THE HUMAN REMAINS AT CARLISLE CATHEDRAL *by* CEILIDH LERWICK and JO BUCKBERRY

INTRODUCTION *by* MIKE MCCARTHY

The excavations revealed human remains covering the post-Roman to post-medieval periods. Initially, all were retained pending detailed osteological examination. However, after the bones had been despatched to a specialist in 1989 it became apparent that the priorities of the then Dean and Chapter and the archaeologists differed with regard to the human remains. Discussions resulted in the return of the bones, most being reburied, albeit without archaeological supervision. The remainder were retained and are the subject of this report.

The original assemblage, prior to reburial, comprised the remains of at least 75 individuals. They ranged from articulated skeletons in handmade-brick-lined graves, some with traces of wood and coffin fittings, to disarticulated bones. In attributing skeletons to site phases, the primary consideration was based on stratigraphic relationships but, in some cases, the nature of the grave itself provided direction.

Illus. 30. A jumble of at least four burials is present here.

For example, the use of coffin plates and brick-linings clearly indicates a late post-medieval date, but the repeated use of the site for interments, coupled with the demolition of the western bays of the nave in the seventeenth century, resulted in considerable disturbance to the underlying stratigraphy. Grave cuts could not always be distinguished, and the possibility of grave contamination through the accidental incorporation of bones or other objects in the soil was very high. Not surprisingly, most of the more complete and articulated skeletons tended to be nineteenth century in date, with the obvious corollary that the least complete burials were the earliest. However, even the pre-twelfth-century graves were not immune to disturbance. The radiocarbon dates discussed by Batt serve to remind us (p. 000) that there was a history of burial on this site extending for over five hundred years before the Augustinian priory was built in the twelfth century.

Table11 below contains details of those graves attributed to pre-priory phases of activity on the grounds of the stratigraphic relationships recorded at the time of excavation. However, whilst stratigraphy is widely regarded as being an excellent indicator of relative date, in ancient churchyards such apparent relationships are not necessarily reliable guides for the date of any one burial or collection of bones for reasons noted above. Some 63% of the graves were poorly defined or not defined at all, and in three cases (Sk 27, Sk 28 and Sk 32), the radiocarbon dates in the fifteenth to seventeenth centuries suggest that contamination may have taken place (Batt, p.000).

Table 11. Details of possible pre-priory graves
(* = C14 dates indicate late medieval date)

Skeleton No.	*Grave*	*Grave details*	*Skeleton details*
1	48	Well defined	Supine, adult; lower torso and lower limbs
20/21	133, 135	An arc of stones at head end	Two burials in same grave. Sk 20 (earlier), supine, adult; hands over pelvis covered by a disartic skull deliberately placed. Sk 21, on right side tightly packed into grave, adult. Both disturbed
22	138	Well defined	Supine, infant; head turned to right, hands over pelvis. Most of skeleton present.
23	140	Well defined. North side defined by cobbles, sandstone fragments	Supine, infant; right torso, pelvis, lower limbs, disturbed

