the assemblage indicates that some burials at least are of lay benefactors rather than friars. However the assemblage shows a marked sexual imbalance, with 11 of the 14 individuals for whom a determination of sex could be made being male. All burials are adults. A bias towards adults, and a sex imbalance towards males, were observed at the Ipswich Blackfriars and in other skeletal collections excavated from Blackfriars, Grey-Friars and Austin friaries in England (discussion in Mays 1991). It was thought that the sex imbalance was probably due to the presence of burials of friars increasing the numbers of males; the relative lack of children was interpreted as to some extent reflecting burials of friars, and also probably indicative that children were not generally selected for burial in a friary by lay benefactors. Although numbers are small, the demographic composition of the Ipswich Whitefriars assemblage is consistent with that from other friaries; hence the above considerations may apply here.

2. Metric variation

(a) Stature

Stature was calculated from long-bone measurements using the formulae of Trotter & (Gleser (1952, 1958).

Table 3: Stature

Skeleton	Sex	Stature (cm)
0619	Male	171.9
0642	Male	166.6
3162	Male	172.1
3412	Female	159.0
3803	Male	172.2
4737	Male	182.8
4745	Female	156.4
4765	Male	166.3
4776	Female	156.7
4789	Male	169.5
5117	Male	169.7
5121	Male	176.4

These stature figures are similar to Mediaeval and modern values.

b) Cranial measurements

Cranial measurements were selected from those of Howells (1973). The raw data are show in the Appendix, the indices (following the definitions of Vallois 1965) are set out below.

Table 4: Cranial indices

Skeleton	Value	Classification
Cranial index		
0642	76.8	Mesocranic
4765	78.9	Mesocranic
5117	74.3	Dolichocranic
5121	79.3	Mesocranic
Height-breadth index		
0642	93.7	Metriocranic
5117	95.0	Metriocranic
5121	89.3	Tapeinocranic
Height-length index		
0642	71.9	Orthocranic
5117	70.6	Orthocranic
5121	70.7	Orthocranic
Orbital index		
0642	83.7	Mesoconchic
4765	88.0	Hypsiconchic
5117	84.8	Mesoconchic
5121	82.9	Mesoconchic

c) Post-cranial measurements

(i) Meric and cnemic indices. The meric index is a measure of the anterio-posterior flattening of the femur in the sub-trochanteric region; the cnemic index expresses the transverse flattening of the tibia at the level of the nutrient foramen. The precise significance of these indices is disputed, but it seems probable that this type of variation in shaft cross-section reflects patterns of mechanical stress on the bone (e.g. Lovejoy et al. 1976). The indices are taken according to the definitions of Brothwell (1981: 88-89).

Table 5: Post-cranial indices

Meric index

Skeleton	Value		Classification	
	L	R	L	R
0619	81.9	-	Platymeric	-
0642	75.8	-	Platymeric	-
1077	-	71.4	-	Hyperplatymeric
3162	79.1	73.4	Platymeric	Hyperplatymeric
3163	81.4	81.0	Platymeric	Platymeric
3412	76.5	73.2	Platymeric	Hyperplatymeric
3803	-	83.1	-	Platymeric
4737	83.7	-	Platymeric	-
4745	-	82.7	-	Platymeric
4765	76.4	80.3	Platymeric	Platymeric
4789	94.5	92.7	Eurymeric	Eurymeric
5117	96.5	93.7	Eurymeric	Eurymeric
5121	79.9	83.6	Platymeric	Eurymeric

Cnemic index

Skeleton	Value		Classification	
	L	R	L	R
0619	71.1	74.9	Eurycnemic	Eurycnemic
3162	74.9	68.2	Eurycnemic	Mesocnemic
3163	71.0	71.3	Eurycnemic	Eurycnemic
3412	74.2	84.2	Eurycnemic	Eurycnemic
4745	78.6	72.2	Eurycnemic	Eurycnemic
4765	76.1	68.6	Eurycnemic	Mesocnemic
4776	71.2	-	Eurycnemic	-
4789	65.1	75.5	Mesocnemic	Eurycnemic
5117	75.3	74.0	Eurycnemic	Eurycnemic

As for the Ipswich Blackfriars assemblage platymeric femora and eurycnemic tibiae predominate.
Some other post--cranial measurements were also taken (see Appendix).

3. Non-metric variation

Non-metric traits take the form of minor variations in skeletal morphology such as presence or absence of bony spurs and foramina. For at least some of these variants there is evidence that they are to some extent inherited, although the causation of many remains uncertain. Thirty-four cranial and 20 post-cranial traits are scored. The cranial traits are mainly selected from those of Berry & Berry (1967). Those not studied by Berry & Berry (1967) are selected from de Villiers (196B) and Ossenburg (1977). Where the scoring rules of Berry & Berry (1967) conflict with those of SjOvold (1984) the latter are used. The post-cranial traits are those of Finnegan (1978).

Table 6: Frequency of cranial non-metric traits

Trait	0619	0642	3162	3163	3412	4737	4745	4765	4789	4776	5117	5121
Metopic suture	0	0	0	0	0	0		0	0	1	0	0
Ossicle at lambda		0	0			1		0	0	0	0	0
Lambdoid ossicle	1	0	1	1		1		0		0	0	1
Inca bone	0	0	0	0	0	0		0		0	0	0
Sagittal ossicle	0		0			0				0		
Ossicle at bregma	0	0	0	0	0	0		0	0	0	0	0
Coronal ossicle	0	0	0	0	0	0		0	0	0	0	0
Fronto-temporal articulation	0/-	0/0		0/-	-/0	0/-		0/0	0/0			0/0
Squamo-parietal ossicle	0/-	0/0	-/0	0/-	0/0	0/-		0/0	0/0		0/0	0/0
Epipteric bone		0/0		0/-	-/0	0/-		0/0	0/0		0/0	1/1
Parietal notch bone	0/0	0/0	0/0	0/-	0/0	1/0		0/0		-/0	0/0	0/1
Auditory torus	0/0	0/0	0/0	0/0	0/0	0/-		0/0		-/0	0/0	0/0
Foramen of Huschke	0/0	0/0	0/0	0/0	0/0	0/-		0/0		-/0	1/0	0/0
Ossicle at asterion	0/-	0/0	0/0	0/-	0/-	0/0		0/0		-/0	0/0	0/0
Clinoid bridging												0/-
Pterygoid bridging		0/-										
Palatine torus	0	0	0	0	0	0		0	0		0	0
Maxillary torus	0	0	0	0	0	0		0	0		0	0
Mastoid foramen extra-sutural	0/0	1/0	0/0	1/1	0/0	1/0		0/0	-/1	-/1	1/1	0/1
Mastoid foramen absent	0/0	0/1	0/-	0/0	0/0	0/0		0/0	-/0	0/0	0/0	0/0
Double condylar facet on occipital	0/0	0/0						0/0			0/0	0/0
Parietal foramen	1/1	0/0	0/0	0/1	1/1	1/1		1/1		-/1	1/1	1/1
Accessory infra-orbital foramen	0/-	0/0	0/-					0/0	-/0	0/0	1/0	0/0
Zygomatic-facial foramen	1/1	1/1	1/1	1/1	1/1	1/1		0/0	1/1	1/1	1/1	1/1
Divided hypoglossal canal	0/0	0/0		0/-				0/0		-/0	0/0	1/0
Posterior condylar canal patent	0/1	0/0		0/-				0/0		-/1	1/0	1/1
Precondylar tubercle		0/0						0/0			0/0	0/0
Foramen ovale incomplete		0/0						0/0			0/0	0/0
Accessory lesser palatine foramen		1/1			1/-			1/-	0/1		1/1	0/0
Supra-orbital foramen complete	0/0	0/0	1/1	0/0	1/0	1/-		0/0	0/0	0/0	0/1	0/0
Maxillary M3 agenesis		1/1	0/0	0/-	0/0	1/1		0/0	0/0		0/0	0/0
Mandibular M3 agenesis	0/0	1/1	1/1	0/0	0/0	1/1	1/1	0/0	0/0	0/0	0/0	0/0
Mandibular torus	0	0	0	0	0	0	0	0	0	0	0	0
Mylohyoid bridging	0/0	1/0	0/-	0/0	0/1	0/0	0/0	0/0	0/0	0/0	1/1	1/0

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

Table 7: Frequency of postcranial non-metric traits

Trait	0619	0642	1077	3162	3163	3412	3803	4737	4745	4765	4789	4776	5117	5120	5121
Fossa of Allen	1/1	0/-		1/1	1/0	0/0	-/0	0/-		0/0	0/0				
Plaque formation	0/0			0/1	0/0	0/0	-/0	0/-	-/0	0/0	0/0				1/1
Exostosis in trochanteric fossa	0/0	1/-	-/1	0/0	1/0	1/1	-/1	1/1	-/0	0/1	1/1		1/1		0/1
Supra-condyloid process	0/0	0/0		0/0	0/0	0/0	-/0	0/-	0/-	0/0	1/0	0/0	0/0		0/0
Septal aperture	0/0	0/0		0/-	0/0	1/1	-/0	0/-	0/-	0/0	0/1	0/-	0/0		0/0
Acetabular crease	0/0	0/0	-/0		0/-	0/0	0/0	0/0		1/0	0/0	0/0	0/0		1/1
Accessory sacral facets on ilium	0/0			0/0		0/0				0/0					0/-
Spina bifida occulta	0			0	0	0	0			0			0		0
Sixth sacral segment	0			0		1	0			0					
Acromial articular facet	0/0	0/0		0/0	0/0	-/0	-/0	0/-		0/0	0/0	0/0			0/0
Os acromiale	1/0	1/1		0/1	0/0	-/0	-/0	0/-		0/0	0/0	0/0			0/0
Supra-scapular foramen	0/0	0/0		0/0	0/0	0/0	-/0			0/0	0/0	0/1	0/0		0/0
Vastus notch	0/0			-/0	1/1	-/0		-/1	-/0	1/1	0/0	0/1	1/1		
Vastus fossa	0/0			-/0	0/0	-/0		-/0		0/0	0/0	0/0	0/0		
Emarginate patella	0/0			-/0	0/0	-/0		-/0	-/0	0/0	0/0	0/0	0/0		
Anterior calcaneal facet double	0/0	0/0	0/0	1/-	-/1	0/1		0/0	0/0	1/1	0/0	0/0	0/0	1/1	
Anterior calcaneal facet absent	1/1	0/0	0/0	0/-	-/0	0/0		0/0	0/0	0/0	0/0	0/0	1/1	0/0	
Atlas facet double	1/-	0/0		-/1					0/0	0/0	-/0		0/0		0/0
Posterior atlas bridging	0/-	0/0		-/1					0/0	0/0	-/0		0/0		0/P
Lateral atlas bridging	0/-	0/-		-/0					0/0	0/-	-/0		0/0		0/0

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

There are several features, in addition to those scored above, which might be classified as aspects of non-metric variation.

Spondylolysis is the condition where the posterior part of the neural arch is cleft from the rest of the vertebra at the pars interarticularis; thus in skeletal material the posterior part of the neural arch appears as a separate fragment, although in life it is bound to the rest of the vertebra by fibrous tissue. There is strong evidence for an inherited component in the aetiology of spondylolysis (Wynne-Davis & Scott 1979). The 5th lumbar vertebra of burial 4765 shows this condition. In cases of spondylolysis trauma may rupture the fibrous union between the two parts of the vertebra, leading to forward slippage of the vertebral body; there is no evidence for this in the present case.

The 7th cervical vertebra of burial 3162 bears cervical ribs. These must be classified as true cervical ribs (Schmorl & Junghanns 1971: 58) as they articulate with both the body and transverse processes of C7. The right 1st (thoracic) rib has a roughened projection on its superior surface which probably articulated with the right cervical rib via fibrous tissue. There is a roughened area on the tuberosity of the left navicular bone of 5120, suggesting fibrous union for an ossicle here. The right navicular bears a joint surface on its tuberosity, suggesting articulation with a fully separate

ossicle. Neither ossicle was present with the remains. Accessory bones at this site are termed os tibiale externs (O'Rahilly 1953).

