8 The Human Bones *by David Henderson*

8.1 Materials and methods

A total of 113 *in situ* inhumations were recovered from the 1981 excavations. A further considerable quantity of unarticulated bone was also excavated, but with the exception of a small number of fragments recovered from within recognized grave-cuts (or immediately adjacent to the inhumations), this material was re-interred at the end of the excavation and was not available for study. During the excavation of the geotechnical trial-pits in 1977, the unarticulated bone was recovered and conserved, but it has proved impossible to relate the recorded stratigraphy of the test-pits to that of the 1981 excavation. Consequently, this earlier material has been treated as a single population.

The burials have been assigned, on the basis of site stratigraphy, into five clear phases of burial activity (described above). Due to the relatively small numbers of individuals recovered, and the uncertainty in assigning 21 skeletons securely to a single burial phase, it was decided that several burial phases would have to be amalgamated for the purposes of this report. The groupings used are Period 2a (Burial Phases 1 and 2, external cemetery, late 12th–13th centuries), Period 2b (Burial Phase 3, external cemetery, 14th century) and Period 3 (Burial Phases 4 and 5, within the South Choir Aisle of the church, late 14th century to Reformation).

8.1.1 Preservation

Of the *in situ* material, the preservation varied considerably. Only six skeletons were recorded as being of 'excellent' preservation (5.3%), a further 30 (26.5%) were 'good' and 11 (9.7%) 'terrible'. These descriptions are necessarily subjective, and it is likely that, as more bones were examined, the criteria for 'good' and 'fair' preservation changed, with the benefit of the doubt being given to skeletons whose preservation was relatively better than the usual. Over the entire site it would appear that the best preserved skeletons were those which had been buried outside the church (during Burial Phases 1, 2 and 3) and those with no evidence of a coffin, suggesting that the best conditions for bone preservation occurred when the products of decomposition were leached quickly away by rainwater draining through the soil of the graveyard.

There was a very low degree of completeness in the skeletons recovered. Apart from the different physical preservation conditions, the graveyard was used intensively between the 12th and 16th centuries, causing many graves to be intercut. In only two cases were bones missing from one skeleton recovered from the grave-fill of the inhumation which cut it, suggesting that no systematic attempt was made to preserve the integrity of disturbed skeletons. In addition to these factors, extensive building work on the kirk of St Giles' from the 14th century onwards caused further disturbance. In consequence, only 14 individuals (12%) presented near-complete skeletons for study, and in no single case was a complete set of standard measurements obtained. Half the skeletons (n = 56) lacked a skull.

8.1.2 Reconstruction

Each skeleton was laid out individually and the bones reconstructed to the greatest possible degree, although ribs were not reconstructed unless they displayed evidence of disease or trauma, and long-bones were only repaired if the articular ends were sufficiently intact to allow measurement of the greatest length. Crania were usually reconstructed as far as possible, unless it became apparent that earth-pressure had rendered them too distorted for accurate measurement, or they were in such small pieces as to make the reconstruction of doubtful accuracy.

Measurements were then taken of the bones, following methods described previously (Cross & Bruce 1989 mf 1, F13) with the exception of FEM MAP, FEM AP(MAX), FEM ML(MAX), TIB NFL, TIB AP(1/3), TIB ML(1/3) and, with the addition of Hum Bd (the bi-epicondylar width of the distal humerus, after Bass 1987), Rad MHD (the maximum diameter of the proximal radius), Rad DTD (the distal transverse diameter of the radius) and Tib Bd (the maximum breadth of the distal tibia). The cranial measurements were taken (following Brothwell 1981, 82–3), with the exception of DA, BQ' and C. Skeletal and cranial indices were calculated. A summary of all the metrical data is contained in the archive.

8.1.3 Age estimation

Where possible, age estimation was made using the teeth – the stage of eruption (after Schour & Massler, quoted in Hillson 1986, 188–94) for immature individuals, and attrition for adults (after Brothwell 1986, 72). The pubic symphysis face was also examined where available (in 20 of 81 adult skeletons) for ageing criteria. In the case of sub-adults for whom the teeth were unavailable, the state of epiphyseal fusion was used to age

Table 3 Sex distribution by period

Period	Male	Female	Unknown	Child
2a	23 (51%)	11 (24%)	1 (2%)	10 (22%)
2b	9 (27%)	8 (24%)		16 (49%)
3	11 (31%)	17 (49%)	1 (3%)	6 (17%)

Table 4 Age distribution of the *in situ* inhumations by period.

Immature	**Age category**						
Period	**PE**	**IN**	**CH**	**YJ**	**OJ**	**SA**	**Total**
2a	1	1	1	3	3	1	10
2b	0	2	2	8	4	0	16
3	1	1	2	1	1	0	6
Adults	**Age category**						
Period		**YA**	**MA**	**OA**	**AD**	**Total**	
2a	Male	7	4	5	7	23	
	Female	1	5	2	3	11	
2b	Male	3	0	4	2	9	
	Female	1	1	1	5	8	
3	Male	0	1	2	8	11	
	Female	6	3	3	5	17	

PE, perinatal; IN, infant; CH, child; YJ, young juvenile; OJ, old juvenile; SA, sub-adult; YA, young adult; MA, middle-aged; OA, old-aged, AD, adult.

the adolescents, and for the younger individuals age was estimated from the length of long-bone diaphyses. The data used for this estimate were a combination of figures used previously (Molleson & Cox 1993, figs 10.3 and 10.4) and diaphyseal lengths derived from sub-adults from the St Giles' sample whose age had been estimated from their dental development. Of the 81 *in situ* adult individuals, 30 (37%) could not be assigned to any age category. Although an attempt was made to place every adult into at least a 10-year age-band, for the purposes of this report only the categories YA (young adult), MA (middle-aged) and OA (old age) have been used. Sub-adult skeletons were placed in one of six categories: Perinatal (PE, birth +/– 2 months), Infant (IN, 2 months–2 years), Child (CH, 2–6 years), Young Juvenile (YJ, 6–12 years), Old Juvenile (OJ, 12–18 years) and Sub-adult (SA, 18–25 years) (following Cross & Bruce 1989, 121).

8.1.4 Sex estimation

Adult skeletons were sexed primarily on the basis of pelvic morphology. In two cases where the pelvis was lacking, skull morphology was used, and where neither skeletal area was present, an attempt was made to sex the skeleton using single-dimension measurements based on the securely sexed populations (see Stroud & Kemp 1993, 166 for discussion). It would appear that this method yields reasonably accurate results, as less than 10% of the securely sexed individuals would have been misattributed on the basis of one of the single-dimension measurements. Ultimately, only two adult individuals remained unassigned as to sex.