Skeleton No.	*Grave*	*Grave details*	*Skeleton details*
24	119	Same grave as Sk 27	Much disturbed – mostly disarticulated
25	151	Little survived	Adult, heavily disturbed, skull, cervical vertebrae, scapula
26	148	Well defined	Supine, adult; torso, skull, femora, hands over pelvis
27*	119	Stones arranged around head and sandstone slabs on top of Sk 27. Same grave as Sk 24. Had been coffined.	Sk 27 – Supine, adult; skull turned to left, hands by sides. Upper and lower limbs present. Most of torso absent, disturbed
28*	125	Well defined, deposit of dark stained sand in area of torso	Supine, adult; head half turned to right, hands over pelvis
29	158	Not clear	Supine, adult; most of left side only, disturbed
30	154	Not clear	Supine, infant; most survived above knees, disturbed
31	127	Well defined, possibly coffined	Supine, adult; lower torso and left side and both lower limbs, disturbed
32*	160	Not clear	Probably supine, infant, torso only, disturbed
33	162	Not clear	Heavily disturbed
34	156	Poorly defined	Adult; left hand by side. Most of right side missing, disturbed
35	166	Poorly defined	Supine, adult, disturbed
36	168	Poorly defined, but deep	Supine, adult; lower limbs, pelvis, disturbed.
37		Same grave and Sk 45	
38	153	Well defined	Supine, adult; upper left body only
39	164	Poorly defined	Probably supine, heavily disturbed
40	123	Undefined	Supine, child; lower limbs only
41	175	Poorly defined	Probably supine, adult; upper body intact, lower body disturbed
42	173	Not clear	Supine, adult; skull and upper torso, lower body disturbed
43	179	Poorly defined	Supine, fairly complete upper body, lower body disturbed
44	188	Poorly defined	Supine, torso only, disturbed
45	153	Poorly defined, same grave and Sk as 37	Supine, adult; near complete, hands over pelvis, head turned to right. A disarticulated skull on chest
47	190	Poorly defined	Supine, adult; torso only
48	222	Poorly defined	Supine, adult; left pelvis and lower limbs; disturbed
49	224	Poorly defined	Supine, heavily disturbed, lower limbs only
50	322	Poorly defined	Supine, adult; lower limbs only
51	242	Poorly defined	Supine, infant; part torso, heavily disturbed

Skeleton No.	*Grave*	*Grave details*	*Skeleton details*
52	244	Poorly defined	Supine, infant; most survived
53	246	Poorly defined	Supine, adult; left lower limbs and skull only, disturbed
54	251	Poorly defined	Supine, adult, disturbed; right upper limb over chest, left hand over pelvis
55	253	Poorly defined	Supine, adult, disturbed – skeleton part removed
56	255	Well defined	Supine, adult; fairly complete, hands on pelvis, left foot crossed over right foot
59	232	Deeply dug into Roman	Supine, adult, heavily disturbed, lower body only
63	269	Poorly defined	Supine, adult, disturbed; left side only
64	240	Definition fair	Supine, adult; fairly complete; upper limbs crossed over abdomen
65	271	Poorly defined	Femora only – heavily disturbed
H1		Well defined, stone-lined and capped. Possible coffin or chest	Supine; hands on pelvis, disturbed
H11		Sandstone-slab lined	Very disturbed

METHODS AND PRESERVATION

Detailed descriptions of the skeletons studied, together with metric data tables on cranial measurements and traits, are excluded from this report but details are available and can be accessed via the Biological Anthropology Research Centre (BARC) at the University of Bradford (www.barc.brad.ac.uk).

The remains of 18 skeletons were submitted for analysis. These were analysed following the BABAO/IFA guidelines (Brickley and McKinley 2004). Skeletal preservation ranges from good (most cortical bone intact) to poor (little cortical bone intact), the majority being good to excellent (66.6%). Skeletal completeness was low within the sample, with 11 (61.1%) individuals less than 25% complete. The highest count of any specific bone or osteological structure was used to establish a minimum number of individuals (MNI); the bones found most frequently were the tibiae, and the left parietal (n=8) suggesting a minimum number of individuals of eight. The MNI of eight reflects the low levels of completeness in the sample.

SEX ASSESSMENT

Sex assessment was undertaken for all adults using the criteria outlined in Buikstra and Ubelaker (1994) and Bass (2005) paying particular attention to the features of the pubic bone (Phenice 1969), which are generally agreed to be the most diagnostic. Sex assessment was not undertaken for the sub-adult remains as the available methods are generally regarded as being inaccurate (Brickley and McKinley 2004). Table 12 sets out the data.

