ASWB10

ALL SAINTS WAY, WEST BROMWICH, SANDWELL, WEST MIDLANDS

Volume 2
The Osteological Analysis

for Stoford All Saints Limited
Sandwell Metropolitan Borough Council

DC/O8/50124

April 2012

HEADLAND ARCHAEOLOGY Ltd

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1. INTRODUCTION

Headland Archaeology undertook the excavation, processing and analysis of the human remains from the Baptist cemetery of the former Providence Chapel, Sandwell Road, West Bromwich. The excavation took place in May to June 2011 with a total of 148 burials being uncovered. These skeletons were assessed *in situ* by an osteologist and 41 skeletons were considered well enough preserved to warrant further analysis. A very small amount of disarticulated material was present due to later disturbance of the site; a service pipe run, burial of a steel petrol storage tank and later demolishing of buildings are all likely to have disturbed burials. Processing took place in September and analysis was undertaken in October 2011.

The burial ground lay to the east of the church and was in use from 1810 to at least 1859 (see Volume 1). The northern corner of the cemetery was not excavated however this was a relatively small area; therefore the majority of the burials were uncovered. The Providence Chapel was not the only chapel in West Bromwich with Wood's 1837 map of the parish recording 19 chapels in total (1837, cited in Chitham 2009).

During the period the Chapel was in use West Bromwich was an urban industrial town with large iron and coal mining industries, as well as the largest gas works in Britain. The total population was 7,485 in the 1811 census, with 1,086 families in trade and 216 in agriculture, and by 1851 the population had grown to 34,591 (Chitham 2009, p.97,118). Lewis' *Topographical Dictionary* of 1831 describes the town as follows:

> *'From little more than a barren heath, a populous and flourishing town has arisen. It extends for more than three miles along the high road from Birmingham to Holyhead, and, exclusively of the numerous dwellings of the people employed in the various works and manufactories, and the respectable houses of the persons who superintended them, contains many handsome private residences' (cited in Chitham, 2009, p.104).*

However in 1838 Osborne in his *Guide to the Grand Junction, or Birmingham, Liverpool and Manchester Railway* (1838) has portrayed a rather unhealthy environment within West Bromwich:

> *'They are extremely rough and uncultivated, and although they get a good deal of money, yet they spend it on eating and drinking, instead of improving their condition even physically… the place is extremely black and dirty, and the people in general, are as dirty as the place, being also, a rough, course, uneducated and violent set of men, daring and reckless, but steady and ingenious in their own business' (Osborne, 1838 cited in Chitham, 2009).*

The majority of burials excavated were in wooden coffins placed into earth–cut graves. There were four individuals in coffins placed within brick–lined vaults, one of which was double–coffined (SK3469). A further individual was buried within an iron mort–safe; its purpose being to prevent 'resurrection men' from snatching the body. Due to the higher expense incurred for such burials, these five individuals are likely to have been of a higher socio–economic status than individuals in earth–cut graves, possibly family members of those 'superintendants' mentioned by Chitham. There were 25 stack burials of two or three individuals, likely indicating family groups/plots and two infant double burials were present.

2. RESEARCH AIMS & OBJECTIVES

Following assessment of the assemblage, it was considered that further analysis of suitably preserved skeletons could provide an insight into the lives of a small religious community covering a relatively short period of time. Several research aims were proposed:

- documentary evidence consists of contradictory statements about the life, health and the environment of the West Bromwich population during the 19th century and osteological examination may highlight which of these two descriptions this assemblage best accords with, if at all,

- is the apparent status of the brick–lined and mort–safe graves reflected in the lifestyle, health or diet of the individuals buried in them?

- can any differences in sex and age be determined in regards to occupation, lifestyle, diet or health? This will have to take into account the relatively small sample size and the levels of preservation of skeletons which might limit the identification of age and sex,

- how does the assemblage as a whole compare against other populations? There are several large skeletal assemblages from contemporaneous sites and such comparison will give us a better understanding of the relative health and lifestyle of this community.