The styloid process of the right 3rd metacarpal of 3163 is missing, instead there is an area of sclerotic, porotic bone suggestive of a fibrous connection with a styloid process present as a separate ossicle.

4. Pathology

(a) Oral

(i) Dental caries. Dental caries was scored as present or absent in each tooth, and as present or absent in individuals with one or more fully erupted teeth present for observation. On this basis a total of 7 individuals out of 12 which could be scored for caries showed the condition.

Table 8: Distribution of dental caries

MAXILLA

	LEFT										RIGHT					
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Teeth	4	7	7	8	10	10	6	9	10	9	11	10	7	7	6	6
Carious	1	3	2	3	2	0	0	0	0	0	1	2	1	2	1	1
Teeth	5	8	6	11	10	10	10	9	10	10	11	11	9	7	11	6
Carious	2	2	1	2	1	1	0	0	0	0	1	1	2	2	6	1

MANDIBLE

Of a total of 271 teeth, 41 (15.1%) are carious.

Although it must be considered a multi factorial disease, many studies of non-industrialised societies (e.g. Turner 1979 & refs therein) show a strong correlation between dental caries and carbohydrate consumption. The prevalence of dental caries in the present material is similar to that in the Ipswich Blackfriars assemblage, and to that quoted for pooled Mediaeval cemetery data by Brothwell (1959).

(ii) Ante-mortem tooth loss. Ante-mortem tooth loss was scored on a presence--absence basis for each tooth position and as present or absent in individuals with one or more erupted tooth positions available for study. On this basis 9 individuals of the 12 which could be scored for ante-mortem tooth loss showed the condition.

Table 9: Distribution of ante-mortem tooth loss

MAXILLA

	LEFT											RIGHT				
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	7	10	11	11	11	11	11	11	11	11	11	11	11	10	10	6
A-m loss	3	3	4	3	1	0	1	1	0	0	0	1	3	4	4	2
Tooth posits.	8	12	12	12	12	12	12	12	12	12	12	12	12	12	12	8
A-m loss	3	3	6	1	0	0	1	1	0	0	0	0	3	4	1	2

MANDIBLE

Of a total of 348 tooth sockets 55 (15.8%) showed ante-mortem tooth loss.

Major causes of ante-mortem tooth loss include dental caries and diseases of the periodontal tissues. The frequency of ante-mortem tooth loss in the present material is similar to that in the Blackfriars assemblage.

(iii) Alveolar abscesses. These were recorded in terms of affected tooth positions and affected individuals in an analogous fashion to the tooth loss data.

Table 10: Distribution of alveolar abscesses

MAXILLA

	LEFT											RIGHT				
	M3	M2	M1	PM2	PM1	C	I2	I1	I1	I2	C	PM1	PM2	M1	M2	M3
Tooth posits.	7	10	11	11	11	11	11	11	11	11	11	11	11	10	10	6
Alv. abscesses	0	0	1	1	2	1	1	0	1	0	1	1	2	2	0	0
Tooth posits.	8	12	12	12	12	12	12	12	12	12	12	12	12	12	12	8
Alv. abscesses	1	2	2	0	0	0	0	0	0	0	0	1	0	1	2	1

MANDIBLE

Of a total of 348 tooth positions 23 (6.6%) show alveolar abscesses.

Of the 23 abscess cavities observed 14 were at the apices of teeth whose pulp cavities had been exposed to infection by dental caries and 3 were situated at the base of teeth whose pulp cavities had been exposed by excessive dental attrition. In the remaining 6 cases the causes of the abscesses were unclear.

iv) Dental calculus. This is a concretion on the teeth consisting mainly of calcium salts and, in life, organic material in which flourish numerous bacteria. It may be considered as mineralised dental plaque and is associated with poor oral hygiene. Of 12 individuals who could be scored for the condition 3 showed no signs of calculus, 6 showed it to grade I, 1 to grade II and 2 to grade III on Dobney & Brothwell's (1987) scale.

v) Dental enamel hypoplasias. The crowns of the anterior dentition of 5121 show a fairly broad line of depressed enamel. These defects represent dental enamel hypoplasias: disturbances

in crown formation which may be associated with disease or nutritional deficiency in childhood (Findborg 1970: 138-310). The location of the defects on the dentition of 5121 indicates (using the methodology of Goodman et al. 1980) that the stress episode giving rise to the hypoplasias occurred when the individual was about 2.7 years.

(vi) Periodontal disease. This is an inflammation of the gums and other periodontal tissues associated with poor oral hygiene. The manifestations of the disease in skeletal material include porosis and profile changes to the interdental septa, and infra bony pockets may form in severe cases (Costa 1982). Nine of the Whitefriars site burials show evidence for periodontal disease.

(b) Arthropathies

(i) Degenerative joint disease: osteoarthritis and spinal osteophytosis (spondylosis deformans). Although the aetiology of osteoarthritis and spondylosis deformans must be considered multifactorial, both human and animal studies have shown that mechanical stress upon the joints plays an important role (Raclin et al. 1980; Kellgren & Lawrence 1958; Kellgren 1961). The most usual cause seems to be repeated minor traumata, as might result from day to day activities (although it may occur as a consequence of a single trauma to a joint). Consistent with this, studies of human populations have shown that the prevalence of these 2 conditions varies with individual age and the amount of physical stress to the joints in life (op. city.

At a synovial joint mechanical stress leads to degeneration of the joint cartilages, with subsequent macroscopic bony changes, including marginal spurring and joint surface irregularities.

At the amphiarthrodial joint between the vertebral bodies mechanical stress may lead to displacement of the intervertebral disc, which in turn causes traction at the sites at which it attaches to the vertebral body; this leads to formation of osteophytes at the margins of the vertebral centra. In addition to their attachments to the margins of the vertebral body, the discs are also attached to the cartilaginous end plate of the centrum; this cartilage may also undergo degenerative changes, in a similar fashion to the cartilage in a synovial joint, resulting in analogous bony changes.

Osteoarthritis and spinal osteophytosis were distinguished from other arthropathies using criteria described by Rogers et al. (1987) and Resnick (1985).

The presence of osteoarthritis and spinal osteophytosis was scored into 3 grades, according to the extent of the bony changes, using to the scheme of Sager (1969, reproduced in Brothwell 1981: Fig. 6.9). Individuals showing erosive arthropathies (see below) were excluded from the figures shown in Tables 11-14.

Table 11: Spinal osteophytosis: maximum severity by individuals

Maximum severity			
0	I	II	III
3	5	3	0

Table 12: Spinal osteophytosis: prevalence by vertebrae

Cervical				Thoracic				Lumbar				Total			
0	I	II	III	0	I	II	III	0	I	II	III	0	I	II	III
37	1	4	0	39	32	1	0	27	6	0	0	103	39	5	0

Table 13: Osteoarthritis: maximum severity by individuals

Maximum severity			
0	I	II	III
7	0	3	2

Table 14: Distribution of osteoarthritis

		Severity		
Skeletal element	0	I	II	III
L mandibular condyle	9	0	0	0
R mandibular condyle	9	0	0	0
L ribs	61	2	5	1
R ribs	55	6	4	2
Cervical vertebrae	61	1	1	1
Thoracic vertebrae	96	2	4	1
Lumbar vertebrae	40	0	2	0
L medial clavicle	9	1	0	0
L lateral clavicle	5	0	2	0
R medial clavicle	9	0	0	0
R lateral clavicle	4	0	3	0
L glenoid cavity	10	1	0	0
R glenoid cavity	9	1	0	0
L proximal humerus	10	0	0	0
L distal humerus	10	0	0	0
R proximal humerus	10	0	0	0
R distal humerus	8	0	0	0
L proximal radius	11	0	0	0
L distal radius	10	0	0	0
R proximal radius	8	0	0	0
R distal radius	9	0	0	0
L proximal ulna	10	0	0	0
L distal ulna	7	0	0	0
R proximal ulna	6	1	0	0
R distal ulna	7	0	0	0
L carpals	62	0	0	0
R carpals	48	0	0	0
L metacarpals	44	0	0	0
R metacarpals	47	0	0	0
L hand phalanges	80	0	0	0
R hand phalanges	81	1	0	0

Skeletal element	0	Severity I	II	III
U hand phalanges	3	0	0	0
L acetabulum	8	2	0	0
R acetabulum	8	2	0	0
L proximal femur	9	0	0	0
L distal femur	9	0	0	0
R proximal femur	11	0	0	0
R distal femur	11	0	0	0
L patella	7	1	0	0
R patella	9	1	0	0
L proximal tibia	10	1	0	0
L distal tibia	10	0	0	0
R proximal tibia	10	1	0	0
R distal tibia	12	0	0	0
L proximal fibula	6	0	0	0
L distal fibula	12	0	0	0
R proximal fibula	7	0	0	0
R distal fibula	11	0	0	0
L calcaneus	11	0	0	0
R calcaneus	12	0	0	0
L talus	11	0	0	0
R talus	12	0	0	0
L tarsals*	46	0	0	0
R tarsals*	52	0	0	0
L metatarsals	49	0	0	0
R metatarsals	52	0	0	0
L foot phalanges	41	0	1	0
R foot phalanges	56	0	1	0
U foot phalanges	15	0	0	0

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

(ii) Erosive arthropathies. These are a group of joint diseases in which bone resorbtion predominates over bone proliferation. They include gout, rheumatoid arthritis, ankylosing spondylitis, colitis arthropathy (arthritis associated with inflammatory bowel disease), Reiter's disease (an arthropathy which may arise from sexually acquired or gastrointestinal infections) and psoriatic arthropathy (arthritis associated with psoriasis). These last 4 are sometimes termed sero-negative spondyloarthropathies.

Burial 1077. Left foot: most intertarsal joints show erosive lesions and there are spiky osteophytes near the joint surfaces. Similar changes are present at most intermetatarsal joints and, to a lesser degree, at most tarso-metatarsal articulations. There are erosive changes on the distal joint surfaces of the 1st and 5th metatarsals, the joint surfaces of both hallucial phalanges, both joint surfaces of the proximal 5th phalanx and the distal joint surface of the 2nd proximal phalanx. The calcaneus shows an erosive lesion at the site of insertion of the Achilles tendon.

Right foot: all the tarsals, save the talus, and metatarsals 25 are fused together. All tarsals bear spiky osteophytes. The following joint surfaces show erosions and marginal

proliferation: the talar articulations with the calcaneus and the navicular, and both faces of the medial cuneiform-1st metatarsal articulation. The hallucial metatarso-phalangeal joint, the distal joint surfaces of the proximal 1st and 4th phalanges and a hallucial sesamoid show erosive lesions.

The plantar surfaces of both calcanei show large, flat, forward-facing spurs.

The foot bones are shown in Plate 1.

Of the lower leg bones only the distal joint surface of the left fibula and the distal quarter of both tibiae are present. The joint surfaces of these bones show erosions, together with spiky bone proliferation near their margins.

Of the rest of the skeleton only the proximal four fifths of the right femur, part of the right ilium and the left 3rd metacarpal survive. The latter shows an erosive lesion on its proximal joint surface and there is a small erosion on the right acetabulum.

The surfaces of the erosions are of trabecular bone and when lesions are sufficiently small for observation to be made they seem to commence at the joint margins.

Thus 1077 shows a proliferative erosive arthropathy affecting the lower extremities in a bilateral and symmetrical manner. A hand and hip bone are also affected. A more precise diagnosis is prevented by the fact that so little of this skeleton is present.