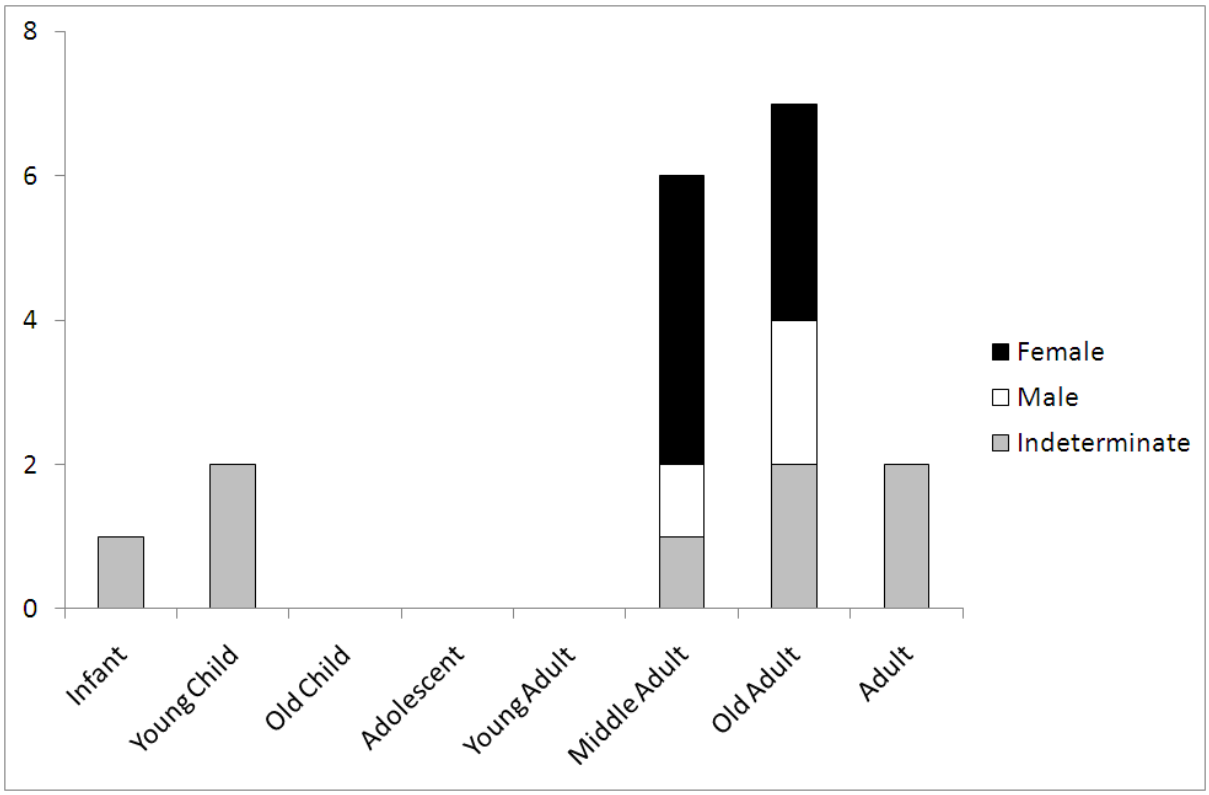
Table 12. Skeletons with age and sex determinations
(M=male; F=female; U=inconclusive; ?=probable)

Skeleton	*Sex*	*Age*
1	U	46+
7	M	36-45
13	U	46+
16	U	neonate
25	F	46+
27	F	36-45
28	U	36-45
32	U	young child
42	U	adult?
44	F?	46+
52	M	Adult
53	F?	36-45
54	M	46+
56	M	46+
57	F	26-35
59	F?	26-35
64	F?	46+
unnumbered	U	young child

In a conventional population male to female ratios are expected to normalise at 1:1. The Carlisle population included seven females, including four probable females, and four males, with a sex ratio of 1:0.57. Based on a Chi^2 test there is a 96.25% probability that this sample is biased. The sample is too small to estimate whether the bias was due to sex-related zoning within the cemetery, as seen at Riccall Landing in north Yorkshire (Buckberry and Storm 2007), and St. Mark's church, Lincoln (Buckberry 2007) or whether too small a sample of the cemetery has been investigated. There are four adults who could not be sexed and it is possible the imbalance would be rendered null if the sex of these individuals could be determined.