8.2 Demography

8.2.1 Number of individuals

The excavations recovered a total of 113 *in situ* inhumations (one of which, SK70, was present as a shadow only, and subsequently not recovered). A summary of the findings from each inhumation is recorded in Appendix A. Of the charnel assemblage from 1977, bones were fully examined and measured only where it was felt the most useful information could be extracted: the femora, tibiae and cranial bones (with dentitions). All other charnel bones were examined for pathological and traumatic lesions (including the small quantity of charnel retained from the 1981 excavations). The most common skeletal element from the charnel was the humerus, which yielded a minimum number of 30 adult individuals. A minimum of a further 12 immature individuals was represented by left femora. Comparisons of measurements from the two assemblages showed no significant difference, it can be assumed that the charnel derived from the same population.

8.2.2 Age and sex

Of the adult inhumations, 44 (55%) were male, 36 (45%) female and two could not be sexed. Thirty-one inhumations (27% of the total) were immature, ie individuals under 18 years of age at death. The sex distribution varied considerably over time (illus 27).

The preponderance of males in Period 2a, of children in Period 2b and of females in Period 3 (shown in Table 3) are statistically significant (χ^2 = 16.263, 4 df, $p < 0.005$, discounting the unsexed individuals). It is particularly striking that nearly half of the inhumations during the 14th century were of children. This may reflect a change of status of the area to the south of the church in the 14th century. There is some evidence that children were buried preferentially at sites dedicated to certain saints (particularly the Magdalene) in medieval Scotland (Lindsay 1989, m.f.1, B12; Henderson, in prep). The preponderance of females among the interments of Period 3 is almost entirely derived from a single row of six individuals at the western limit of the adult burials in these burial phases. This row contained no males, and it is perhaps significant that a one-year-old infant and a child of five or six years were also buried in this area. There is a distinct preponderance of males in Period 2a, a large number of whom (seven of 23, ie 30%; Table 4) had either leprosy or an injury that may have caused restricted movement.

Low numbers in each age category and the high proportion of non-aged adults preclude any reconstruction of age-at-death profiles for this site. For the 1977 charnel, analysis of all the items of bone which allow an estimate of sex (innominates, mastoid processes, frontals, occipitals and metrical analysis of long-bones as described above) all yielded an approximately 1:1 ratio of sexes. Age estimates for adult dentitions in the charnel assemblage (n = 38) showed 47.8% YA, 30.4% MA and 21.8% OA.

8.3 Population variability

8.3.1 Non-metric traits

A summary of prevalence of various common skeletal anomalies (following Brothwell 1989, 91–100) is contained in the archive. Of the anomalies noted systematically there, the following were of particular note.

SK23 had no proximal tibio-fibular articulations (the fibulae were bowed). In SK58 the tubercles of the 5th metatarsals had failed to ossify, bilaterally (see burial 5502 in Stroud & Kemp 1993, 195). SK107 had no articular surface on the pubic part of the right acetabulum (left; no data) but had a rough fossa instead. There is no effect on the femoral head, so the condition was probably asymptomatic. In SK115 the medial cuneiform was in two parts on the right (split transversely) and also in two parts, but incompletely separated, on the left (see burial 2175 in Stroud & Kemp 1993, 195). The 1977 charnel yielded a rib with a bifurcated body and a left distal humerus fragment with a supracondyloid process.

8.3.2 Body size and indices

Stature was estimated from the long bones of the inhumations using Trotter's figures (quoted in Bass 1985). Because of the incomplete nature of the skeletons, and of the bones which comprised them, heights were estimated from any leg-bones recovered, and the results averaged for that individual. The results were as shown in Table 5, with external and internal burial phases separated.

Table 5 Average estimated height in metres (Periods 2a and 2b amalgamated because of low numbers of adults in Burial Phase 3)

Period	Male	Female
Whole site	1.677	1. 559
Period 2	1.667	1.561
Period 3	1.710	1.556

Male height ranged from 1.80m (*c* 5ft 11in) to 1.55m (*c* 5ft 6in), with females ranging between 1.67m (*c* 5ft 5.5in) and 1.49m (*c* 4ft 10.5in). The average heights of the sexes are very close to those derived from a small medieval sample excavated at Holyrood Abbey in the neighbouring burgh of Canongate (Hazel 1998) so that people from Edinburgh appear to be slightly smaller than their contemporaries in medieval Britain. The females, especially, were shorter than the women from the Carmelite friary site in Aberdeen, for example (Cross & Bruce 1989, 126). The males are shorter than those from Linlithgow Friary (Cross & Bruce 1989, 126), although the tallest individuals at St Giles' were taller. At all periods the Edinburgh citizens were shorter than their exact contemporaries from Fishergate, York (Stroud & Kemp 1993), and other broadly contemporary sites in the north-east of England (Anderson 1994, 5).

The diaphyseal lengths of children's long-bones all indicated that they were shorter at a given age (where established by dental eruption stage) than the Maresh sample (quoted in Molleson & Cox 1993, fig 10.4) but were of comparable height with the Spitalfields sample (Molleson & Cox 1993).

Very few skulls from the *in situ* sample were complete enough to yield indices; however, with the addition of the cranial material from the 1977 charnel, sufficient indices could be calculated to show some differences between the sexes. It would appear that the males had a greater tendency to narrow foreheads and narrow nasal apertures, while the females had a slight bias towards skulls that were low compared to their breadth. Most males in the sample had narrow eyesockets, a trait also found in the sample from Holyrood (Hazel 1998), although there the small sample produced mostly

broad noses. In general, the crania were distributed fairly evenly through the various categories of skull shapes. Any changes over time are unfortunately masked by the majority of measurable skulls coming from unstratified deposits.

Of the 96 individual femora recovered, 83.3% were platymeric (80/96). This rate is comparable with the medieval sample from Whithorn (Cardy 1997, 523) but much greater than the rates in Aberdeen and Linlithgow, which are 64% and 69%, respectively (Cross & Bruce 1989, 127). The cnemic indices were obtained from 106 tibiae, of which 12 (11%) were platycnemic or hyperplatycnemic, 27 (26%) were mesocnemic and 67 (63%) were eurycnemic. There was no significant difference between the rates of these indices either between males and females or between Periods 2 and 3. These figures are similar to those from Aberdeen and Linlithgow but a greater proportion of the Whithorn tibiae were mesocnemic (45%). Platymeria and platycnemia (flattening of the bones of the leg) are more common among pre-industrial peoples than their present-day descendants, possibly as a result of a generally more vigorous lifestyle (Cross & Bruce 1989,129).

SK43, a Burial Phase 3 male of over 50 years old, showed some indication of obesity. The position of the skeleton in his grave (the arms bowed out from the torso and pushed hard against the sides of the grave-cut) may have been a result of a large girth. The individual was suffering from a mild or incipient form of Diffuse Idiopathic Skeletal Hyperostosis (DISH, or Forestier's disease; see below for discussion) It has been shown that DISH is often associated with late-onset diabetes, a disease of the overweight elderly (Roberts & Manchester 1995, 120).

8.4 Pathology (illus 27)

8.4.1 Trauma

Bones from 13 individuals from the inhumations (11.5%) displayed signs of trauma in the form of healed or healing fractures (Table 6).