Burial 3803. There is unilateral sacro-iliitis: the left sacro-iliac joint is fused across its inferior part, and the iliac face has been destroyed by erosive lesions (Plate 2). Eight vertebrae (T10-LS) are present and most of their facet joints show erosive changes and some also show marginal proliferation. There are erosive lesions at the articulations for the left 11th and 12th ribs (Plate 3). The body of T10 bears a large, smooth osteophyte which appears to have originated from near the disc margins but at the lateral parts of the centrum it covers the whole of the height of the vertebral body. Erosions and marginal proliferation are present on the proximal joint surfaces of the left ulna, there is pitting on the radial heads and there is bony proliferation at the margins of the proximal joint surface of the right ulna. There are erosive changes at the insertion of the triceps of the left olecranon process and there are erosive and proliferative changes at the distal joint surfaces of the left forearm bones (the corresponding parts of the right bones are missing). Both radii show slight periostitis towards their distal ends.

Seven right carpals are present and all show erosive changes, as do all the intact surfaces of the right metacarpals (the proximal end of the 1st and the distal end of the 4th are missing). Four proximal right hand phalanges are present and most of their joint surfaces show erosions. All the left carpals, and all intact joint surfaces of the left metacarpals (the distal surface of the 1st is missing) show erosions. Of the proximal left hand phalanges all the distal articular surfaces, and the proximal joint surfaces of the 1st and 2nd show erosive changes. The distal interphalangeal joint of the left 3rd finger is ankylosed, and there are erosions on both joint surfaces of the 2nd and the distal end of the 4th intermediate phalanx, and

on the distal phalanx of the left thumb. The hand and wrist bones are shown in Plates 4 & 5.

Of the foot bones only a right proximal phalanx is sufficiently intact for observations to be made: its distal joint surface is destroyed by an erosive lesion.

The surfaces of the erosive lesions are of trabecular bone which in some instances is slightly sclerotic. For those lesions which are sufficiently small for judgement to be made, many seem to have started at the joint margins.

This seems to be an erosive arthropathy with some joints showing marginal proliferation. With so much of the skeleton missing it is difficult to assess the distribution of lesions, although it is clear that there is unilateral sacro-iliitis, spinal involvement, particularly at the vertebral facet joints, and there is some bony proliferation at the margins of the vertebral bodies. The hands are affected in a bilaterally symmetrical manner and there is involvement of a foot bone. The incomplete nature of the skeleton makes a precise diagnosis difficult but the pattern of changes is not atypical of a seronegative spondylo-arthropathy.

Burial 5121. The following sites show erosive lesions: the iliac faces of both sacra-iliac joints, many vertebral facet joints (Plate 6), including the odontoid process of the axis (there seems to be no real concentration of these changes in any particular part of the spine), the Luschka joints and posterio-lateral disc margins of some cervical vertebrae (Plate 7), the heads and articular parts of the tuberosities of 6 left and 6 right ribs, the facets on the manubrium for the right 1st rib and the right clavicle, both faces of the left and right acromioclavicular joints, both acetabula (slight), the medial joint surfaces of the claviculae, the tips of the coracoid processes of the scapulae, the superior angle of the left scapula (slight), the distal joint surfaces and epicondyles of the left humerus, the medial epicondyle of the right humerus, both olecranon processes, the proximal joint surface of the left ulna, the distal ends of both ulnae and radii, the head of the right radius and the site of insertion of the pronator teres on the left radius. The lower leg and foot bones are missing.

Seven carpals, 5 metacarpals and one phalanx are present from the left hand, and 3 carpals, 5 metacarpals and 3 phalanges from the right: most joint surfaces intact for study show erosions. The changes are particularly marked in the proximal phalanges of both thumbs: their distal halves are completely destroyed, as are the head of the left 2nd, and proximal end of the right 3rd metacarpals. A proximal phalanx of unknown side is present and shows destruction of its distal joint surface. The gross and radiographic appearance of the hand and wrist bones is shown in Plates 8-10.

All the hand bones are rather light and rarefied with focal demineralisation of sub-chondral bone visible on X--ray in some places (e.g. beneath the distal joint surface of the right 5th metacarpal - Plate 9). X-ray also shows that some erosions have sclerotic margins. In cases where observations can be made there seems to be no consistency in the starting point of lesions: some seem to originate from the joint margins, some from the middle of

the joint surface.

This seems to be an erosive arthropathy and enthesopathy affecting most joints in the skeleton. Changes are particularly severe in the hands, with osteolysis of some phalanges. The lack of proliferative changes around affected joints, lack of osteophytes on vertebral bodies, lack of periosteal reactions on any bones, the fairly bilaterally symmetrical distribution of lesions, erosion of disc margins and Luschka joints of cervical vertebrae, and the demineralisation of the subchondral areas of some hand bones might be interpreted as arguing for a diagnosis of rheumatoid arthritis over other erosive arthropathies. Against this, however, some aspects of the changes observed in 5121 cannot be considered typical of rheumatoid arthritis, for example spinal rheumatoid arthritis characteristically affects the cervical spine, and sacro-iliitis is only occasionally a feature (the criteria in the above discussion derived from Jensen & Steinbach 1977; McCarty 1989; Rogers et al. 1987).

(iii) Miscellaneous joint disease. The head of the right 1st metatarsal of 0619 has a Sx5mm area of depressed sclerotic trabeculae. This is probably osteochondritis dissecans, death of a section of subchondral bone through deficient blood supply with eventual cleavage away of the necrotic fragment forming a loose body in the joint (Jacobs 1976: 720f), this leaves a pit or depression on the joint surface. The precise aetiology of osteochondritis dissecans is obscure but trauma appears to play a part (ibid.).

(c) Trauma

(i) Fractures. Four individuals show fractured bones; the overall fracture rate with respect to bones is 4/1548=0.26%.

Burials 4737, 4776 and 5121 respectively show a compression fracture of a lower thoracic vertebral body, a fracture of the proximal phalanx of the right ring finger and a fracture of an unsided rib fragment. All are firmly healed in good alignment with no sign of infection. In the case of 4737 the fracture may have been precipitated by osteoporosis (see below).

The left radius of 7167 is very damaged post-mortem but sufficient remains to show that the proximal part ends in a smooth stump about half way down the shaft. (Plates 11-13); fragments of the distal end of the radius are present, although the part immediately distal to the stump is missing. This stump seems to represent an un--united fracture of the radial diaphysis. The proximal part of the left ulna is swollen and slightly pitted (Plate 11) and X-ray reveals some irregularity of the endosteal surface of the cortex in this area The above observations are suggestive of osteomyelitis - infection of the bone extending to the marrow cavity. X-ray reveals marked rarefication and cortical thinning of the left forearm and hand bones (Plates 13 & 14). It thus seems probable that 3163 suffered an injury to his left forearm which fractured the radius and led to osteomyelitis of the ulna. The radius fracture failed to unite and the rarefication of the left forearm and hand bones suggests some loss of function in the left arm subsequent to the injury.

(ii) Schmorl's nodes. An intervertebral disc consists of a tough outer layer (the annulus fibroses) surrounding an inner core (the nucleus pulposus) which, until young adulthood is composed of semi-gelatinous material. In younger individuals excessive compression of the spine, as might result from heavy lifting, may result in extrusion of material from the nucleus pulposus into the adjacent vertebral body. The bony manifestation of this is a pit or cleft - the Schmorl's node. In some individuals congenital weakness of the cartilage end plate of the vertebral body may predispose to Schmorl's node formation, but there is no doubt that a single trauma may produce a Schmorl's node in a healthy spine (Schmorl & Junghanns 1971: 158166). Of a total of 11 individuals with one or more vertebral bodies intact for observations to be made, 2 showed Schmorl's nodes. The distribution of Schmorl's nodes in the different areas of the spine is shown below.

Table 15: Schmorl's nodes: distribution in the spine

	Total vertebrae	No of vertebrae with nodes	No. of nodes
Cervical vertebrae	42	0	0
Thoracic vertebrae	72	8	9
Lumbar vertebrae	33	1	1

d) Cribra orbitalia

Cribra orbitalia takes the form of small pits or perforations in the orbital roofs. Of 11 individuals who could be scored for cribra orbitalia, 3 showed lesions of Brothwell's (1981: Fig. 6.17) porotic type and one showed changes of Brothwell's cribriotic type. It seems probable that cribra orbitalia is a consequence of anaemia (Hengen 1971; Stuart-Macadam 1989). Iron deficiency anaemia is the most common anaemia in all parts of the world (Steinbock 1976: 230). In addition to deficient dietary intake of iron, iron deficiency anaemia can be caused by gut parasites, frequent in unhygienic conditions, which were doubtless prevalent in antiquity.

e) Infections

When it is not possible to identify a particular micro-organism as responsible for an inflammation it is termed a non-specific infection. When the inflammation involves the marrow cavity it is termed osteomyelitis. In the Whitefriars material there is one probable case of osteomyelitis (burial 3163); this was described on page 15. When an infection results in inflammation confined to the periosteum, resulting in the laying down of new bone upon the underlying cortex, it is termed periostitis. Three individuals (burials 4776, 4789 and 5117) show periostitis; in all 3 cases lesions are slight and are confined to the lower legs. In archaeological material the lower leg bones are the most common site for non--specific periostitis, the reason for this is probably that they are frequently subject to minor

injury, with subsequent inflammation.

f) Osteoporosis
All the bones of burial 4737 are very light and have very thin cortices - for example the thickness of the cortex on the lateral side of the left tibia at the level of the nutrient foramen is only 1.7mm. In addition all the muscle markings on the bones are very slight. A lower thoracic vertebral body shows a healed compression fracture: this type of vertebral fracture is a common consequence of osteoporosis (Kelsey 1987). This individual is a male and, incidentally, is the tallest in the present group at 182.8cm (6' 0"). Dental wear and cranial suture closure are consistent with an age at death in young adulthood - estimated age at death is about 25-35 years. This degree of loss of bone mineral, and the slightness of the markings for muscle attachments are highly unusual in a young adult male, perhaps the individual was bedridden for a prolonged period prior to death or perhaps suffered from some paralysing disease.

g) Neoplasms.
There is a cavity in the lateral part of the superior margin of the right orbit of burial 3163. It measures about 15x10mm and has some fine grained, amorphous bone within (Plate 15). This lesion is suggestive of a tumour. Burial 4765 also shows a lesion which may be a neoplasm: a small cavity on the right maxilla midway between the infra orbital foramen and the nasal aperture, partially filled with fine grained amorphous bone.

h) Miscellaneous disease
The joint surfaces of the patellae of burial 4776 show irregular pits and gullies, as do their superior surfaces (Plates 16 & 17). These changes are clearly ante-mortem in origin and their causes are unclear. Other than degenerative changes the joints in the remainder of the skeleton are normal.

5. Summary

Fifteen inhumations from the Whitefriars site, Ipswich were examined. Of these, 13 are of Mediaeval date (c1278-1538) and represent burials within the friary complex. The remaining two burials may date from the Post-mediaeval period. All burials are adult, the ages at death range from early 20s to elderly individuals probably aged well over 50 years. Of 14 sexed individuals 11 are males. This sex imbalance is consistent with skeletal series from other English friary sites and is probably due to burials of friars increasing the numbers of males.

Although numbers are small the cranial and post-cranial measurements suggest a similar skeletal form to that found in the Ipswich Blackfriars assemblage.

Three individuals showed erosive arthropathies. Erosive arthropathies are a group of joint diseases including rheumatoid arthritis, ankylosing spondylitis, gout and several forms of

arthritis associated with venereal and gastro-intestinal infections. These diseases are generally fairly uncommon in archaeological skeletal series, for example out of 226 adult skeletons at the Ipswich Blackfriars 6 probable cases of erosive arthropathies were identified. In this light the occurrence of 3 cases in the present series might be viewed as noteworthy, however given the small numbers involved it may well be a chance finding. As is so often the case in palaeopathology it proved impossible to determine with any confidence which of the various erosive arthropathies was responsible for the lesions observed in any particular case; in 2 of the skeletons the incomplete nature of the remains played a role in hindering precise diagnosis.