AGE ESTIMATION

Sub-adult age was estimated using diaphyseal lengths (Maresh 1970) and epiphyseal fusion (Scheuer and Black 2000). No sub-adult dentitions were recovered. Adult age was estimated using late fusing epiphyses (Scheuer and Black 2000), the pubic symphysis (Brooks and Suchey 1990), auricular surface (Lovejoy et al. 1985; Buckberry and Chamberlain 2002), sternal rib ends (İşcan et al. 1989a; 1989b), dental wear (Brothwell 1963), and ectocranial suture closure (Meindl and Lovejoy 1985). In general, sub-adult ageing methods tend to be consistent and accurate, with relatively low levels of individual variation. This enables narrow age estimates to be provided for most individuals, but accuracy of an individual estimate will be less precise for very incomplete or fragmentary remains. Adult age ranges, on the other hand, tend to be very wide and it is often best to consider if individuals were young, middle or older adults based on levels of skeletal development and degeneration. As the Carlisle assemblage was rather fragmented, for the purposes of this report each individual has been grouped into age categories (Table 13). This should also allow for the individuals to be compared to other sites with similar age categories.



Illus. 31. The demographic profile

All of the individuals from Carlisle could be aged, although two individuals could only be aged as far as the determination of adulthood. Three individuals were sub-adults and fifteen were adults as shown by Illustration 21. A normal population curve shows a high number of deaths in infants and the elderly (Larsen 1999; Paine 1989). There are fewer neonates and 4-8 year olds than would be expected; however, children's bones do not tend to preserve taphonomically as well as their adult counterparts (Larsen 1999, 338; Djuric et al. 2011). Small graves may be destroyed by later grave-digging and small bones that survive are often prone to be missed during excavation. Thus, any deviations from a normal cemetery population curve are probably due to the nature of the sample rather than the age structure of the population from which they derived.

Table 13. Age distribution of individuals analysed

Age	*Approximate age range*	*No. of individuals*
Neonate	Birth to one month	1
infant	1-12 months	0
Young child	1-3	2
Middle child	4-8	0
Older child	9-12	0
Adolescent	13-17	0
Young adult	18-25	0
Young middle adult	26-35	2
Old middle adult	36-45	4
Mature	Over 46	7
Adult	Over 18 years	2

STATURE

Stature was estimated using the formulae developed by Trotter and Gleser, as modified by Trotter (1970). Where possible, lower limb bones were used to calculate stature, as error levels for upper limb bones are much higher. However, the fragmentary nature of the Carlisle skeletons produced individuals with lower limbs either unsuitable for stature calculations or missing altogether. Thus, to gain stature estimations for as many individuals as possible, both lower and upper limbs were used. Individual stature has been given in Table 14. The mean stature for males (including probable males) was 171.8 cm (67.5 in). The mean stature for females (including probable females) was 160.6 cm (63.2 in).

Table 14. Stature by individual

Skeleton	*Sex*	*Bone used*	*Stature (cm)*
27	F	right femur	167.8 ± 3.27
52	M?	left humerus	161.04 ± 4.57
53	F?	left femur	153.9 ± 3.72
54	M	right tibia	181.4 ± 4.00
56	M	left femur	172.0 ± 3.94
64	F?	right femur	160.0 ± 3.72

Inter-site comparison (Table 15) suggests that both males and females from Carlisle are of similar stature to contemporary individuals from North Yorkshire. It must be noted; however, that the small sample size from Carlisle makes statistical testing invalid and renders it difficult to place any significance on these results.