Table 1 lists the comparative sites referred to in the subsequent text. The majority are large assemblages from urban industrial areas, like West Bromwich in the 19th century, but represent populations of differing levels of socio–economic status. Comparative osteological analysis will provide evidence for similarities or differences in child mortality and longevity between populations, as well as injury, diseases, nutrition, general morbidity and lifestyle. Not all sites will have comparable data for specific pathologies, therefore different sites are discussed so as to provide a broad insight into the West Bromwich population.

The research aims were addressed through skeletal analysis in order to ascertain:

- preservation levels of the skeletal remains,

- the minimum number of individuals present,

- age at death – within broad age categories listed in Table 2,

- an assessment of biological sex,

- adult stature estimations,

- metric and non–metric variation,

- presence and frequency of skeletal and dental pathology present.

Site	Date	Type	No. of skeletons	Reference
St Martin's Church, Birmingham	19th	Urban industrial: working & middle class	505	Brickley *et al.* 2006
St Marylebone, London	18th–19th	Urban industrial: wealthy population	301	Miles *et al.* 2008; MOLAS Centre for Human Bioarchaeology
St Brides Lower, London	Late 18th–19th	Urban industrial: low status	544	MOLAS Centre for Human Bioarchaeology
Cross Bones, Redcross Way, London	19th	Urban industrial: Paupers' Cemetery	147	Brickley & Miles 1999; MOLAS Center for Human Bioarchaeology
Christchurch, Spitalfields Crypt, London	18th–19th	Urban industrial: wealthy population	968	Molleson & Cox 1993

Table 1

List of comparative sites

Category	Abbreviations	Age
Non–adult	Non–AD	<18 years
Foetus	f	3rd foetal month – 40 weeks in utero
Infant	I	Birth – 1 year
Younger child	yC	1 – 6 years
Older child	oC	7 – 12 years
Adolescent	aO	13 – 17 years
Adult	aD	18+ years
Younger adults	y AD	18 – 25 years
Younger–middle adults	y–M AD	25 – 35 years
Older–middle adults	o–M AD	35 – 45 years
Older adults	o AD	45+ years

Table 2

Age categories

3. METHODOLODGY

All 148 inhumations were recorded, but only 128 had skeletal remains present; these were assessed *in situ* noting preservation and where possible age, sex and any pathology. Twenty coffins were empty; from the size of the coffins it was evident that 10 contained non–adult remains and 10 adult or adolescent individuals. Of the total population 41 individuals were considered well enough preserved to be analysed in detail (see preservation section); pathology could not be noted on those not retained for analysis due to their prevalent poor preservation.

The skeletal material was analysed macroscopically and recording was in accordance with the standards recommended by the British Association for Biological Anthropology and Osteoarchaeology (BABAO) in conjunction with the Institute of Field Archaeologists (Brickley & McKinley 2004) as well as English Heritage guidance (2004).

Surface preservation was recorded using the grading system of McKinley (2004) where 0 indicates no modification to bone and 5+ has extensive penetrating erosion resulting in modification of the bone profile. The degree of fragmentation was recorded using the categories 'low', 'moderate' or 'high' and completeness was expressed as a percentage either <25% complete, 25–50%, 51–75% or >75%.

Sex was determined using standard osteological techniques; several morphological differences in the skull and pelvis, as well as the overall size of bones, are considered when estimating sex of an individual (Mays & Cox 2000). Sex was not determined for non–adults as it can only be ascertained once secondary sexual characteristics have developed during late puberty and early adulthood.

The presence and preservation of the pelvis is vital for the estimation of adult age allowing different stages of bone morphology and degeneration to be identified at the pubic symphysis (Suchey–Brooks 1990) and/or the auricular surface (Lovejoy *et al.* 1985). Estimation of age is based on as many criteria as possible; sternal rib morphology (Iscan 1984/5) and dental attrition were also considered (Brothwell 1981). The latter technique was not used as a sole criterion for estimating the age of an individual due to its unreliability, especially in post–medieval assemblages, probably as a result of changes in the diet compared to earlier periods (Walker *et al.* 1991, Brickley *et al.* 2006). Denta attrition exhibited a tendency to underage within this assemblage. It should be remembered that adult skeletal age–at–death represents physiological age rather than actual chronological age. Several studies (*eg* Molleson & Cox, 1993, Miles *et al.* 2008) have shown that age–at–death estimations from the skeleton frequently underestimated age for older adults.