Table 6 Numbers of fractures recorded

Parietal	3
Hand	3
Clavicle	1
Ribs	1
Humerus	1
Tibia	3
Radius	1
Fibula	4
Ulna	2
Foot	2

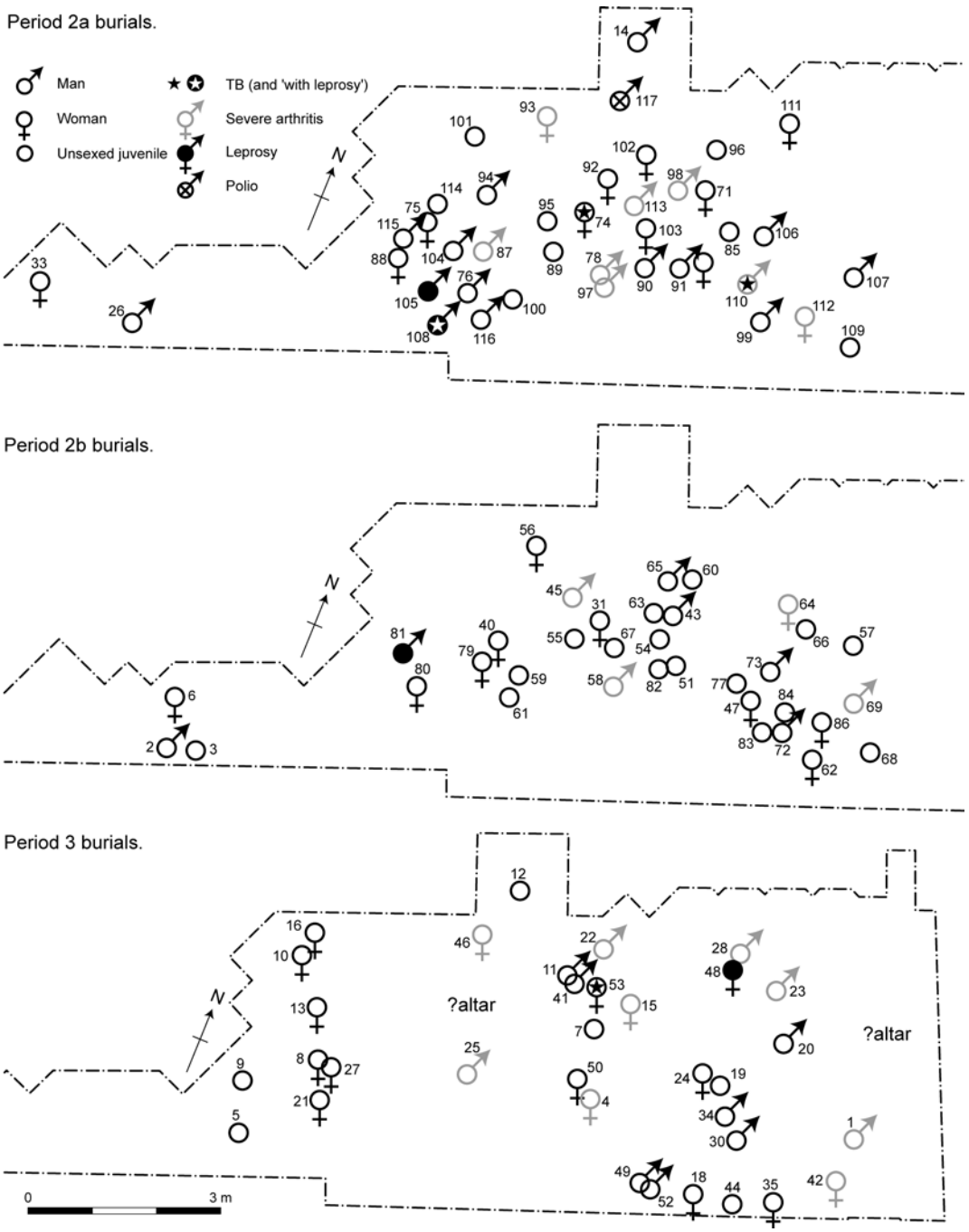
One individual (SK104) displayed an unreduced fracture of the right clavicle, as well as a fractured skull which may have been sustained in the same episode. This skeleton also had a scoliosis of the spine, but it is not certain that this was caused by an injury as the aetiology is not clear.

One of the ulna fractures came from the 1977 charnel, a fragment of left mid-shaft with the signs of an un-united healing break. The distal end was not recovered. In SK34, the left metacarpals 3 and 4 had been fractured. Small marks of adhesions showed that the hand had been bound too tightly, immobilizing it during healing, causing the fusion of the two metacarpals in a 'squeezed-together' position. SK72 seemed to have had the left little finger amputated, from halfway along the proximal phalanx. In SK99 an unreduced right tibial fracture was associated with a fracture of the fibula. Both bones were broken about two-thirds of the way down the shaft and the subsequent shortening had pulled the right toes into plantar flexion. The right tibia was 33mm shorter than the left and the incident had caused extensive arthritic changes to both legs, a consequence of the uneven gait which would have resulted. The broken feet were an unreduced fracture of a left 5th metatarsal (SK53) and a fracture of the distal end of a first proximal phalanx of the right foot from charnel.

8.4.2 Arthropathies

All joint surfaces were examined for signs of degeneration and disease; osteophytic lipping, sclerosis, porosity and eburnation were all noted where they occurred, but for the purposes of the following discussion, only those joints where the disease process was sufficiently advanced as to produce polishing (eburnation) of the sub-chondral bone are considered, in view of the generally poor bone preservation of the assemblage. A total of 36 individuals from the *in situ* inhumations displayed signs of arthritis in at least one joint (outwith the spine, which will be dealt with separately). Of these, 18 were male, 17 female and one unassigned to sex. The age distribution is shown in Table 7.

Primary osteoarthritis was never the cause of polished joint surfaces in the young adult individuals. In two cases (SK69, male; SK103, female) the lesions had probably been caused by the unusual stresses placed on the joints by a scoliosis of the spine. For SK81 the cartilage was probably destroyed by an infection secondary to leprosy. SK78 had ankylosing spondylitis. In the case of SK111, the individual had DISH, unusual in one so young, but both the dental and pubic symphysis indicators placed his age securely under 35 years. Almost every woman in the Old Age category had some evidence of osteoarthritis. There was one case each in the foot, the hand and the shoulder; two cases affecting the hips only; and in one case the hips, knees and the symphysial surface of the pubis were affected.



Illus 27 Plot of sex and pathology of excavated skeletons by period

No certain evidence of erosive arthropathies, such as rheumatoid arthritis or psoriatic arthritis, were observed but, in light of the generally poor state of preservation of many of the bones (especially the articular parts of the fingers and toes), post-mortem damage may perhaps have masked some cases. Table 8 shows the most frequently affected joints, expressed as a proportion of all joints of that type examined from the *in situ* inhumations. A joint was considered to be present if either of its surfaces was recovered; the knee was considered as two joints: the tibio–femoral and the patello–femoral.