Four fractures are present. Burial 3163, of possible Post-Mediaeval date seemed to have suffered an injury to the left forearm which resulted in a radius fracture which failed to unite and osteomyelitis of the ulna and seems to have led to some loss of function in the left arm.

One unusual finding was a skeleton of a young adult male which showed marked osteoporosis (which probably precipitated the compression fracture observed in one of the lower thoracic vertebral bodies) and very reduced muscular markings on the bones. The cause of these changes is unclear but it may be that this individual was bedridden for a prolonged period prior to death, or perhaps he suffered from some paralysing disease.

6. References

Berry, A.C. & Berry, R.J. (1967). Epigenetic Variation in the Human Cranium. *Journal of Anatomy 101*: 361-379.

Brothwell, D.R. (1959). Teeth in earlier Human Populations. *Proceedings of the Nutrition Society* 18: 59-65.

Brothwell, D.R. (1981). *Digging Up Bones (3rd edition).* Oxford University Press (British Museum Natural History), Oxford.

Costa, R.L. (1902). Periodontal Disease at the Prehistoric Ipiutak and Tigara Skeletal Remains From Point Hope, Alaska. *American Journal of Physical Anthropology* 59: 97-110.

Dobney, K. & Brothwell, D. (1987). A Method For Evaluating the Amount of Dental Calculus on Teeth From Archaeological Sites. *Journal of Archaeological Science* 14: 343-351.
480-494.

Finnegan, M. (1978). Non-metric Variation of the Infracranial Skeleton. *Journal of Anatomy* 125: 23-37

Goodman, A.H., Armelagos, G.J. & Rose, J.C. (1900). Enamel Hypoplasias as Indicators of Stress in Three Prehistoric Populations From Illinois. *Human Biology* 52.1 515-528.

Hengen, 0.P. (1971). Cribra Orbitalia: Pathogenesis and Probable Aetiology. *HOMO 22*: 57-76.

Howells, W.W. (1973). Cranial Variation in Man: A Study by Multivariate Analysis of Patterns of Difference Among Recent Human Populations. *Papers of the Peabody Museum of Archaeology & Ethnography No 67.*

Jacobs, P. (1976). Osteochondrosis (osteochondritis). In (Davidson, J.K., ed) *Aseptic Necrosis of Bone*. Excerpta Medica, Oxford. pp. 301-332.

Jensen, P.S. & Steinbach, H.L. (1977). Roentgen Features of the Rheumatic Diseases. *The Medical Clinics of North America 61:* 389-404.

Kellgren, J.H. (1961). Osteoarthrosis in Patients and Populations. *British Medical Journal* 2:1-6.

Kellgren, J.H. & Lawrence, J.S. (1958). Osteo-Arthrosis and Disc Degeneration in an Urban Population. *Annals of the Rheumatic Diseases* 17: 388-397.

Kelsey, J.L. (1987). Epidemiology of Osteoporosis & Associated Fractures. *Bone & Mineral Research* 5: 409-444.

Lovejoy, C.O., Burstein, A.H. & Heiple, K.G. (1976). The Biomechanical Analysis of Bone Stength: A Method and its Application to Platycnemia. *American Journal of Physical Anthropology* 44: 489-506.

McCarty, D.J. (1989). Clinical Picture of Rheumatoid Arthritis. In (McCarty, D.J., ed) *Arthritis & Allied Conditions: A Textbook of Rheumatology (11th edition).* Lea & Febiger, Philadelphia. pp. 715-742.

Mays, S.A. (1989). The Anglo-Saxon Human Bone From School Street, Ipswich, Suffolk. AM Lab Report 115/89.

Mays, S.A. (1991). The Mediaeval Burials From the Blackfriars Friary, School Street, Ipswich, Suffolk (Exacavated 1983-85). AM Lab Report 16/91.

O'Rahilly, R. (1953). A Survey of Tarsal & Carpal Anomalies. Journal of Bone & Joint Surgery 35A: 626-642.

Ossenburg, N. S. (1977). Within & Between Race Distances in Population Studies Based on Discrete Traits of the Human Skull. *American Journal of Physical Anthropology* 45: 701-716.

Perizonius, W.R.K. (1984). Closing & Non-Closing Sutures in 256 Crania of Known Age & Sex From Amsterdam (AD 1883-1909). *Journal of Human Evolution* 13: 201-206.

Pindborg, J.J. (1970). *The Pathology of the Dental Hard Tissues*. Munksgaard, Copenhagen.

Radin, E.L., Paul, I.L. & Rose, R.M. (1980). Osteoarthrosis as a Final Common Pathway. In (Nuki, G., ed) *The Aetiopathogenesis of Osteoarthrosis*, Pitman Medical, London. pp. 84-89.

Resnick, D. (1985). Degenerative Diseases of the Vertebral Column. *Radiology* 156: 3-14.

Rogers, J., Waldron, T., Dieppe, P. & Watt, I. (1987). Arthropathies in Palaeopathology: The Basis of Classification According to Most Probable Cause. *Journal of Archaeological Science* 14: 179-183.

Schmorl, G. & Junghanns, H. (1971). *The Human Spine in Health & Disease* (2nd American edition, translated by E.F. Beseman). Grune & Stratton, New York.

Sjøvold, T. (1984). A Report on the Heritability of Some Cranial Measurements and Non-Metric Traits. In (van Vark, G.N. & Howells, W.W., eds) *Multivariate Statistical Methods in Physical Anthropology*. D. Riedel, Groningen. pp. 223-246.

Stuart-Macadam, P. (1989). Porotic Hyperostosis: Relationship Between Orbital & Vault Lesions. *American Journal of Physical Anthropology* 80: 187-193

Suchey, J.M., Wisely, D. V. & Katz, D. (1987). Evaluation of the Todd & McKern-Stewart Methods of Ageing the Male Os pubis. In (Reichs, K.J., ed) *Forensic Osteology: Advances in the Identification of Human Remains.* Charles, C. Thomas, Springfield. pp. 33-67.

Suchey, J.M., Brooks, S.T. & Katz, D. (1988). *Instructions For the Use of the Suchey-Brooks System for Age Determination of the Female Os Pubis*. Instructions materials accompanying female pubic symphyseal models of the Suchey-Brooks System. Distributed by France Casting (Diane France), Fort Collins.

Trotter, M. & Gleser, G.C. (1952). Estimation of Stature From Long Bones of American Whites and Negroes. *American Journal of Physical Anthropology* 10: 463-514.

Trotter, M. & Gleser, G.C. (1958). A Re-Evaluation of Stature Based on Measurements of Stature Taken During Life and Long-Bones After Death. *American Journal of Physical Anthropology 16*: 79-123.

Turner, C.G. (1979). Dental Anthropological Indications of Agriculture Among the Jomon People of Central Japan. *American Journal of Physical Anthropology* 51: 619-636.

Vallois, H.V. (1965). Anthropometric Techniques. *Current Anthropology 6*: 127-143.

de Villiers, H. (1968). The Skull of the South African Negro. A Biometrical & Morphological Study. PhD Thesis, University of the Witwatersrand. Witwatersrand University Press, Johannesburg.

Workshop of European Anthropologists (1980). Recommendations for Age & Sex Diagnosis of Skeletons. *Journal of Human Evolution 9:* 517-549.

Wynne-Davis, R. & Scott, J.H.S. (1979). Inheritance and Spondylolisthesis: Radiographic Family Survey. *Journal of Bone & Joint Surgery* 61B: 301-305.

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PLATES

Plate 1. The foot bones of burial 1077 showing proliferative and erosive changes

Plate 2. The left sacro-iliac joint of burial 3803. The joint is fused across its inferior portion (although most of the sacrum has broken away post-mortem) and there is destruction of the iliac face of the joint

Plate 3. The 11th and 12th thoracic vertebrae and the left 11th rib of burial 3003. The costo-vertebral articulations show erosive lesions

Plate 4. The hand and wrist bones of burial 3803 showing erosive changes

Plate 5. Radiograph of the hand and wrist bones of burial 3803

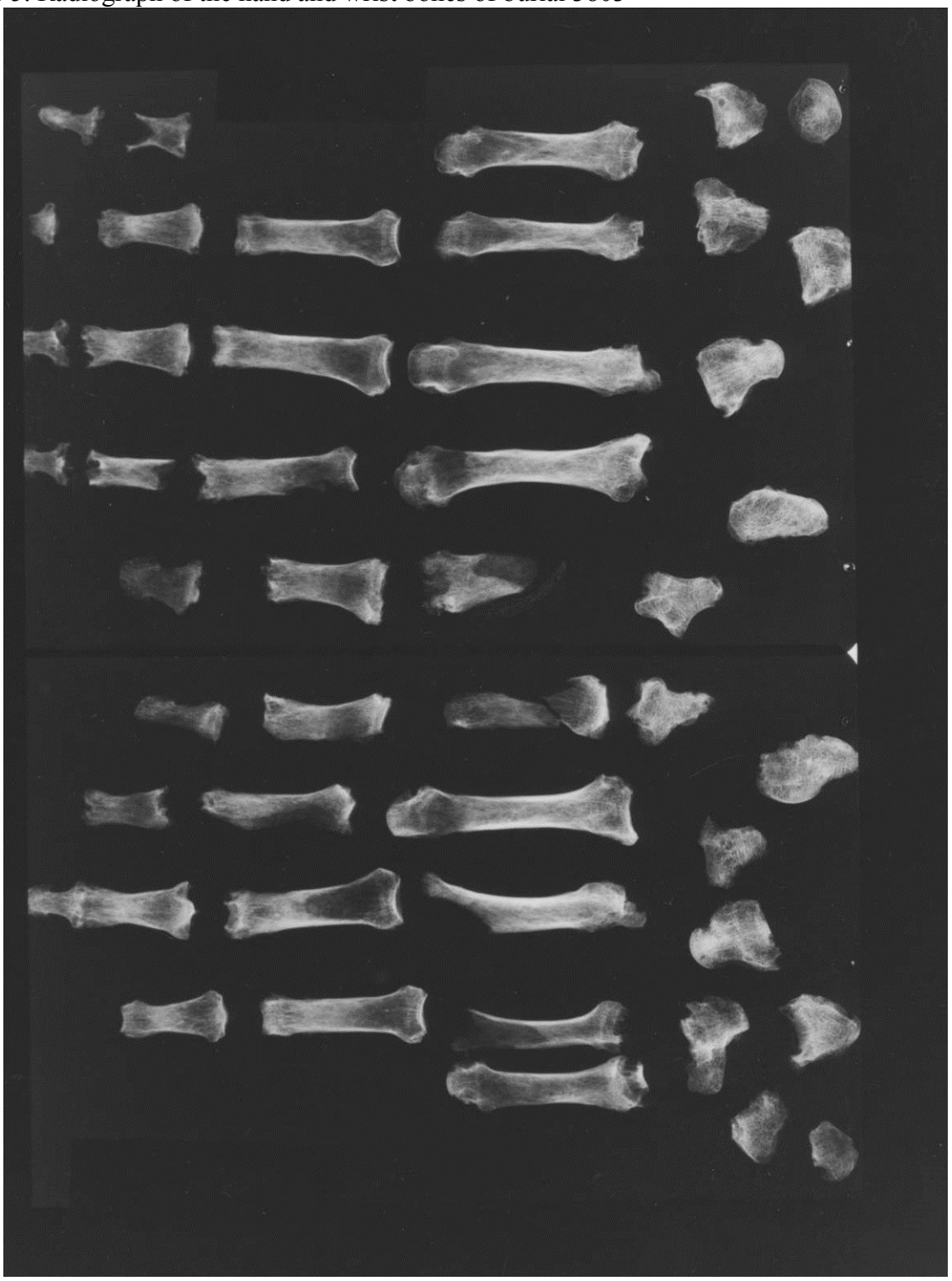


Plate 6. A lumbar and a thoracic vertebra from burial 5121 showing erosions at their facet joints