In non–adults consideration of primary and secondary ossification centres (Scheuer & Black 2000a, 2000b), dental formation and eruption timings (Ubelaker, 1989) as well as long bone length (Fazekas & Kosa 1987, Maresh 1970) were used to calculate age.

The stature of an individual can only be estimated if at least one complete and fully fused long bone is present and sex is known. The bone is measured using an osteometric board, and stature is then calculated using Trotter's regression formulae (1970). Of the complete bones of a skeleton, the bone which gives the most accurate stature estimation was used in individual calculations *eg* the femur or the tibia, or a combination of both these bones having the lowest standard deviation. Standard metrical data was recorded, where preservation allowed, following the guidelines of Buikstra and Ubelaker (1994) for infants and Brothwell and Zakrzewski (2004) for adults. *Meric* and *cnemic* indices, as well as the cranial facial indices were calculated for adults (Bass 2005). Non–metrical information was obtained from the observation of 19 cranial and 13 post–cranial traits from the adult population only (Brothwell & Zakrzewski 2004, Finnegan 1978).

All pathological manifestations were described in detail (Roberts & Cornnell 2004) and where possible a diagnosis was stated. The crude prevalence rate (CPR), per individuals present, has been stated for multi–regional pathologies and also to allow comparison with other assemblages which have been recorded using the CPR. The true prevalence rate (TPR), which is the rate per bone, bone segment or joint surface present, has been given where possible. It should be remembered that the TPR rates for small assemblages are still only approximate indicators of the true rate of each disease.

4. OSTEOLOGICAL ANALYSIS

The estimation of both age and sex are crucial for understanding the mortality pattern indicating the overall success of the adaptation of a population to its surrounding environment as well as how groups of people within the population differed in respect to occupation, lifestyle, diet and morbidity. Stature, metrical dimensions and non–metrical traits can suggest hereditary affiliation, as well as environmental and mechanical activity and stress.

A summary catalogue of all skeletons excavated (N=148) with on–site assessment results are provided in Appendix 1, and data for the analysed sample (N=41) is present in Appendix 2.

4.1 PRESERVATION

Preservation has a large impact on the quality and quantity of information that can be obtained from skeletal remains. A number of factors can influence skeletal preservation; intrinsic factors include age, sex and pathological status of an individual, (*eg* fragile infant or less dense older adult osteoporotic bone will deteriorate comparably faster) and extrinsic factors include type of burial, materials used, surrounding soils and post–depositional disturbance.

The assessment of the 148 *in situ* inhumations illustrated that preservation was considerably varied across the site. Some individuals were >75% complete with good surface preservation and minimal fragmentation of bones, whereas most were less well preserved, and 20 graves had no bone surviving at all. A few individuals had remnants of soft tissue adhering to the cranium and upper neck regions, and/or intracranial neural tissue present. Several individuals, adults and non–adults, had hair present on the cranium or in the case of one male individual on his mandible indicating he had a beard. The majority of hair was present in the form of small tufts with the exception of one female individual (SK3486) who had a large proportion of her hair present in the style of a bun. The majority of hair observed was of a brown–blonde colour, however the appearance may have been altered by chemicals formed during decomposition as well as the burial environment.

The majority of skeletons were poorly preserved exhibiting soft fragmented or completely disintegrated bone. There was a lack of truncated burials illustrating that the cemetery was not used as intensively as others of this date *eg* St Marylebone. The poor preservation was likely due to the highly permeable sand in which they were interred which allowed frequent changes in the burial environment – alternation between water saturation and dehydration makes bone brittle. The frequent destruction of bone underlying coffin furnishings, especially breast plates, illustrated that these also had a part to play in poor preservation. Overall 62% of burials had evidence for a coffin plate with more adults having coffin plates than non–adults likely resulting in poorer preservation (Table 3). Coffin plate burials were not confined to a specific group of individuals in the population, with coffin plates present in burials of both sexes and all age categories, with the exception of foetus burials (3 individuals). The distribution of burials within the cemetery was also mixed, with no separation by age, sex or status and therefore no bias in preservation of a specific group of individuals.