All these figures are quite low compared to other medieval sites, even when less severe indications of joint degeneration are added into the figures. For example, where osteophytic lipping and pitting or sclerosis of the joint surface are added in the case of the knee joint, the percentage of affected knees rises to 7.02% on the left, which contrasts with between 9% and 16% of knees affected in the Fishergate sample (Stroud & Kemp 1993, table 46). It should also be noted that there was only one example of a severe lesion, where the polishing effect of bone on bone had led to grooving of the joint surface. This was at the distal end of a 1st metatarsal, where a sesamoid bone was involved.

Table 7 Individual skeletons with extra-spinal arthritis (percentage of total in age class in brackets)

Age category	Male	Female	Unknown
YA	5 (45%)	1 (12.5%)	0
MA	3 (60%)	4 (50%)	1 (100%)
OA	4 (36%)	6 (86%)	0
AD	6 (37%)	6 (43%)	0

Table 8 Joints most commonly affected by severe osteoarthritis (eburnation)

Joint	No. affected	Total examined	%
Hips (L + R)	17	60	28.33
Clavicle/acromion	5	45	11.11
Radius distal (R)	4	39	10.25
Ulna/Lunate (R)	3	30	10
Proximal humerus (L)	3	37	8.1
Clavicle/sternum	4	52	7.69
Lunate/triquetral (L)	2	28	7.14
Capitate/hamate (L)	2	33	6.6
Femur/patella (R)	3	49	6.17
Fibula/talus (R)	3	51	5.88
Proximal humerus (R)	2	35	5.7
Radius proximal (R)	2	35	5.7
Femur/patella (L)	3	56	5.35
Femur/tibia (R)	3	58	5.17
Radius distal (L)	2	40	5
MT 1 /Sesamoid (R)	2	43	4.65
MT/ Ph1 (L)	2	46	4.35
MT 1 /Sesamoid (L)	2	46	4.35
Hamate/triquetral (R)	1	25	4

Overall, the most commonly affected joints were the hip, the acromio-clavicular and the wrist, which broadly reflects the pattern seen from the medieval period to the modern day (Roberts & Manchester 1995, 114). The results for the hip joint were examined to test for differences in prevalence between male and female, but no significant difference was found.

8.4.3 Spinal degeneration

The gradual increase in the severity of degenerative changes displayed in the vertebral column appears to be an inevitable concomitant of increasing age in humans. A full analysis of degenerative changes to individual vertebrae is held in the site archive, showing percentage of joint surfaces examined which had degenerated to Sager's Grade 2 or 3 (Brothwell 1981, fig 6.9). The most commonly affected sites were the body surfaces between the 5th, 6th and 7th cervical, and between the 10th, 11th and 12th thoracic and the 3rd and 4th lumbar vertebrae. On the articular joints, the 4th/5th thoracic and 4th/5th lumbar vertebrae were most often affected; with the cervical spine and the 6th to 9th thoracic vertebrae very rarely involved.

Schmörl's nodes were common in the load-bearing parts of the spine, with up to a quarter of examined body surfaces between the 9th thoracic and the 2nd lumbar vertebra displaying this lesion.

8.4.4 DISH

In addition to this normal degeneration, several spines displayed specific pathology. Six individuals had signs of Diffuse Idiopathic Skeletal Hypertrophy (DISH). The classic symptoms are large flowing osteophytes (bony outgrowths) on the front right-hand side of the thoracic vertebrae fusing them together, and the ossification of muscle tendons where they are inserted into the bones. Although the disease is said to be present clinically only when four or more vertebrae are fused, the signs of 'incipient' DISH can often be recognized in archaeo-

logical material (Stroud & Kemp 1993, 213). One such example from St Giles' is SK34, an adult male, where enthesoses (tendon ossifications) were found at the calcaneus, patella, tibial tuberosity and sacro-illiac joints and there were extensive ossifications of the costal cartilages as well as large (though as yet unfused) osteophytes on the anterior surfaces of the vertebrae from 5th thoracic to 2nd lumbar. A similar case was SK43 (an old male) whose body position in the grave suggested obesity (see Section 3.2, above). SK4 (old female), SK71 (adult?female), SK76 (old male) and SK111 (young male) all displayed the standard signs of DISH.

8.4.5 Other spinal pathologies

Several individuals had a scoliosis or lateral distortion of the spine. In the case of SK48, this may have been a result of osteomalacia (adult rickets), and in SK104 it may possibly be the result of severe trauma, such as a fall, but in SK10, SK34, SK69, SK103 and SK110 there was no clear aetiology. SK27 showed a kyphosis (the spine is bent forward) at the 11th thoracic vertebra, as a result of vertebral body collapse due to Paget's disease.

In SK22 the 10th and 11th thoracic vertebrae were fused, probably as the result of a prolapsed disc. SK78 and SK39 showed signs of ankylosing spondylitis, in neither case severe.

Osteomyelitis

Apart from the specific infections (discussed below) three bones showed signs of osteomyelitis, a pyogenic infection of the bone and periosteum. Two of these were from charnel, a left fibula (distal one-third) and a shaft fragment of a right radius. It is possible that the fibula may have derived from an individual with syphilis. The left tibia of SK28 had a large swelling on the posterior part of the shaft, below the soleal line, which appeared to be a result of osteomyelitis (the roughened cortex of the bone and the position of the lesion would seem to preclude an alternative diagnosis of osteochondroma, although the affected area had no visible drainage sinuses.)

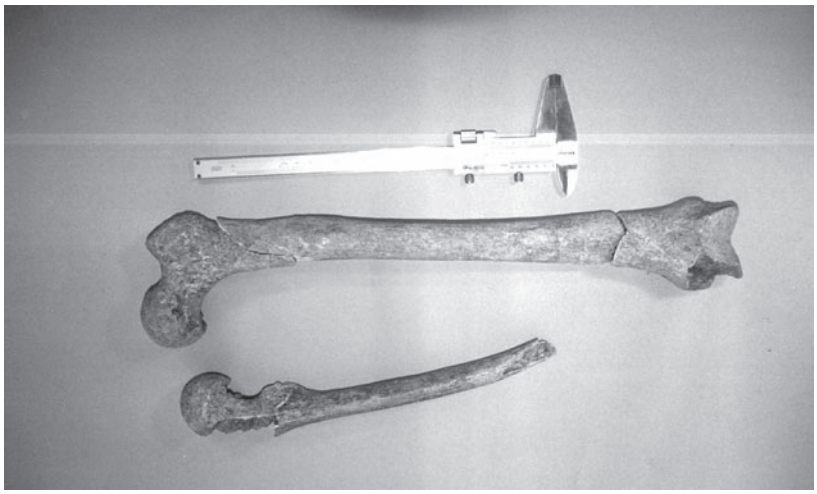
Syphilis

Evidence of syphilis was recorded in several individuals, the only securely dated specimen was of 16th century date. Bone changes associated with syphilis (usually manifest in the skull and the lower legs) occur in only about 10% of those infected (Roberts & Manchester 1995, 153) so it is possible that one or two of the other Burial Phase 4 & 5 individuals may have suffered from the disease. SK32, the legs and feet of an adult male, had the tibiae and fibulae grossly malformed by infection with *Treponema pallidum*, the infectious agent of syphilis. The right leg was particularly badly affected, with osteomyelitis tracked up to the end of the femur and down to involve some talar bones in the ankle. Unfortunately, preservation of the knee joints was very poor, so it is unknown if these were affected; syphilis in its final stages sometimes attacks and destroys joints. Two syphilitic individuals were recovered from the charnel. A skull of a 30- to 40-year-old man (St G77 II.1) with five radial scars (typical of healed caries sicca lesions) and some palatal and alveolar destruction; it also had erosion of the nasal bones and nasal aperture. A matching pair of tibiae (U(co) and U(cp)), probably from a woman, were also recovered, showing the 'sabre shin' deformity typical of the disease.