Plate 7 A cervical vertebra from burial 5121 showing erosions at the Luschka joints and at the disc margins

Plate 8. The hand and wrist bones of burial 5121 showing erosive lesions

Plate 9. Radiograph of the hand and wrist bones of burial 5121

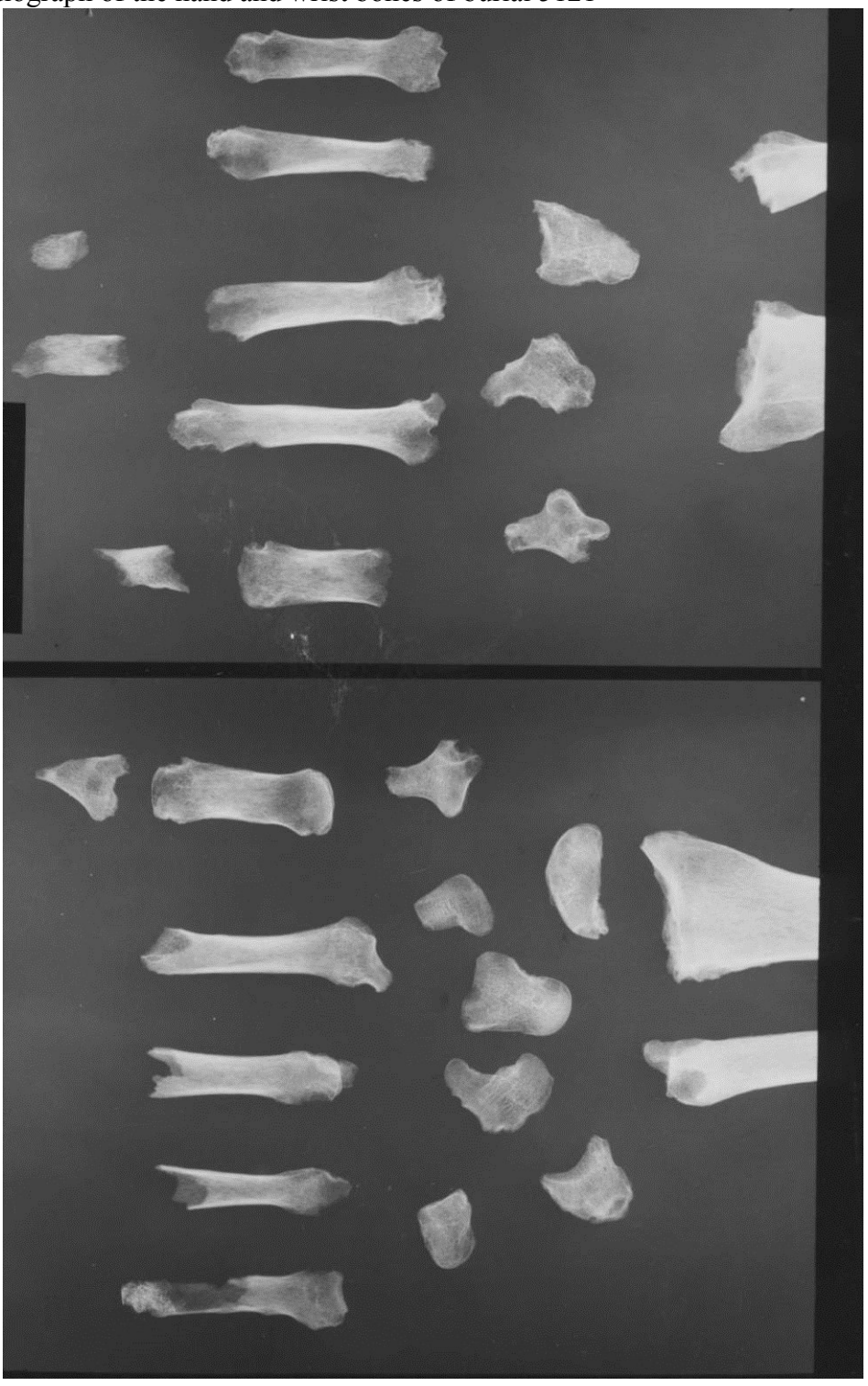


Plate 10 Details of the erosions on (from bottom to top in the photo) the distal ends of the right and left proximal thumb phalanges and the distal end of the left 2nd metacarpal of burial 5121

Plate 11. The forearm bones of burial 3163. The left radius is rather fragmentary but enough remains to show that the proximal part ends in a smooth stump, although parts distal to this stump are present

Plate 12. A fragment of the mid-shaft area of the left radius of burial :3163 (lateral view - the slight groove near the proximal end of the fragment (towards the bottom of the photograph) is the site for attachment for the pronator teres). The distal part (towards the top of the photograph) ends in a smooth stump

Plate 13, Radiograph of the radii of burial 3163. Note the increased radiolucency of the left radius

Plate 14. Radiograph of the hand and wrist bones of burial 3163. Note the increased radiolucency of the bones of the left hand and wrist

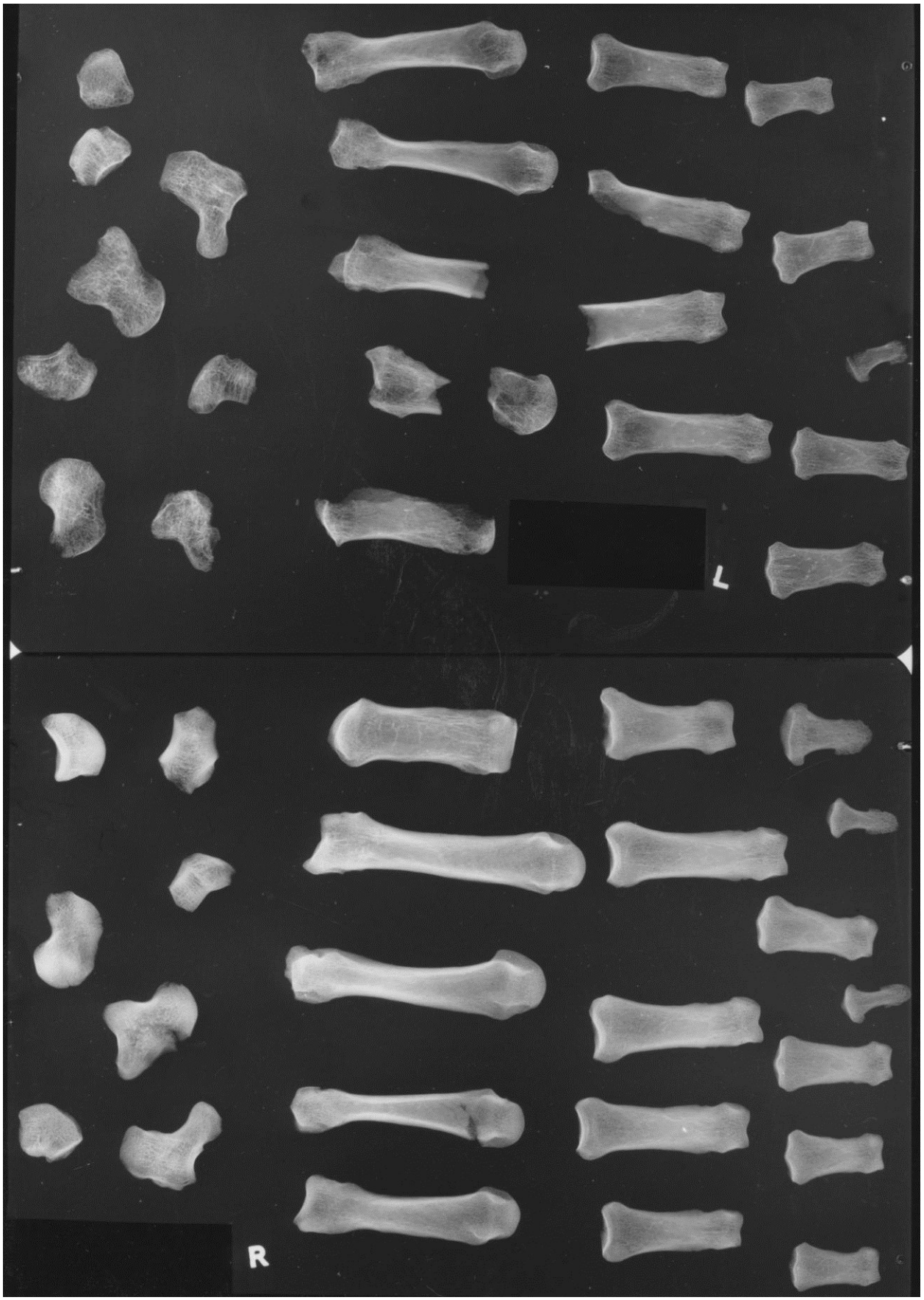


Plate 15 The left orbital roof of burial 316:3 showing a cavity filled with fine drained bone on the lateral part of the supra-orbital margin