Table 15. Inter-site comparison of stature in the Anglo-Scandinavian period

Site	*Male*			*Female*		
	Mean	*Range*	*N*	*Mean*	*Range*	*N*
Carlisle Cathedral	171.8	161.0-181.4	3	160.6	153.9-167.8	3
Riccall Landing, N Yorks	174.1	166.4-183.6	9	159.6	151.2-165.8	8
Dixon Keld, Masham, N Yorks	169.4	161.4-178.7	16	161.9	148.4-169.0	8

POPULATION VARIATION AND AFFINITY

Standard anthropological cranial and post-cranial measurements (Buikstra and Ubelaker 1994) were taken from all individuals from Carlisle. Cranial measurements were only taken from intact areas of the adult crania, as reconstruction can introduce error. Cranial measurements were taken from three males, three females and one indeterminate individual. Post-cranial measurements were available from three males, five females and one indeterminate individual.

Cranial and post-cranial indices were calculated to give an indication of the shape of the crania, tibiae and femora, using the equations and ranges given in Bass (2005) and Brothwell (1972), but only three females and one indeterminate individual produced measurements that were suitable for calculating cranial indices. Details of the measurements

and indices for Carlisle are given in the BARC report. The cranial index values for Masham ranged from 73.4 (indeterminate; dolicocranic) to 81.9 (female; brachycranic), with a mean of 79 (mesocranic). The values for females were compared with measurements from the Anglo-Scandinavian populations from Masham (Neale and Buckberry 2008) and Riccall (Buckberry and Storm 2007) and the medieval population from Norton Priory (Boylston 2008; Table 16).

Neither Riccall nor Masham had comparable cranial indices; the mean cranial index for Carlisle was mesocranic, or medium headed, and those from Riccall and Dixon Keld were dolichocranic, or long headed. The usefulness of such comparisons may be limited by the low numbers of indices available (3 for both Carlisle and Riccall, 2 for Masham), or due to the wide date range for the few Carlisle skeletons with radiocarbon dates (see Batt, p 000) – brachycranic crania are more common in medieval populations.

Table 16. Inter-site comparison of cranial indices in the Anglo-Scandinavian period

Site	*Females*			
	Mean	*Value*	*Range*	*N*
Carlisle Cathedral	79	Mesocrany	78-81.9	3
Riccall Landing, N.Yorks	74.3	Dolichocrany	71.4-77.2	3
Dixon Keld, Masham, N Yorks	66.9	Dolichocrany	66.1-67.7	2
Norton Priory, Cheshire	82.5	Brachycrany	75-91	5

Two post-cranial indices were calculated for the Carlisle population. The platymeric index assesses the degree of antero-posterior flattening of the femur. The platycnemic assesses the level of medio-lateral flattening of the tibia. These adaptations in shape are probably due to mechanical adaptations and are often found to vary between past populations (Brothwell 1972). The platymeric index varies from both the Riccall Landing and the Masham populations; however, the platycnemic values for Carlisle are more closely comparable (Table 17).

Table 17. Inter-site comparison of platycnemic index

Site	*Males*			*Females*		
	Mean	*Value*	*N*	*Mean*	*Value*	*N*
Carlisle Cathedral	67.6	Platycnemic	2	80.8	Eurycnemic	4
Riccall Landing, N Yorks	73.2	Eurycnemic	7	75	Eurycnemic	8
Dixon Keld, Masham, N. Yorks	74.3	Eurycnemic	11	70.5	Eurycnemic	9

Cranial and post-cranial non-metric traits were recorded for the Carlisle population using the diagrams supplied by Berry and Berry (1967) and Finnegan (1978) respectively. Frequencies are given in the BARC report.

PALAEOPATHOLOGY

All individuals were examined macroscopically for evidence of pathology. Prevalence rates were calculated as a percentage of the total population of eighteen individuals (called the crude prevalence rate, or CPR) and as a true prevalence rate (TPR). The TPR is calculated using the total number of observable elements, and in the case of dental disease, the total number of teeth (or tooth sockets) that could be observed.