Tuberculosis

Several possible cases of tuberculosis were apparent in the population. The most certain in the very poorly preserved ribs and spine of an adult of unknown sex from Burial Phase 2 (SK74). The poor preservation, especially of the vertebral bodies, make this diagnosis tentative, but several features seem to favour a diagnosis of TB. There is a smooth-sided erosive lesion on the anterior aspect of the body of the 7th thoracic, and apparently on the 10th and 11th thoracic vertebrae also. While the bodies of the 12th thoracic and 1st lumbar vertebrae are unrecovered, the arches of these vertebrae are fused in a kyphosis; the individual must have been bent forward at the waist at a sharp angle.

In SK53, from Burial Phase 4, the poor preservation again prevents any certain diagnosis, but certain features are suggestive. The arches of the 4th and 5th lumbar vertebrae (once again the bodies are missing) show severe eburnation and pitting of the articular processes, while all the other lumbar and thoracic vertebral arches are completely normal, suggesting a very localized lesion at a site typical of TB. There are also extensive cystic lesions around the rims of the acetabulae and the heads of the femurs, which may be indicative of early signs of the erosive destruction of the hip joints, a symptom of tubercular infection, although without the spinal lesion simple osteoarthritis would be a more likely explanation. One other possible case is in SK108, which presents even more problems of diagnosis than the above cases. According to Roberts & Manchester, plaques of periosteal bone on the internal surfaces of the ribs may indicate pulmonary tuberculosis (Roberts & Manchester 1995,139). These lesions were found on the internal surface of all the ribs on the left side of this skeleton (except the first); however, the rest of the skeleton displays clear signs of leprosy. It is very rare to find the two diseases in a single individual (Roberts & Manchester 1995, 150) as the bacteria responsible for both diseases are very closely related, and a tubercular infection will confer a degree of immunity to leprosy. The converse is not true, however, and pulmonary



Illus 28 Evidence of poliomyelitis in SK117

TB was a common cause of death in 20th-century leper hospitals. None of the periosteal lesions on the ribs of SK108 displayed the oval foci described previously (Stroud & Kemp 1993, 222) as typical of pulmonary tuberculosis, and it may be that there is another aetiology for this finding, such as pleurisy.

Leprosy

Five individuals exhibited the symptoms of lepromatous leprosy. Four of these individuals were buried, during Burial Phases 1 & 2, in close proximity to one another at the western end of the excavated area; the other individual is from BP5. SK48, a middle-aged female and the sole post-15th century leper, displayed symptoms of a whole slew of diseases, trauma and other conditions. Her lepromatous symptoms include enlarged nutrient foramina and periostitis on the shafts of the metacarpals and proximal phalanges of the hands, with wasting and periostitis of the intermediate and distal phalanges of the hands and feet, florid periostitis of the fibulae (especially the left) and erosive lesions on the maxillae and at the lateral wall of the right orbit. SK17 displayed some periostitis and wasting of the bones in the hands and feet, the palate was paper thin and the inferior border of the piriform aperture was eroded. The maxilla on the right was very eroded with the loss of the incisors, the alveolar crest being reduced in this area to a sharp edge. SK81 was a male young adult, of which only the legs, left radius and hands were recovered. Every bone displays some periostitis except for the bones of the fingers. These, however, have enlarged nutrient foramina. SK105, the poorly preserved skeleton of a middle-aged female, displayed periostitis on bones of hands, forearms, feet and distal ends of tibiae, with some vascular grooving. Her facial bones were not recovered. The hands, forearms and shins of SK108, an old male, with possible tubercular lesions on the internal rib surfaces (see Section 4.8 above) all displayed periostitis; unfortunately, the feet and most of the facial bones were missing from this skeleton.

Poliomyelitis(?)

SK117 was an adult male with very poor preservation of the bone. The right femur and possibly the right humerus (only a small mid-shaft fragment was recovered) were considerably shorter and more gracile than their corresponding left-side bones (illus 28). Photographs of the burial *in situ* show the femora to be articulated. When reconstructed, the right femur head showed distortion. Although very similar in size to the left, the ball of the right femur pointed in a much more vertical and posterior direction (relative to the normal orientation of the shaft). The shaft itself was wasted, with a very slight linea aspera and other muscle scars. The presence of osteophytes round the head of the femur indicate that the limb must have borne some weight, even though an approximate calculation shows that the right leg was about 80mm shorter than the left, without taking account of any further discrepancies there may have been in the tibia (the lower legs were missing.) Although present in a very fragmented and decayed state, the vertebrae did not reveal any signs of disc degeneration, or lateral spondylarthrosis (at least fragments typical of every spinal level were recovered) and the site photograph shows no scoliosis; this is a remarkable finding in view of the considerable stress which must have been placed on the spinal column with the very uneven gait of this individual (probably requiring crutches or a built-up shoe). The skeleton lacked any parts suitable for establishing age. There are several possible aetiologies of the restricted growth in the right side of the body. In light of the apparent involvement of upper and lower limbs, perhaps the most likely is polio. Other possibilities are defective growth subsequent to a traumatic

birth or *in utero* trauma, or childhood spinal nerve trauma or disease.

Periostitis

Several of the skeletons were affected in one or more bones with periostitis, an inflammation of the periosteum (a fibrous membrane covering the surface of all bones, except at their articular surfaces). In 21 individuals there was no obvious cause for the periostitic reaction and, of these, 15 were affected in one or several of the bones of the lower leg. This is a common finding in medieval material, though no thoroughly convincing explanation has been put forward for its prevalence. Among the other cases noted were two women from BP4 with periostitis on the internal surface of the pelvis, which may have arisen from an adjacent gynaecological inflammation. A middle-aged woman, also from BP4, showed porosity and periostitis on the occipital bone, posterior to the foramen magnum, which probably arose from an overlying tissue infection. Another BP4 middle-aged woman had an area of periostitis on the right maxilla, secondary to periodontal disease at the roots of her incisors. It is possible that these lesions were a consequence of vitamin C deficiency (scurvy).