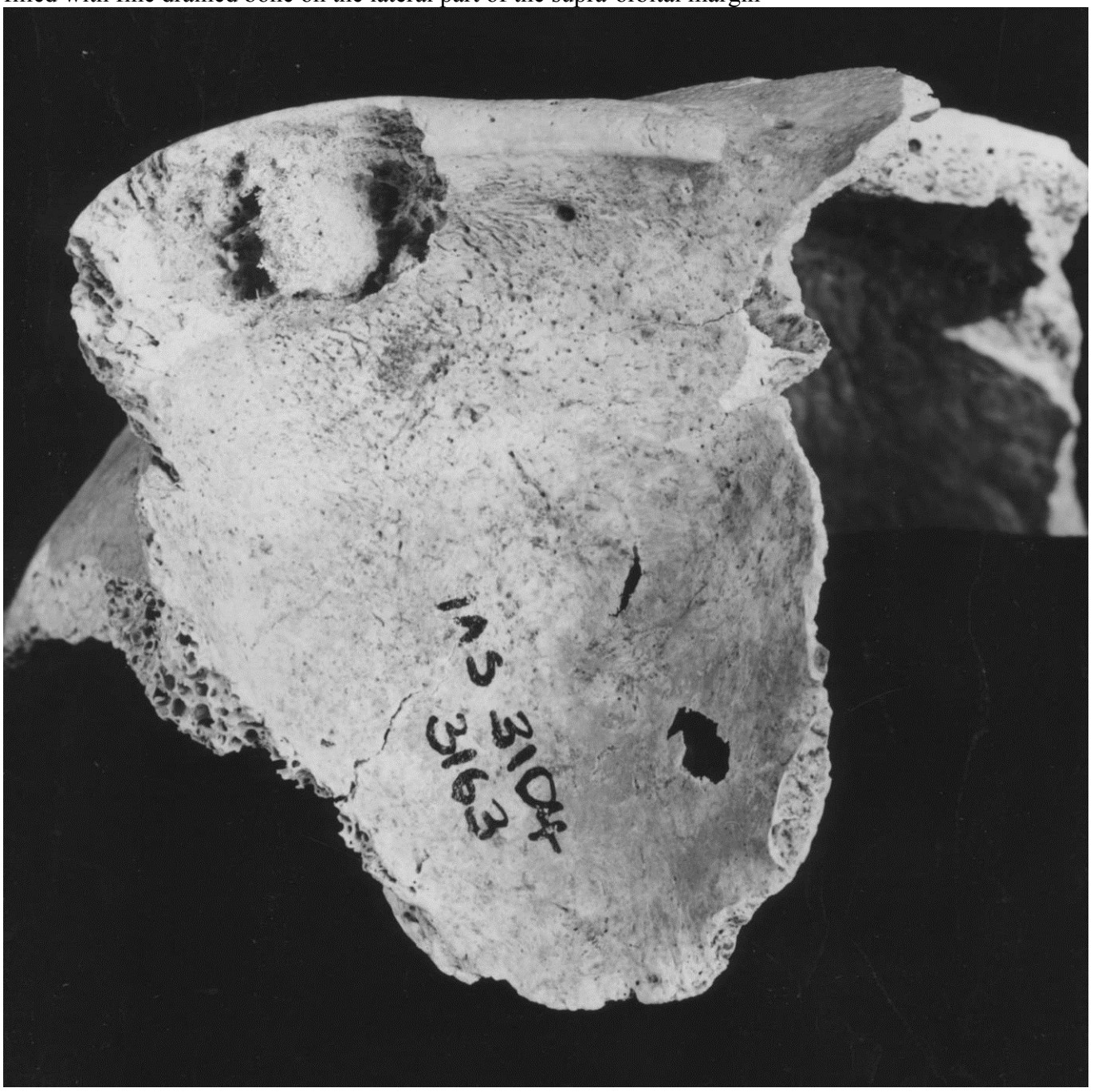
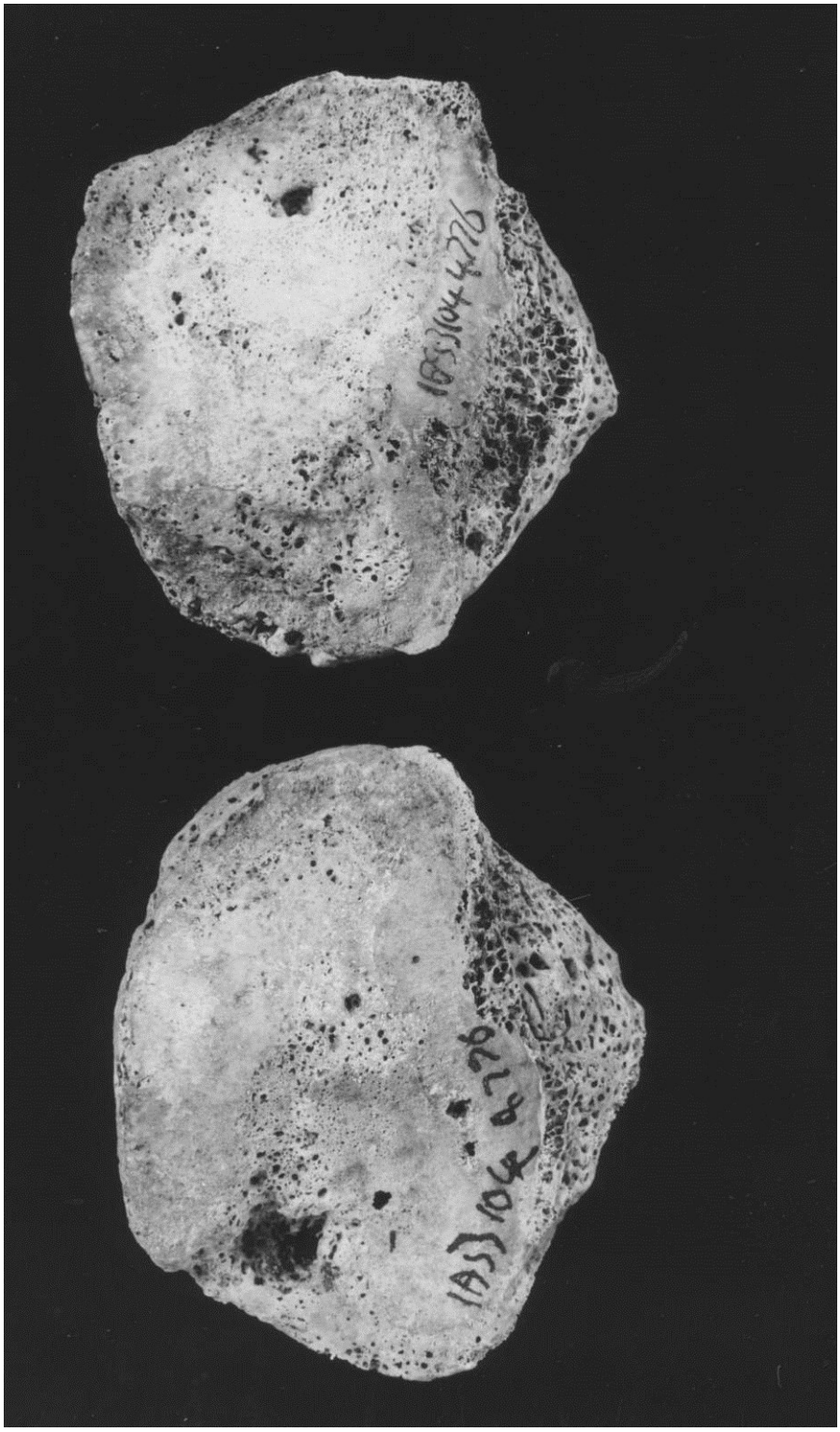


Plate 16, The patellae of burial 4776 (anterior view) showing pits and gullies on their superior parts

Plate 17. The patellae of burial 4776 (posterior view) showing pitting and erosions on their joint surfaces



APPENDIX: DATA FOR INDIVIDUAL BURIALS

DENTITION

MAXILLARY TEETH

	LEFT								RIGHT							
SKEL	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
0619		.	.	.	.	.	X	X	.	X	.	.	.	.	.	T
0642	0	.C	.C	.C	.	.	X	.	.	.	.	.	.	*A	.	0
3162	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3163	*	.	.	.C	.	.	X	.	X	.	.	.	.AC	.	.	T
3412	.	.C	*	*	.	.	.	.	.	.	.	.C	*A	*	*	.
4737	0	.C	.	.	.	.	.	.	.	.	.	.	.	.C	.C	0
4765	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
4776			*	*	.	.	.	.	.	.	.	.	X	T		
4789	*	*	.CA	.CA	.CA	.	.A	.	.	.	.	.CA	.	.CA	*	*
5117	.C	*	*	*	*	X	*	*	.	X	.C	*	*	*	*	.C
5121	*	*	*	.	.CA	.A	X	.	.A	.	.A	.	*	*	*	*

MANDIBULAR TEETH

	LEFT								RIGHT							
SKEL	8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
0619	.	.	.	.	X	.	X	X	.	X	.	.	.	.	.	.
0642	0	.	.CA	.	.	.	.	.	.	.	.	.	.	XA	.C	0
3162	0	.	.	.	.	X	.	.	.	.	X	.	.	.	.	0
3163	.	.	.	.C	.	X	.	.	.	.	.	.	.C	.	.	.
3412	.C	.CA	*	.	.	.	.	X	X	.	.	.	.	*	.CA	.
4737	0	*	*A	.	.	.	.	.	.	.	.	.	.C	.C	.CA	0
4745	0	.	.	.	.	.	*	.	.	.	.	.	.	.	.	0
4765	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.
4776	*	*	*	*	X	.	.	.	.	X	.	.A	*	*	*	.
4789	*	X	*	.C	.	.	.	.	.	.	.	.C	*	*	.C	*
5117	*	*	*	.	.C	.C	.	*	.	.	.C	X	*	*	.C	*
5121	.CA	.CA	*	.	.	.	.	.	.	.	.	.	.	.C	.C	.CA

Key: .=tooth present in socket X=tooth lost post-mortem
‣=congenital absence of tooth T=socket missing or damaged but loose tooth present *=tooth lost ante-mortem A=alveolar abscess C=carious tooth. Blank space denotes missing data: both tooth and socket missing.

CRANIAL MEASUREMENTS

SKEL	SEX	GOL	XCB	BBH	BNL	XFB	ZMB	ZYB	FMB	PAC	MDH	FRC	ASB	MNB	OBB	OBH	FOL
0619	M	-	-	-	-	118.0	-	-	-	115.8	29.3	-	115.8	-	-	-	-
0642	M	185.0	142.0	133.0	100.0	126.0	98.4	135.5	101.1	117.5	24.2	114.0	115.0	8.3	41.0	34.3	35.0
3162	*M*	-	-	-	-	-	-	-	-	*109.3*	*28.8*	*111.0*	*117.7*	-	-	-	-
3163	M	-	-	-	-	-	-	-	-	-	34.0	-	-	-	-	-	-
3412	F	-	-	-	-	-	-	-	-	-	24.8	-	-	-	-	-	-
4737	M	-	-	-	-	-	-	-	-	117.2	36.2	115.8	114.8	-	-	-	-
4765	M	185.0	146.0	-	-	128.0	99.8	-	97.7	114.2	28.4	116.0	113.3	6.3	41.7	36.7	-
4776	F	-	-	-	-	124.0	-	-	-	-	25.4	-	-	-	-	-	-
4789	M	-	-	-	-	122.0	-	-	100.1	-	29.4	103.5	-	-	-	-	-
5117	M	187.0	139.0	132.0	105.0	122.0	89.4	125.2	97.9	111.1	30.6	113.7	112.1	7.5	40.9	34.7	36.5
5121	M	188.0	149.0	133.0	98.0	129.0	93.5	136.7	100.8	119.8	27.7	113.6	114.0	6.6	43.8	36.3	39.8

Key: the symbols are those of Howells (1973).

LONGBONE LENGTHS

SKEL	SEX	LFeL1	RFeL1	LTiL1	RTiL1	LFiL1	RFiL1	LHuL1	RHuL1	LRaL1	RRaL1	LUlL1	RUlL1	LClL1	RClL1
0619	M	462	458	375	375	371	371	320	317	240	241	257	261	150	-
0642	M	-	-	-	350	-	-	320	317	-	-	-	-	-	-
3162	M	465	460	-	-	371	369	343	-	256	251	-	-	-	-
3163	M	451	-	-	352	354	348	327	328	-	-	260	-	-	146
3412	F	421	418	341	341	-	329	302	315	221	224	245	245	138	137
3803	M	-	-	-	-	-	-	-	-	-	-	257	-	-	-
4737	M	-	-	-	417	-	-	347	-	-	-	-	-	-	-
4745	F	-	400	341	344	-	-	-	-	212	-	-	-	-	-
4765	M	443	447	342	345	337	-	314	-	-	-	249	249	-	143
4776	F	-	-	328	-	-	-	-	-	-	-	-	-	124	-
4789	M	449	443	369	365	-	-	-	328	-	243	-	260	-	-
5117	M	454	455	358	361	-	-	321	323	-	240	253	258	-	-
5120	U	-	-	350	350	-	349	-	-	-	-	-	-	-	-
5121	M	-	478	-	-	-	-	-	-	-	-	277	282	-	-

Key: the symbols are those of Brothwell (1981).

MISCELLANEOUS POST-CRANIAL MEASUREMENTS

SKEL	LHHD	RHHD	LHEW	RHEW	LFHD	RFHD	LFeD1	LFeD2	RFeD1	RFeD2	LFeE1	RFeE1	LTiD1	LTiD2	RTiD1	RTiD2
0619	-	49.5	-	71.4	51.4	51.3	26.2	32.0	-	-	88.2	89.8	34.9	24.8	33.8	25.3
0642	-	-	-	62.1	-	-	24.8	32.7	-	-	-	-	-	-	-	-
1077	-	-	-	-	-	-	-	-	25.7	36.0	-	-	-	-	-	-
3162	47.1	47.9	68.6	-	48.3	47.8	27.2	34.4	26.2	35.7	80.1	82.0	35.4	26.5	38.4	26.2
3163	48.0	-	-	67.8	50.0	-	28.5	35.0	29.0	35.8	81.9	81.9	36.5	25.9	36.3	25.9
3412	42.6	42.9	58.3	60.6	42.7	43.7	25.0	32.7	24.0	32.8	73.7	73.4	29.9	22.2	28.5	24.0
3803	-	-	-	65.7	-	48.2	-	-	28.6	34.4	-	-	-	-	-	-
4737	-	-	63.3	-	50.3	-	31.3	37.4	-	-	-	-	-	-	-	-
4745	39.8	-	-	-	-	-	-	-	22.9	27.7	-	-	30.9	24.3	33.1	23.9
4765	48.5	47.6	-	-	-	-	27.2	35.6	26.9	33.5	81.1	80.6	35.1	26.7	37.0	25.4
4776	-	41.1	-	-	-	41.6	-	-	-	-	-	-	31.3	22.3	-	-
4789	-	46.5	-	-	46.2	46.2	30.9	32.7	30.5	32.9	-	-	38.1	24.8	35.5	26.8
5117	49.0	47.8	-	-	-	-	27.3	28.3	26.8	28.6	-	-	32.4	24.4	31.2	23.1
5121	-	-	-	62.8	-	50.8	28.3	35.4	29.0	34.7	-	-	-	-	-	-

Key: L=left R=right HHD=maximum humeral head diameter HEW=humeral epicondylar width FHD=vertical diameter of the femoral head. Otherwise abbreviations from Brothwell (1981).