	Coffin plate	Total no.	%
Non–AD	36	68	53%
Males	21	25	84%
Females	21	25	84%
Adults (un–sexed)	13	30	43.3%
Total	91	148	62%

Table 3

Individuals with coffin plates present

The completeness of burials varied considerably within the 148 inhumations (Table 4). However most bone surfaces were unobservable with 71.0% of those with skeletal remains present either exhibiting poor preservation (grade 4+, Fig. 1) or no surviving remains, and 58.8% of those with remains exhibiting high fragmentation (Table 5). The 87 burials with poor surface preservation and/or high fragmentation had limited potential for revealing further information at the analysis stage. The 41 skeletons analysed are all over 25% complete with the vast majority being >75% complete. Furthermore, 80% (33/41) of the bones in this group displayed good to moderate surface preservation (grade 1–3) and all skeletons exhibited a low to moderate degree of fragmentation. Eight skeletons did have poorly preserved surfaces at grade 4, where all bone surfaces were affected by some form of erosive action but the general profile of the bone was

Fragmentation	Assessed		Analysed	
	N	%	N	%
Low	22	14.9	22	53.7
Mod	19	12.8	19	47.5
High	87	58.8	0	–
Empty	20	13.5	0	–
Total	148	–	41	–

Table 4

Completeness of articulated skeletons

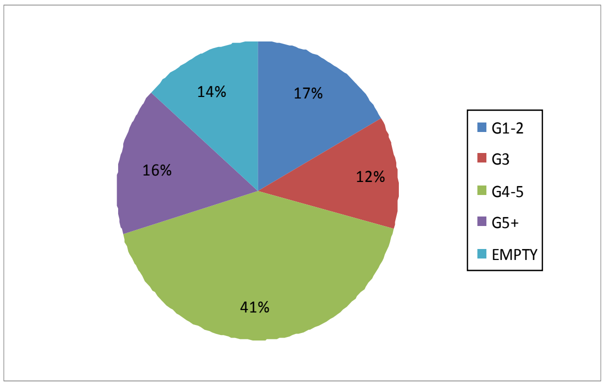

Figure 1

Surface preservation of all skeletons

Completeness (%)	Assessed		Analysed	
	N	%	N	%
>75	43	29.1	30	73.2
51–75	25	25.0	6	14.6
25–50	22	14.9	5	12.2
<25	38	25.7	0	–
Empty	20	13.5	0	–
Total	148	–	41	–

Table 5

Fragmentation of skeletons

maintained. However all of these skeletons were over 51% complete with moderate fragmentation, except the mortsafe individual (25–50%) who was retained due to the special nature of the burial and the pathology observed on this individual.

4.2 MINIMUM NUMBER OF INDIVIDUALS

The MNI for the small amount of disarticulated material uncovered was three adult individuals and one non–adult (Table 6) who were probably disturbed by later works on the site. The overall MNI is calculated by counting and siding all the articulated and disarticulated bone elements without taking archaeologically defined graves into account and the most common element represents the MNI. The most common bone part in the adult population was the left proximal femoral epiphysis (joint surface) and for non–adults was the right ilium. The MNI for adults is 48 individuals and for non–adults is 27. The MNI represents the absolute minimum number of individuals present and in reality will be lower than the actual number of skeletons present; one hundred and forty eight defined inhumations were excavated on site (20 without skeletal remains).

Bone	Part	Side	Age	Sex
Femur	Prox shaft + JS	L	AD	–
Femur	Prox shaft + JS	L	AD	–
Femur	Shaft x6 frags	–	–	–
Femur	Prox + mid shaft	L	AD/AO?	–
Ethmoid	Frags x2	–	–	–
Pubis	Body no symphysis	R	–	M
Rib	Frag x1	–	Non–AD	–
Tooth	Maxillary PM4	L	AD	–
Cranium	Parietal frags x3	–	AD	–
MNI	4	–	–	–

Table 6

Disarticulated remains

4.3 ASSESSMENT OF SEX

Among the assessed adult assemblage with skeletal remains present (N=70) sex could be assessed for 50 individuals leaving 29% that could not be sexed. Twenty five males including three likely males, and twenty five females including one likely female were present. The near equal ratio of 1.04:1 is similar to that expected within any population (1.06:1, Rousham & Humphrey 2002, p.128). All 21 adults retained for analysis could be sexed and represent twelve females and nine males.