Where possible, the surface of the maxillary sinuses was inspected. In seven of the inhumations and in one of the maxillae from the charnel (out of 23 examined), changes were seen indicative of chronic sinusitis, probably related to pollution of the air by dust and smoke (Roberts & Lewis 1994). These figures are certainly a large underestimate of the incidence of sinusitis in the population, given that not all of the delicate sinus surfaces which did survive were available for examination.

Metabolic diseases

A number of skeletons and charnel bones showed evidence that the individual concerned had suffered from metabolic diseases or from vitamin deficiency. Ten individuals from the inhumations, and ten bones from the charnel, displayed bowing of the long bones of the limbs, typical of rickets (vitamin D deficiency). Two of these individuals were children (a five-year-old and a seven-year-old) who may well have been in the active phase of the disease when they died. The femora of the seven-year-old (SK57) were particularly distorted. Of the others, one individual, SK48, had a scoliosis of the spine at the 3rd and 4th lumbar vertebrae (see Section 4.3 above) and a distorted pelvis, with the symphysial faces of the pubes being apparently a considerable distance apart. This suggests that this individual was suffering from osteomalacia, the adult form of rickets.

Anaemia

Childhood and adult anaemias can sometimes affect the skeleton as iron-deficiency anaemia and may cause the blood-forming cells of the marrow to proliferate, causing changes in the bones, most unmistakably in the skull. Eight of the skulls from the inhumations (of 38 orbits examined 21%), displayed cribra orbitalia (porosity of the roof of the orbit associated with childhood anaemia). In one of these cases (SK114), the lesions were healing, even though the individual was around seven years old. Two further adult skulls, both male, had thickened frontal and parietal bones, with a porous surface texture. Both also had porosity of the palate, which may also be indicative of iron-deficiency anaemia occurring after maturity. Three bones from the charnel (one female, two male) also displayed cribra orbitalia (all inactive) and a further cranial fragment had a 'lumpy' and matted appearance over the parietal bones, possibly healed porotic hyperostosis. An alternative diagnosis would be an overlying scalp abscess.

Paget's disease

Four possible cases of Paget's disease were observed. Often the disease will cause no problems for the sufferer; in other cases, constant pain and spontaneous limb fractures occur. SK113 showed some symptoms, for example there was no medullary cavity at the midline of the jaw. SK14 may also have been in the early stages of the disease, he was of unknown age, but his femora and humeri were very heavy and slightly thickened and distorted. In SK27, an old female, the femora and the clavicle were thickened, and there was a kyphosis at the 11th lumbar vertebra, possibly as a consequence of the disease. SK56 was a young adult female, all the limb-bones recovered show thick, disorganized looking cortex but the diagnosis of Paget's disease is unlikely because of her age.

Osteoporosis

Osteoporosis is characterized by loss of bone volume, especially thinning of the bone cortex. It is a symptom of various conditions and can lead to fragile bones, prone to fracture. No fractures typical of the condition, such as of the wrist or the femur neck were found in the St Giles' assemblage and the microscopic structure of the trabecular bone of the limbs was not examined to search for micro-fractures. However, one right innominate from charnel showed extreme thinning of the ilium blade, with the loss of cancellous bone over a large area, leading to the bone being paper thin and in places actually perforated. This phenomenon was entirely erosive and showed no signs of inflammation. Osteoporosis seems the most likely cause. Several other

skeletons had noticeably light bones, but the variable preservation over the site makes any diagnosis of osteoporosis prohibitively tentative.

Neoplasms

Evidence of cancers (both benign and possibly malignant) was recovered from both the *in situ* inhumations and the charnel. Because of the relative rarity of neoplasms in the archaeological record it is worthwhile to list them all separately.

a. SK110 osteosarcoma. This was a disorganized spherical mass of cancellous bone, about the size of a cherry-stone, investing the frontal process of the left maxilla, just superior to the nasal-lachrymal groove. This mass in the corner of the eye would inevitably have caused some visual disturbance. A small (*c* 13 × 10mm) plaque of disorganized bone was also noted on the inner table of the frontal bone, which may be a metastasis from the main sarcoma (illus 29).
b. Charnel skull U(c) had one lenticulate button osteoma just to the right of lambda.
c. SK108 revealed a small odontome in the mesial wall of the right maxillary first incisor alveolus, where the bone was broken. The small oval mass (maximum dimension 4.6mm) appeared to be made of dentine only.

8.5 The teeth

8.5.1 Dental pathology

Dentitions or partial dentitions were recovered from 46 of the *in situ* inhumations (29 adult), and a further 45 dentitions (39 adult) were recovered from charnel. From these, rotated teeth were noted (Table 9).

Of the nine *in situ* individuals with rotated teeth, it is striking that, with only two exceptions, the individuals also displayed some sign of childhood stress or illness; four displayed symptoms of deficiency disease (rickets or cribra orbitalia), two showed multiple ossicles at the lambdoid suture (possibly linked to childhood stress; Cross & Bruce 1989, 124) and three (SK15, SK66 and SK109) displayed hypoplastic lines in the tooth enamel (discussed further in Section 8.5.2 below), indicating physiological stress before five or six years of age. Of all individuals displaying rickets or cribra orbitalia from whom the jaws were recovered, four of 15 (27%) had rotated teeth. Overall, nine of 46 dentitions (19%) displayed this trait. Bearing in mind the low numbers of cases, the coincidence of rotated pre-molars and the evidence of stress at age five or six, when the permanent pre-molar roots are just starting to grow, it is tentatively suggested that this tooth rotation may be related to physiological insult in a similar manner to enamel hypoplasia.

One lower right canine from 1977 charnel was double-rooted. In SK116 the lower left deciduous canine had been retained onto adulthood (although it was lost post-mortem) in addition to the full complement of adult teeth.

The most common tooth to be congenitally lacking was the third molar (M3). If there was any doubt, for example if the second molar had been lost ante-mortem, then the third molar was not counted as congenitally absent. One individual lacked all four M3s, one lacked all M3s except for the lower right, which was reduced to a small 'peg', three lacked both the upper M3s, two lacked both lower M3s, one lacked lower right and upper left, and one lacked lower right only. Other congenitally lacking teeth were in SK48 (lower left I1), SK109 (upper right

Table 9 Position of rotated teeth. L, left side; R, right side

Tooth	SK no
Lower I1	60(R), 73
Lower I2	11(R), 60(R),77(R)
Lower C	48(R),60(R),73(R),109(R), Charnel U(bp) and U(bu)
Lower P3	15(R),
Lower P4	15(R), 66(L), 73
Upper I2	60(L)
Upper C	60(R)
Upper P3	15(L), 109(R)
Upper P4	48(L)
Upper M2	115

Illus 29 Evidence of osteosarcoma in SK110

I2) and SK111 (upper left I2). In a charnel maxilla (Uae), the left second molar was of reduced, peg-like, size.