PATHOLOGIES

SKEL	CRIBRA	CALCULUS	DENTAL ENAMEL HYPOPLASIA	
0619	0	1	0	
0642	C	0	0	
3162	0	1	0	
3163	0	3	0	
3412	0	1	0	
4737	P	0	0	
4745	-	1	0	
4765	0	1	0	
4776	P	2	0	
4789	P	3	0	
5117	0	0	0	
5121	0	1	1	LINE, 4.3MM CEJ MAX I1

Key: Cribra: 0=absent, P=porotic type, C=cribriotic type (Classified according to Brothwell 1981). Calculus: scored according to Dobney & Brothwell (1987). Dental enamel hypoplasia: 0=absent

SPINAL OSTEOPHYTOSIS

	Cervical grades				Thoracic grades				Lumbar grades			
SKEL	0	1	2	3	0	1	2	3	0	1	2	3
0619	6	0	0	0	12	0	0	0	5	0	0	0
0642	3	0	2	0	4	0	0	0	1	0	0	0
3162	6	0	0	0	9	0	0	0	4	0	0	0
3163	6	0	0	0	4	2	0	0	4	0	0	0
3412	6	0	0	0	2	10	0	0	5	0	0	0
4737	0	0	0	0	0	1	1	0	1	1	0	0
4745	3	0	0	0	4	0	0	0	2	0	0	0
4765	3	0	0	0	3	11	0	0	1	0	0	0
4776	1	0	0	0	1	5	0	0	4	1	0	0
4789	3	1	2	0	0	1	0	0	0	0	0	0
5117	0	0	0	0	0	2	0	0	0	4	0	0
*** Total ***												
	37	1	4	0	39	32	1	0	27	6	0	0

SPINAL OSTEOARTHRITIS

	Cervical grades				Thoracic grades				Lumbar grades			
SKEL	0	1	2	3	0	1	2	3	0	1	2	3
0619	7	0	0	0	12	0	0	0	5	0	0	0
0642	6	0	0	0	12	0	0	0	4	0	0	0
3162	7	0	0	0	9	0	0	0	3	0	0	0
3163	6	0	0	0	5	0	0	0	2	0	0	0
3412	6	0	0	0	12	0	0	0	5	0	0	0
4737	3	0	0	0	7	0	2	0	6	0	0	0
4745	7	0	0	0	12	0	0	0	2	0	0	0
4765	7	0	0	0	12	0	0	0	5	0	0	0
4776	1	0	0	0	6	0	0	0	5	0	0	0
4789	7	0	0	0	2	0	0	0	0	0	0	0
5117	4	1	1	1	7	2	2	1	3	0	2	0
*** Total ***												
	61	1	1	1	96	2	4	1	40	0	2	0

GRADE I OSTEOARTHRITIS

3163: 1L RIB, 1R RIB
4776: 1L RIB, 5R RIBS, 1R HPHALANX, L ACETABULUM, R ACETABULUM
4789: MED LCLAVICLE
5117: L GLENOID, R GLENOID, P RULNA, L ACETABULUM, R ACETABULUM, L PATELLA, R PATELLA, P RTIBIA, P LTIBIA

GRADE II OSTEOARTHRITIS

3163: LAT RCLAVICLE
4737: 2L RIBS, 2R RIBS
4776: 3L. RIBS, 2R RIBS, LAT LCLAVICLE, LAT RCLAVICLE, 1L FPHALANX, 1R FPHALANX
4789: LAT LCLAVICLE, LAT RCLAVICLE
5117: 81 FACET JOINTS

GRADE III OSTEOARTHRITIS

4776: 1L RIB, 2R RIBS

NOTES ON INDIVIDUAL BURIALS

0619. Black staining on skull base and on the ends of some longbones; affected parts tend to be poorly preserved.

The R mandibular PM1 has twin roots; both maxillary PM1s have 3 roots.

Much pitting and some concavity of interdental septa and slight alveolar resorbtion. Periodontal disease.

The sacrum lacks its normal anterior curvature.

The head of the R 1st metatarsal has a 5x5mm area of depressed, sclerotic trabeculae near the dorsal part of the joint surface. The adjoining joint surface of the proximal hallucial phalanx is normal. Probably osteochondritis dissecans.

Bilateral frontal foramina. Ossicle in the L masto-occipital suture.

0642. Slight alveolar resorbtion and marked porosis of interdental septa, together with flattening or concavity of their profiles. Periodontal disease.

Both transverse foramina on the axis are incomplete.

There is a thin, flat plaque of bone, irregular in shape, maximum dimensions about 35x17mm; it is pierced by several small holes (?for blood vessels). Possibly a pleural calcification.

Black staining on skull base; preservation of this area is poor although the rest of the skull is well preserved.

1077. R foot: the calcaneus, the 5 tarsals and 2nd to 5th metatarsals are fused in a solid block. The talo-navicular joint seems to have been just on the point of fusing had death not intervened. The tarsals and the calcaneus bear spiky osteophytes on their plantar surfaces and smooth ones on their dorsal surfaces. There is a large, flat, forward-facing spur on the plantar surface of the L calcaneus and there is destruction of the anterior articular facet for the talus; the talar face of this joint is also destroyed. Both faces of the talo-navicular joint have suffered extensive destruction, as have the following: both faces of the medial cuneiform-1st metatarsal articulation,

both faces of the 1st metatarso-phalangeal joint, the joint surface of the medial hallucial sesamoid, the distal joint surface of the 4th metatarsal, and the distal joint surfaces of the proximal phalanges of the 1st and 4th toes. The proximal phalanx of the 2nd toe and an intermediate phalanx are present and are normal.

L foot: no bones are fused together but the following joint surfaces show partial destruction: both faces of the anterior talo-calcaneal articulation, both faces of the talo-navicular joint, most inter tarsal joints, both faces of the articulation between the 2nd and 3rd metatarsals and the intermediate and lateral cuneiforms, most inter-metatarsal articulations, the distal ends of the proximal phalanges of the 2nd and 5th toes, and the joint surface of the distal hallucial phalanx. Two further distal and 2 intermediate phalanges are present and are normal. There are slight erosive changes to both faces of the hallucial metatarso-phalangeal joint. The lateral cuneiform, cuboid and navicular show spiky osteophytes on their plantar surfaces and all tarsals show smaller, smoother osteophytes on their dorsal surfaces. Like its counterpart from the R foot, the L calcaneus shows a smooth, flat, forward-facing spur on its plantar aspect and there are also some erosions at the site of insertion of the Achilles tendon (this area is damaged post-mortem on the R calcaneus). In general the erosive and proliferative changes are rather less marked on the L foot.

The distal 1/4 of both tibiae and the distal joint surface of the L fibula are present. There is destruction of the distal joint surface of the R tibia in the area of the medial malleolus, with some osteophyte formation near (but not at) the margins of the joint surface. Similar changes are present in the L tibia. The distal joint surface of the L fibula shows marginal erosion. There is no evidence for periostitis on surviving parts of the lower leg bones.

A heavily post-mortem damaged fragment of the L 3rd metacarpal is the only hand bone present and it shows erosion of its proximal joint surface.

There is no evidence for osteoporosis of affected bones and the surfaces of the erosions are of trabecular bone and show negligible sclerosis.

Other than the bones already described only part of the R ilium and the proximal 4/5 of the R femur are present; the R acetabulum shows slight erosive changes.

Thus 1077 shows a proliferative erosive arthropathy affecting the feet in a bilateral and fairly symmetrical manner. A more precise diagnosis is greatly hampered by the fact that so much of this skeleton is missing - the absence of the vertebral column and sacro-iliac joints is particularly unfortunate.

There is fusion of the distal and intermediate phalanges of the R 5th toe. There is no sign of disease in these bones, fusion is probably a skeletal anomaly.

3162. The last sternabra is not fused to the rest of the sternal body.
C7 bears 2 cervical ribs; the L is more gracile than the R. Both ribs articulate with facets on the body and the transverse processes of C7. The R 1st (thoracic) rib has a projection on

its superior aspect near the posterior margin, which bears a roughened surface which probably articulated with the inferior surface of the R cervical rib via a fibrous connection, although the relevant area of the cervical rib is missing. The corresponding areas of the L cervical rib and 1st true rib are both missing so it is impossible to ascertain whether there was a similar articulation between them.

Both femora show increased anterior curvature, especially the L. This is probably not pathological, perhaps the changes are a response to mechanical forces acting during the growth of the bones.

The preservation of the bones is good, but they are very fragmentary and many show fresh breaks. There is green staining on the anterior edge of the R tibia, in the midshaft area, and in the midshaft region of the R fibula.

3163. The maxillary R 12 is shovel shaped. The R mandibular canine has 2 roots.

Rarification and porosis of interdental septa and moderate alveolar resorbtion. Periodontal disease.

Very large incisive fossa.

Manubrium fused to sternal body.

The styloid process of the R 3rd metacarpal is missing. Instead there is an area of sclerotic, porotic bone, implying a fibrous connection between the main part of the bone and a styloid process present as a separate ossicle. The L 3rd metacarpal is normal.

There is a pitted, slightly swollen, rather irregular area on the L ulna, just distal to the coronoid process; there is some sub-periosteal new bone formation in this area X-ray shows that there is some irregularity of the endosteal wall of the cortex in the area of the lesion - probably osteomyelitis. The bone shows no trace of fracture. The L radius is very damaged post-mortem, but enough remains to reveal that it ends in a smooth "stump", approximately half way down the shaft. Fragments of the distal end of the radius are present. This "stump" seems to represent a healed but un-united fracture of the radial diaphysis, although the healed surface shows no evidence for pseudarthrosis formation. The part of the diaphysis immediately distal to the break is missing. The L ulna is complete down to its distal end.

X-ray shows marked thinning of the cortex and general rarification of the L radius as compared with the R, and similar but more slight changes are present in the L ulna and are (mainly confined to the more distal parts) and also to a very slight degree in the L humerus. The bones of the L hand are markedly less radiodense and have much thinner cortices than their counterparts from the R.

It thus seems that 3163 suffered an injury to the L forearm which fractured the radius and led to infection, in the form of osteomyelitis, in the ulna. Following fracture the radius failed to unite, and the rarification present in the L hand and arm bones suggests that the injury resulted in some loss of function of the L arm.

There is a cavity in the frontal bone in the lateral part of the superior margin of the R orbit. It measures 15x10mm and shows some fine grained, amorphous bone within. This appears to

be a mainly lytic lesion but possibly with some new bone formation. The lesion is suggestive of a neoplasm.

The skeleton is rather fragmentary, particularly the vertebrae and skull. Some bones show fresh breaks. There is green staining on the anterior aspect of the L femur in the sub-trochanteric region.