Four maxillae and five mandibles from a total of five individuals were available for analysis of dental pathology. A total of 81 teeth were analysed for evidence of caries, calculus and enamel hypoplasia. In addition, 133 tooth sockets were examined for evidence of ante-mortem tooth loss, abscesses and granulomas. Dental caries were recorded using the system outlined by Moore and Corbett (1971). Four of the individuals had carious lesions, a crude prevalence rate (CPR) of 22.2%. A total of eighteen teeth were affected, giving a true prevalence rate (TPR) also of 22.2%. Most of the carious lesions at Carlisle were large (11.1%), and while slightly more were located inter-proximally (6.2%), they were found across the dentition fairly evenly, apart from the cervical junction which exhibited a prevalence rate of zero.

Five of the 18 individuals with teeth present had calculus, giving a CPR of 27.8%. However, 35 of the 81 extant teeth were affected, giving a TPR of 43.2%. Most of the calculus was on the buccal, lingual, mesial and distal surfaces of the teeth. None was

observed on the occlusal surfaces. Three teeth (all in the same individual – Sk 25) exhibited root calculus.

Dental enamel hypoplasia (DEH) is caused by the cessation of enamel materialization during tooth development and appears as a groove or pit defect in the tooth enamel. It is caused by severe stress, illness or malnutrition (King et al. 2005; Hillson 1996: 165-167). DEH was recorded as grooves, lines or pits on the tooth (Lukacs 1989). Two individuals had enamel hypoplasia (CPR 11.1%). This was observed on seven teeth (TPR 8.6%). Five of the teeth displayed pits and two exhibited grooves.

Abscesses and granulomas both result in holes in the alveolar bone, but represent very different pathological processes. Abscesses are infections in the jaw, and are observable in skeletal material after the infection has burst through the alveolar bone allowing pus to drain. The margins of the lesions are usually rounded, due to the continued drainage of pus over time (Hillson 2005, 295-319; Hillson 1996, 284-87; Ogden 2008). Granulomas are small, rounded areas of soft tissue deposited at the apex of tooth roots as a reaction to breakdown products leaking from a dead tooth. The lesions observable in skeletal material are sharp-edged and therefore can be easily distinguished from abscesses (ibid.). Of the five individuals with available alveoli from Carlisle, only two exhibited abscesses with a total number of six sockets affected (CPR 11.1%, TPR 4.5%). Three granulomata were present, again in two individuals (CPR 11.1%, TPR 2.3%).

Ante-mortem tooth loss usually occurs following carious infection or extreme wear, and is often more prevalent in older individuals. It can be clearly distinguished from post-mortem tooth loss as, in life, the tooth socket in the alveolar bone fills in and remodels following the loss of the tooth. Ante-mortem tooth loss was present in five individuals, giving a CPR of 27.7%. This amounted to the loss of 27 teeth out of the 133 extant crypts, giving a TPR of 20.3%. Periodontal disease was observed in six individuals (CPR 33.3%). This affected 105 sockets, giving a TPR of 78.9%.

The only metabolic condition present at Carlisle was cribra orbitalia, a term used to describe small perforations in the orbital roof. Although the exact aetiology of cribra orbitalia is unknown, debates involve dyserythropoietic, normocytic and macrocytic anaemias and Vitamin B12 deficiency (Walker et al 2009; Oxenham and Cavill 2010). Two adults had mild healed cribra orbitalia (CPR 11.1%, TPR 50%).

Only one congenital abnormality was present in the Carlisle population and that was the incorrect development of the L5-S1 vertebrae. The development of the spine essentially involves serial replication. The differences in the vertebrae rely on the body's ability to

retrogressively differentiate as each element forms (Mahato 2010). This differentiation is not always successful, resulting in extra vertebrae, or in vertebrae of one form taking the shape of another. In archaeological populations, the fifth lumbar taking on the characteristics of the first sacral vertebra (lumbar sacralisation) or the first sacral taking on the characteristics of the fifth lumbar is not uncommon, with crude prevalence rates of 0.6 to 14.3% recorded for the early medieval period (Roberts and Cox 2003, 180). At Carlisle, two individuals exhibited this form of differentiation failure. Sk 56 exhibited a lumbarised S1 and Sk 54 exhibited an S1 that appeared lumbarised; however, Sk 54 possessed only four lumbar vertebrae and it is possible that this was a sacralised L5. Both were adult males.