4.4 ASSESSMENT OF AGE

In the total assessed sample with skeletal remains present (N=128), non–adults compromised 58 skeletons and adults 70. Of those retained for analysis 20 are non–adults and 21 adults. The analysed sample is therefore slightly biased towards the selection of non–adults as they were slightly better preserved than adults on site (possibly due to coffin plates, see above). The data for the total assessed sample will therefore provide a better indication of the age distribution within the burial population. However due to poor preservation 51% of the assemblage (65 individuals) could not be put within a specific age category including 32.8% (19/58) of non–adults aged 1–17 years and 65.7% (46/70) of adults aged over 18 years; this age distribution may therefore not accurately reflect the buried population. The higher percentage of un–aged adults is likely due to the reliance on the presence of the pelvis for age estimation however non–adults can be aged by the observation of developments across the skeleton (see above).

Figure 2 shows the distribution of non–adult ages within the 58 assessed skeletons.

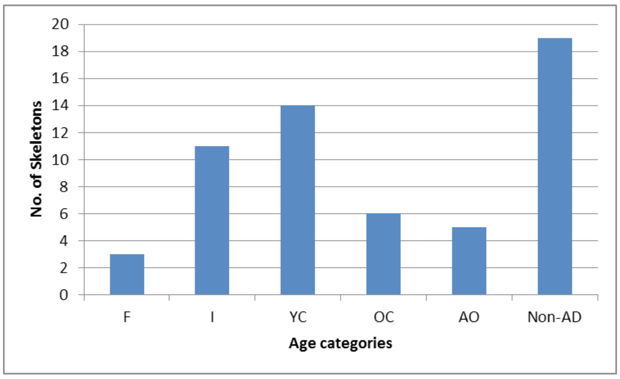

Figure 2

Non–adult age distribution

The proportion of non–adults in this West Bromwich population (45.3%) is only slightly below that which might be expected from documentary evidence. The London Bills of Mortality suggest around 50% of the population died before the age of 20 years between the early eighteen and mid nineteenth centuries (Roberts & Cox 2003, p.304). Table 7 shows that the West Bromwich percentage of non–adults is relatively high compared to the majority of other contemporaneous urban sites with the exception of the paupers cemetery at Cross Bones burial ground, London.

Site	No. non–adults	%
St Martin's	153	30.3%
St Marylebone	78	25.9%
St Brides	175	32.2%
Cross Bones	104	70.7%
Spitalfields	215	22.2%

Table 7

Comparative non–adult mortality

A peak in child mortality is present in the 1–6 year–old age group (YC), which consists of 35.9% of the non–adult population who could be aged. All of these younger children, with the exception of one, were approximately three years of age and under. Epidemic disease would have had the greatest impact on the youngest individuals and it is generally considered that once over the age of 5 years, that average life expectancy of an individual would be greatly increased, a fact that is borne out by both demographic and archaeological data (Kausmally 2004, Roberts & Cox 2003). Of the foetal individuals two were 36–40 weeks *in utero* and one of 30–32 weeks *in utero* and therefore at the later stages of development and near the time of birth, a time of high riSKfor both mother and child. The 7.7% proportion of foetuses is relatively low compared to sites of this period except St Martin's (5.9%), more infants may have been successfully delivered.

The 8.6% of adolescents in the assemblage is low compared with 20% expected from archaeological populations (Lewis 2007, p.86). The higher percentages of adolescence in urban archaeological populations is concluded to be due to large numbers of people in their early teens moving from the countryside to industrial cities or towns during the post–medieval period who were vulnerable to new diseases and frequently died not long after arriving (Roberts & Cox 2003, p.294). The population of West Bromwich did increase dramatically from the early to mid–19th century and therefore such migration must have taken place, however their sparcity within this community may be due to the nature of the social group drawn into the Baptist congregations and young adult immigrants are likely to be represented to a greater extent in the general Church of England cemeteries.