8.5.2 Childhood morbidity

If episodes of severe malnutrition or disease occur during childhood, the physiological insult may leave a permanent record on the teeth; any tooth developing at the time may show a hypoplastic line and the position of this line can be related to the known ages of tooth development (estimated from Massler's illustration, quoted in Hillson 1986, 135). For example, hypoplastic lines were evident in eight out of 11 dentitions from individuals with other skeletal evidence of childhood stress (cribra orbitalia or rickets). Within the *in situ* sample, severe hypoplastic lines were noted on 23 dentitions (of 46 recovered, 50%) but it was striking that in many cases the affected individual was a young adult, or younger. Nine of 15 (60%) young adult dentitions, and nine of 17 (53%) sub-adult dentitions, were affected with at least one strong hypoplastic line. In contrast, among adults over about 35 years at death, five of 14 (36%) were affected. It has been suggested (Stroud & Kemp 1995, 204) that the higher prevalence of dental hypoplasia in those who die younger is due to the long-term effects of the childhood stress, leading to 'sickly' individuals more likely to succumb to subsequent illness. It must be remembered, however, that abrasion and attrition of the teeth in older individuals may well remove the evidence of enamel hypoplasia, thereby skewing the apparent prevalence towards the younger individuals. In 13 cases the hypoplastic line suggests illness or malnutrition at about five or six years old, five other lines are at the 18- to 24-month age span and may be related to weaning. SK116 displayed three lines, corresponding to episodes of stress at six months, two years and ten years old (this individual died at between 25 and 35 years old). Ten other individuals showed at least two separate lines. Of the 23 individuals displaying enamel hypoplasia, four had suffered from rickets and six displayed cribra orbitalia, suggesting an episode of iron-deficiency anaemia. In SK82, a 12-year-old girl from BP3, the canine and incisor teeth showed a particularly marked hypoplastic line, corresponding to bodily stress at about 3.5 years of age. In this case the stress was severe enough to delay the formation of the pre-molar teeth (the crowns of which are beginning to form between three and four years old). Although her adult incisors and canines were in wear and her permanent second molars were through, she had retained her deciduous molars, which normally begin to drop out by the age of ten.

8.5.3 Dental disease

The molars were by far the most commonly affected teeth for both ante-mortem loss and caries. Indeed most of the incisors lost ante-mortem were as a consequence of leprosy rather than dental disease. Overall, the most common site for caries was the lower first molar, with 23% of surviving teeth affected. Of these caries cavities, 39% were at the distal side of the cervical/enamel junction. The incisors and canines were the teeth most often lost post-mortem (especially in the charnel sample, where by definition the bones had been moved around). This is the inevitable result of the single straight roots of these teeth making them easier to dislodge. A summary of the age-specific rates of ante-mortem loss and caries for the site is contained in the archive. The rate of caries increased between the external and internal burial phases. Taking the bias towards younger adults in the external cemetery into account, each tooth in BP4 and BP5 was nearly two-thirds more likely to develop a caries cavity. An analysis of the ratio of carious to sound teeth for only those individuals affected with caries shows that there was also a significant increase in severity of infection over the same time-span, ie if an individual in BP4 or BP5 had caries, they would be likely to be affected in a greater number of teeth. It is likely that the individuals buried underneath the kirk were of higher status than those buried outside and access to more refined food might account for the increase in caries. No significant difference was found between the caries rates for men and women and, as would be expected, there was a significant increase in caries rate and ante-mortem tooth loss with age. Nine individuals from the *in situ* collection and seven from the charnel had dental abscesses. Of particular note was SK106, where an apical abscess at the right upper M1 had peaked into the maxillary sinus and the subsequent sinus infection had peaked into the mouth. The skull of a very old woman recovered from 1977 charnel (Cranium 1) revealed a large abscess in the right maxilla, centred around the canine and pre-molars, which had peaked to the maxillary sinus and destroyed part of the palate. The missing area of bone was roughly ovoid and about 20mm in diameter at the tooth-row. From the 1977 charnel, skull StG 77 II.18 had retained the broken stump of the left upper second molar, possibly the result of a poorly executed extraction. Calculus was common, and often considerable, on all adult teeth. Many jaws showed periodontitis, the loss of bone from around the tooth sockets, which can result in tooth loss over time. From the charnel recovered in 1977, a maxilla (U(ac)) exhibited generalized maxillary alveolar hyperostosis. This takes the form of eight 'mushroom-shaped' compact bony masses on the buccal surface of the maxilla. Each is associated with an individual alveolus (right I2 to M2 and left I2 and C), each arises on a short stalk from just above the alveolar crest and appears, from the lines of calculus on the teeth, to have been completely invested in the gum tissue. The largest lesion (at the right canine) was 9.5mm long, the smallest

(at the left canine) was 3mm. This condition is a response of the body to the bone loss of periodontitis, an attempt to preserve the teeth.

8.5.4 Sub-adult dentitions

Of the 285 erupted teeth recovered from individuals under the age of 15 years, only seven were found to be carious (2.5%). In only one case did the lesion appear to be of normal aetiology (a distal interproximal caries cavity on the lower right M1 of a 14-year-old). SK57, seven years old, displayed gross caries of the occlusal surfaces of the lower left and right first permanent molars and interproximally at the right second deciduous molar. These lesions were secondary to severe enamel hypoplasia, from a disease episode at 18 to 20 months old. In SK68, two years old, caries lesions were observed at the lingual surfaces of the upper deciduous incisors, it is suggested that these may have been caused by the use of a dummy-tit (see Watson 1995, 244).

Other dental anomalies displayed in sub-adult skeletons include SK85, 15 years old, where all four permanent canines were deviated and unerupted, and SK114, seven years old, where the lower deciduous first molars had been lost and the alveoli remodelled, but there is no sign of the underlying permanent teeth. The delayed eruption of the pre-molars of SK82 is discussed in Section 8.5.2 (above).

8.6 Summary

The site at St Giles' yielded an absolute minimum of 155 individuals, 113 represented by *in situ* inhumations, and the rest by unarticulated charnel (Table 10). Over the entire period of the use of the site as a burial ground, the ratio of sexes was around 1:1, but women predominated in Period 3, men predominated in Period 2a and children predominated in Period 2b. It is speculated that the reasons for these inequalities relate to the religious dedication of this area of St Giles' in Periods 2b and 3, and to a designated area for marginal members of society in Period 2a. The individuals represented are on average quite short compared to their contemporaries in Scotland and north-east England but in other respects appear to be a typical medieval population, although with a low prevalence of osteoarthritis. Apart from a group of individuals buried in the western end of the site during the first two burial phases, who were distinguished by the severity of their pathological conditions, the population seems quite healthy. Three individuals were syphilitic (5% of Period 3 inhumations plus charnel), three may have been tubercular (2.6% of all inhumations) and five exhibited symptoms of leprosy (4%). A Period 2a adult male appeared to have contracted poliomyelitis, although poor preservation leaves the possibility of other diagnoses. Episodes of malnutrition were apparent in a number of individuals. Nine of the inhumations had suffered rickets in childhood, one individual had osteomalacia, a symptom of vitamin D deficiency in adulthood. Examination of the eye-sockets revealed that 21% of the population had suffered childhood anaemia. Other episodes of stress in childhood were revealed in hypoplastic lines in the tooth enamel, with 50% of the dentitions from *in situ* inhumations displaying this trait. Dental disease, especially caries cavities and lost teeth, became more common and more severe in Period 3, possibly reflecting a higher social status (and access to more refined food) in those individuals buried under the floor of the kirk, as opposed to the surrounding graveyard in earlier burial phases.