3412. Two small pits are present in the proximal joint surface of the R proximal hallucial phalanx. Non-pathological.

The sacrum has 6 segments, the 6th being an extra vertebra rather than sacralisation of L5.

3803. The left sacro-iliac joint shows erosive lesions; the iliac face is destroyed and there is ankylosis across the inferior portion of the joint. The right sacro-iliac joint is normal.

LI-5 and T10-12 are the only vertebrae present. All except T12 show erosive changes at one or more of their facet joints, as do the left rib articulations on TII and 12. There is a smooth osteophyte on the body of T10; the osteophyte is thickest on the lateral parts of the vertebral body and it seems to have originated near the margins of the body but where bone formation is most pronounced it covers the whole height of the centrum. This osteophyte articulates, but is not fused with, a similar, smaller one on T11.

The facet joints of the first sacral segment show erosions as does the articular facet of the left 11th rib.

Turning to the appendicular skeleton, erosions are present at the insertion of the triceps on the left olecranon process and there are erosive and proliferative changes on the proximal and distal articular surfaces of the left ulna, and on the distal joint surface of the left radius. There is pitting on the radial heads and proliferation at the margins of the proximal joint surface of the right ulna. There is slight periostitis towards the distal ends of the radii. The distal joint surfaces of the right forearm bones are missing.

Right hand: 7 carpals are present, all show erosions, as do all the intact surfaces of the metacarpals (the proximal end of the 1st and the distal end of the 4th are missing). All proximal phalanges except the 5th are present and all their joint surfaces show erosions save the proximal end of the 4th.

Left hand: all 8 carpals show erosions, as do the metacarpals on all joint surfaces for which observations can be made (all proximal and all distal except 1st). Of the proximal phalanges all the distal, and the proximal joint surfaces of the 1st and 2nd show erosive lesions. The intermediate and distal phalanges of the 3rd finder are ankylosed, both ends of the 2nd intermediate phalanx are destroyed by erosions, and the distal end of the 4th intermediate phalanx shows erosive changes. The distal thumb phalanx (the only other distal phalanx present) shows an articular erosion.

Of the foot bones only the right 5th metatarsal and a right proximal phalanx are present. The former is too damaged for observations for pathology to be made but the distal joint surface of the latter is destroyed by an erosive lesion.

The surfaces of the erosive lesions are of trabecular bone

which in some cases is slightly sclerotic. For those lesions which are sufficiently small for observations to be made, many seem to have started at the joint margins.

This seems to be an erosive arthropathy with some joints showing marginal bone proliferation; there is some periostitis near some affected joints. With such an incomplete skeleton the distribution of erosive lesions is difficult to assess, although it is clear that there is unilateral involvement of a sacro-iliac joint, marked involvement of vertebral facet joints (and some vertebral bodies show marginal proliferation), the hands are affected in a bilaterally symmetrical manner and there is involvement of a foot bone. It seems probable that this is a sero-negative spondyloathropathy but the incomplete nature of the remains prevents firm precise diagnosis.

4737. Rather reduced maxillary M2s. They are also rotated by about 45 degrees from their normal orientation.

This individual has a very large, heavy mandible. The post cranial bones large but with very smooth muscle markings.

There is much pitting and concavity of interdental septa - periodontal disease.

All bones are very light and have very thin cortices, for example the cortical thickness on the lateral side of the L tibia at a post-mortem defect at the level of the nutrient foramen is only 1.7mm. The muscle markings are all very smooth, for example there are no deltoid ridges on the humeri; slightly roughened areas are all the betray the sites of attachment of these muscles. This degree of loss of bone mineral is unusual, particularly in a male, and especially in a male who died as a young adult (dental attrition and cranial suture closure were both consistent with an age at death of about 25-35). A lower thoracic vertebra shows a compression fracture of its body; the height of the centrum at its anterior edge is reduced to about 3-4mm. This fracture is probably associated with the general loss of bone mineral in this skeleton. One possible explanation for the severe osteoporosis here is that 4737 was bedridden for a extended period prior to death or perhaps suffered from some paralysing disease.

There are 6 lumbar vertebrae.

All bones very friable and the vertebrae are very fragmentary.

4745. Small, gracile skeleton.

4765. There is a small infra-bony pocket on the distal side of the L maxillary M2. Interdental septa show porotic changes. Periodontal disease.

A few middle/lower thoracic vertebrae bear short, thick osteophytes on the R sides of their bodies.

L5 shows spondylolysis, no sign of spondylolisthesis.

There is a small pit on the proximal joint surface of the R proximal hallucial phalanx. Its counterpart on the L side shows irregularity of its proximal joint surface. Probably non-pathological.

The intermediate and distal phalanges of the R 5th toe are fused together.

There is a small cavity 4-5mm diameter on the R maxilla, midway between the infra-orbital foramen and the nasal aperture. It is partially filled with fine grained amorphous bone. Possibly a neoplasm.

There is slight periostitis on the L and R femora (on the anterior surfaces near the distal ends), and on the R tibia (1/3 of the way from the proximal end), all present as stray bones in this context.

4776. The mandible is rather thin and atrophied; the molar teeth were probably lost a considerable time before death.

Most teeth bear calculus deposits to Dobney & Brothwell's (1987) grade 1, but the crown of the R mandibular M3 is completely covered by calculus. This tooth has an infra-bony pocket around its roots and it appears that it was just about to be shed had death not intervened. The maxilla hereabouts is damaged but this degree of calculus formation suggests that this tooth lacked an occlusal partner. The infra-bony pocket around the R mandibular M3 indicates localised periodontal disease.

Gracile skeleton.

Manubrium fused to sternal body.

The proximal phalanx of the R ring finger shows a healed fracture at its midshaft. Slight deformity and no callus - it must have occurred long before death.

The lateral part of the joint surface of the L patella has a gully, and a pit 5mm diameter and 8mm deep. Both are lined with porotic bone. The superior surface of the bone shows some new bone formation and erosion. The R patella shows a smaller pit (2x3mm & 3mm deep) in a similar location to that on the L patella, and the whole joint surface is rather pitted and irregular. There is a deep gully on the superior surface of the bone. The only other component of either knee joint present is the proximal joint surface of the L tibia; this is normal. The cause of the lesions is unclear.

The tibiae show slight, well remodelled periosteal reactions - that on the L is mainly confined to the medial surface near the proximal end, and of the R bone only the distal 1/2 remains; the lateral and medial surfaces show lesions.

There is a small pit in the distal joint surface of the R tibia - probably non-pathological.

4789. Slight crowding and rotation of anterior mandibular dentition. The L mandibular canine is twin rooted.
There is slight pitting and new bone formation in the antrum of Highmore. No extant periapical abscess in the maxilla actually pierces the maxillary sinus, so this probably represents infection from a dental abscess which has since healed.
There is pitting of interdental septa and slight-moderate alveolar resorbtion. Periodontal disease.

There are well remodelled periosteal reactions on the medial surfaces of both tibiae, about 1/3 of the way from the proximal ends. There is a slight, well remodelled periosteal reaction just above the middle of the shaft of the L fibula.
There is an unidentified rounded soft tissue calcification, 15mm long.

5117. The interdental septa are porotic and irregular in profile, there are infra-bony pockets around the mandibular canines. L PM1 and R M2, and there is moderate-severe apparent alveolar resorbtion. Periodontal disease.

There are slim bridges of bone between the posterior arch and the L and R transverse processes of the atlas.

There is slight, well remodelled periostitis on the lateral surfaces of the tibiae and on the anterior/medial surfaces of the fibulae.

There is a small exostosis on the lateral surface of the L fibula, 1/3 of the way from the proximal end.

There is a cleft in the distal joint surface of the R tibia, near the base of the medial malleolus - non-pathological.

5120. There is a roughened area on the tuberosity of the L navicular, suggesting fibrous union with an ossicle here. The R navicular bears a joint surface on its tuberosity, suggesting an articulation with a fully separate ossicle. Neither ossicle was present with the remains. Bilateral os tibiale externum.

Bones very eroded. Lower legs and feet only present.

5121. There are infra bony pockets around the L maxillary PM2 and the L mandibular PM2, and many interdental septa are pitted and have rather irregular profiles. There is moderate apparent alveolar recession, but some of this last is probably due to super-eruption of the teeth.

Periodontal disease.

The atlas shows spina bifida.

A small fragment of a rib shows a fracture, healed with slight misalignment and minimal callus: probably the fracture healed a long time before death.

Many joints show erosive changes: sacral facet joints, sacral (slight) and iliac faces of the sacro-iliac joints, facet joints and vertebral articulations (including the articular facet of the odontoid process of axis) of many vertebrae in the complete vertebral column (there is no real concentration of these changes in any particular part of the spine; joints on lumbar, thoracic and cervical vertebrae are similarly affected), some cervical vertebrae show erosions at the posterior-lateral disc margins and at their Luschka joints, the heads and articular parts of the tuberosities of 6L and 6R ribs, the facets for the R 1st rib and R clavicle on the manubrium, both acetabula (slight), both faces of the L and R acromio-clavicular joints, the medial joint surfaces of the claviculae, the tips of the coracoid processes of the scapulae, the superior angle of the L scapula (slight), the distal joint surface and both epicondyles of the L humerus, the medial epicondvle of the R humerus, both olecranon processes (at points of insertion of triceps tendons), L proximal ulna, both distal ulnae, proximal R radius, both distal radii and the site of insertion of pronator teres on L radius. The lower leg and foot bones are missing from this skeleton.
Changes in the L hand: 7 carpals are present (the pisiform is missing), all show erosive changes. The proximal joint surfaces of all metacarpals save the 1st show erosions, as do all the distal ends which are present for study (those of 1st, 2nd and 5th), and the distal end of the 2nd is completely destroyed. Only 1 phalanx (the proximal thumb phalanx) is present; it shows

osteolysis of its distal 1/2 and erosions of its proximal joint surface.

Changes in the R hand: 3 carpals (capitate, hamate and trapezium) are present and show erosions. The proximal joint surfaces of all metacarpals show erosive changes and that of the 3rd is completely destroyed. All the distal joint surfaces of the metacarpals are present save that of the 3rd and show erosions. The proximal phalanx of the thumb shows osteolysis of its distal half and a fragment of the distal end of another proximal phalanx shows erosive changes.

A fragment of 1 proximal phalanx of unknown side is present and shows destruction of its distal joint surface.

All hand bones are rather light and rarefied, with focal demineralisation of sub-chondral bone visible on X-ray in some places (e.g. beneath the distal joint surface of the R 5th metacarpal). X-ray also revealed that some erosions have sclerotic margins. In most cases destruction of joint surfaces was too far advanced for the precise location of the origin of erosions to be discerned, but in cases where the erosions were sufficiently small for this to be determined most seem to start at the joint margins but some clearly originate in the middle of the joint surface away from the margins. There is negligible proliferative bone around pathological joints and no vertebra showed osteophytes on its body. No bone showed periostitis. Thus this is an erosive arthropathy and enthesopathy affecting most joints in the skeleton in a bilaterally symmetrical way and osteolysis of the distal portions of both proximal thumb phalanges.
Several factors argue for a diagnosis of rheumatoid arthritis over that of a sero-negative spondylo-arthropathy: lack of proliferative new bone around affected joints, lack of periostitis, no osteophytes on vertebral bodies, fairly symmetrical distribution of lesions in the skeleton, erosion of posterio-lateral disc margins and Luschka joints of cervical vertebrae, the lesions in the hands, most marked at the metacarpo-phalangeal joints, and demineralisation of hand bones. Against this, however, spinal rheumatoid arthritis characteristically affects the cervical vertebrae and sacro-iliitis is only occasionally a feature (these criteria derived from Jensen & Steinbach 1977; McCarty 1989; Rogers et al. 1987).

T12 has lumbar-type facet joints.

There is green staining on the R ulna (1/4 of the way from the proximal end), and on 2 middle R ribs, towards the sternal ends.