Only one form of non-specific infection was evident. Two individuals exhibited bone proliferation in the sinus cavities of the cranium, indicative of sinusitis. Sk 25 exhibited such symptoms in the maxillary sinuses and Sk 7 exhibited these symptoms in both the maxillary and the frontal sinuses (CPR 11.1%, TPR 50%). No evidence of tuberculosis, leprosy or treponemal disease was observed at Carlisle.

The individuals in the Carlisle assemblage presented no fractures or major trauma. Degenerative joint disease is common in archaeological populations, and the prevalence rates usually increase with age. Joint diseases were diagnosed using the criteria outlined by Rogers and Waldron (1995). Spinal joint diseases were divided into those affecting the vertebral bodies and the apophyseal joints. The apophyseal joints are synovial articulations and therefore can be affected by osteoarthritis; for these joints osteophytes, porosity and eburnation were recorded. The changes seen in intervertebral osteochondrosis – osteophytes and porosity of the vertebral bodies – are caused by degeneration of the intervertebral discs and are visible on the vertebral bodies. Schmorl's nodes are small depressions in the superior and inferior surfaces of the vertebral body, and are caused by prolapse of the nucleus pulposus of the intervertebral disc (Rogers & Waldron 1995, 27). These were recorded on a presence/absence basis for the Carlisle population. Evidence of spinal joint disease is summarised in Table 18, below. Degeneration of the intervertebral disk was quite high, whereas joint disease of the apophyseal joints was moderately low, apart from osteophytes which were seen on most apophyseal joints. Schmorl's nodes were seen in 23.3% of thoracic and 100% of lumber vertebrae. Comparisons of degenerative joint disease of the apophyseal joints in males and females are given in the BARC report.

Table 18. Summary of spinal joint disease at Carlisle

Type	*Pathology*	*Apophyseal joints*		*Vertebral bodies*	
		N	*%*	*N*	*%*
Cervical	Osteophytes	15/27	55.6	10/10	100
	Porosity	3/25	12	10/10	100
	Eburnation	0	0	–	–
Thoracic	Osteophytes	180/235	76.6	57/61	93.4
	Porosity	53/226	23.5	50/53	94.3
	Eburnation	2/226	0.9	–	–
	Schmorl's Nodes	–	–	10/43	23.3
Lumbar	Osteophytes	53/57	93	6/6	100

Osteoarthritis was observed in the proximal articular surface of the left metatarsal of Sk 13 – this was evidenced by severe porosity and osteophytic growth. In addition three individuals displayed osteoarthritis of the temporo-mandibular joint – in each case changes were seen just anterior to the glenoid fossae of the temporal bones (Rando and Waldron 2012).

DISCUSSION

With only eighteen individuals, the Carlisle assemblage was not large enough for detailed statistical analysis. However, the population would appear to be a normal lay population, with both males and females and individuals of all ages present. With regard to health, the assemblage represented a relatively healthy population with little infection or disease outside of those expected with the onset of age (degenerative joint disease), and the not unexpected problems of limited dental care. The variation in cranial indices may indicate that the society at Carlisle was biologically diverse.

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ILLUSTRATIONS

The following illustrations are included as representative examples from the phase 4 and the later cemetery.

Illus. 32. Skeleton 21 (Skeleton 20 removed)

Illus. 33. Skeleton 28

Illus. 34. Skeletons 41-43 at the eastern end of the trench

Illus. 35. Skeleton 64 in a slab-lined grave

Illus. 36. Skeleton 2 in a brick-lined grave. A name-plate rests on the abdominal cavity

Illus. 37. Skeleton 3 in brick-lined grave with collapsed remains of coffin and a name plate