One individual, in particular, had suffered extreme and continuous bad luck. SK48, a middle-aged female from BP5, suffered childhood anaemia, followed by osteomalacia leading to a deformed spine, pelvis and legs, the stress of which occasioned osteoarthritis of the knees. Also, in adulthood, she contracted leprosy (a lesion from which in her left orbit may have led to loss of sight in that eye) and her teeth were badly affected with cavities and abcesses. At some point she sustained fractures to her sixth to ninth ribs on the left side, which were still in the process of healing when she finally died.

Table 10 Catalogue of recovered skeletons, giving estimated age, sex, estimated height and major pathology (for age categories, see Section 1.3). R, right; L, left

Skeleton no	Sex	Age	Height (m)	Pathology	Trauma	Other
1	M	OA	1.70			
2	M	OA	1.62			
3		CH				
4	F	MA/ OA	1.58	Periostitis on basioccipital	?Fracture of (R) parietal	
5		IN				
6	?F	AD				
7		PE				
8	F	MA	1.54	Rickets		
9		CH				
10	?F	YA				Slight scoliosis
11	F	YA	1.54	Periostitis at pubis		
12		OJ				
13	F	AD	1.60		Rotator cuff ensethopathy	
14	M	AD		?Early Paget's disease		
15	F	OA	1.62	Rickets		
16	F	YA	1.53			
17	F	MA	1.55	Leprosy		
18	F	YA	1.64			
19		OJ				
20	M	AD	1.69			
21	F	YA	1.50	Rickets		
22	?	MA		T10 and T 11 fused (secondary to spondylolysis)		
23	M	AD	1.80			Proximal tibio-fibular joint absent
24	F	YA	1.57			
25	M	AD	1.64			
26	M	YA		Cribra orbitalia		
27	F	OA	1.58		Rotator cuff ensethopathy	Kyphosis at T11
28	M	AD	1.66	Osteomyelitis (L) tibia		
29		OJ				
30	M	MA	1.73			(L) Femur hyperplatymeric
31	M	AD	1.61	Rickets		
32	M	AD		Syphilis		
33	F	AD				
34	M	AD	1.67	DISH	Fracture, (L) metacarpals 3 & 4	
35	F	?YA	1.50			
39	F	AD			Trimaleolar fracture (L) tibia	
40	F	AD	1.51			
41	M	OA	1.77			
42	?F	AD	1.60			? Hammer toes
43	M	OA	1.69	Incipient DISH		

Table 10 (*cont.*) Catalogue of recovered skeletons, giving estimated age, sex, estimated height and major pathology (for age categories, see Section 1.3). R, right; L, left

Skeleton no	Sex	Age	Height (m)	Pathology	Trauma	Other
44		CH		Rickets		
45	M	YA	1.55			Chronic sinusitis
46	F	OA		Rickets		
47	F	AD	1.49			
48	F	MA	1.55	Leprosy, osteomalaccia, cribra orbitalia	Fractured (L) ribs 6–9	Scoliosis (secondary to bowed tibia)
49	M	AD	1.75			
50	F	AD	1.57	Rickets		
51		IN				
52	M	AD				
53	F	AD	1.52	Possible TB	Fractured (L) MT V	
54		YJ				
55		YJ		Cribra orbitalia		
56	F	YA		Paget's disease		
57		YJ		Rickets		
58	M	AD	1.59			MT V tuberosities unfused
59		CH				
60		OJ				
61		YJ				
62	F	OA	1.54			
63		OJ				
64	F	AD	1.55			
65	M	OA	1.61			
66		OJ				
67		IN				
68		IN				
69	M	YA	1.64			Scoliosis at lumbar spine
71	F	OA	1.67	DISH	Fractured (L) index finger	
72	M	OA	1.71		Rotator cuff ensethopathy, (R) little finger amputated	
73	M	YA	~1.65		Rotator cuff ensethopathy	
74	?	AD		Probable TB		Kyphosis at T12/L1 (?Sequelae of TB)
75	F	AD	1.61			L5 sacralised
76	M	OA	1.65	DISH		
77		YJ		Cribra orbitalia and frontal porosity		
78	M	YA	1.65	Ankylosing spondylitis	? Healed fracture (R) parietal	
79	F	AD	1.56		Healed fractures (L) radius, (L) fibula	
80	F	AD	1.58			
81	M	YA	1.71	Leprosy		
82		OJ		Cribra orbitalia		Anomalous tooth eruption

Table 10 (*cont.*) Catalogue of recovered skeletons, giving estimated age, sex, estimated height and major pathology (for age categories, see Section 1.3). R, right; L, left

Skeleton no	Sex	Age	Height (m)	Pathology	Trauma	Other
83		YJ				
84		YJ				
85		OJ	1.67	Spina bifida occulta		Canines deviated, unerupted
86	F	MA	1.53			
87	M	AD	1.72			(R) leg shorter than (L)
88	M	AD	1.71			Little toes ankylosed
89		YJ				
90	M	SA	1.72			
91	M	AD	1.65			
92	F	MA	1.61			
93	F	MA				
94	M	OA	1.68	Porosity of frontal	Healed fracture (L) ulna	
95		PE				
96		CH				
97	M	OA	1.68	?Rickets		
98	M	MA	1.71			
99	M	AD	1.64		Unreduced fracture (R) tibia and fibula	(R) foot fixed in plantar flexion
100		YJ				
101		YJ				
102	F	MA	1.61			
103	F	YA	1.54			Scoliosis and fusion at T 4/5
104	M	YA	1.64	Cribra orbitalia	Fractures (R) parietal and clavicle	Severe scoliosis
105	F	MA	1.55	Leprosy		
106	M	MA	1.72			Dental abscess infecting (R) maxillary sinus, peaking to buccal
107	M	AD	1.74			No articular surfaces on pubic part of acetabulum
108	M	OA	1.71	Leprosy and TB		Odontome
109		OJ		Cribra orbitalia		
110	M	MA	1.62	Osteosarcoma, corner of (R) eye		Scoliosis
111	M	YA	1.59	DISH		
112	F	OA	1.56			
113	M	MA	1.64		Sternum deviated	
114		YJ		Cribra orbitalia, sinusitis		Lower deciduous m1s shed, no permament replacements
115	M	OA	1.80			Medial cuneiforms in two parts
116	M	YA				
117	M	AD	~1.66	Probable poliomyelitis		

next section