Table 8 shows the distribution of adult age and sex in the assessed adults. There is a general increase in the number of adults with increasing age–at–death, which is to be expected. The figures indicate that females and males had different life expectancies as females tended to die younger between the ages of 18–35 years, or to live longer than males beyond the age of 45. The majority of males however have an age of death between 35–45 years. The perils of childbirth may reflect the higher number of females dying at a young adult age as the average age women married was 21 years of age in the mid–18th century (Lane 2001, p.34). It must be remembered the 61.5% of males and 41.7% of females could not be aged and therefore this is a tentative interpretation, however this is a pattern seen within other large assemblages of this period *eg* St Marylebone and St Martin's.

Three adults and one child were buried within brick vaults. SK3378 and SK3469 were buried within the same vault, the former was on top and was a 50–59 year old female and the latter an adult male. A further two vaults adjacent to each other, included SK3479 a male adult and SK3483 a younger child of 1.5–3 years old. The

Age category	M (%)	F (%)	Unsexed (%)	Total (%)
Y AD	0	4 (16.7%)	0	4 (5.7%)
Y–M AD	2 (7.7%)	3 (12.5%)	0	5 (7.1%)
O–M AD	5 (19.2%)	2 (8.3%)	0	7 (10%)
O AD	2 (7.7%)	6 (25%)	0	8 (11.4%)
AD	16 (61.5%)	10 (41.7%)	20 (100%)	46 (65.7%)
Total	**26**	**24**	**20**	**70**

Table 8

Adult age and sex distribution assessed skeletons

individual in the mortsafe was a 17–25 year old female. Individuals of both sexes and widely varying ages are represented within the 'higher status' burials.

The 20 non–adult skeletons retained for analysis had a distribution of three foetuses, three infant, seven younger children, four older children and three adolescents. The 21 adult individuals consisted of two adults (>18 years), two young adults, four younger–middle adults, six older–middle adults and seven older adult.

4.5 METRIC ANALYSIS

The Stature of an adult depends upon genetical inheritance as well as nutritional factors and has been used as an indicator of population health. Stature could be estimated for 25 of the 70 adult individuals with skeletal remains including 15 males and 10 females measured either *in situ* or on analysis.

Sex	Mean	SD	Range	
			Min	Max
Male	168.9	4.6	160.9	176.2
Female	158.8	4.6	152.9	166.9

Table 9

Adult stature

SD = standard deviation

The mean stature of males at West Bromwich falls within the range of means given for post–medieval sites (168–174cm) by Roberts and Cox (2003, p.308) and is only slightly below the height of the majority of the comparative assemblages with the maximum difference being 2.9cm (St Martin's at 171.8cm). The mean female stature is 159.1cm, which is the same as the height of females at St Martin's Church and it falls within the 156–164cm range for post–medieval sites (Roberts & Cox 2003). Both male and female stature at West Bromwich, along with that of the other comparative assemblages, are higher than that found at Spitalfields reflecting the fact that status during this period does not equal taller stature. However it is interesting that the two individuals from vault burials at West Bromwich whose stature

Sex	Right			Left		
	Mean	Range		Mean	Range	
		Min	Max		Min	Max
Male	87.99	78.59	101.05	87.68	82.04	91.68
Female	84.9	74.37	93.94	84.51	79.71	91.32
Total	**86.23**	**74.37**	**101.05**	**85.51**	**76.71**	**91.68**

Table 10

Meric index calculations

Sex	Right			Left		
	Mean	Range		Mean	Range	
		Min	Max		Min	Max
Male	76.5	73.31	80.79	72.23	66.80	76.05
Female	76.31	63.65	89.17	75.76	69.83	89.76
Total	**76.38**	**63.65**	**89.17**	**74.25**	**66.80**	**89.76**

Table 11

Cnemic index calculations

	Mean	Range	
		Min	Max
Male	72.12	69.73	75.65
Female	74.85	72.66	78.02
Total	**73.26**	**69.73**	**78.02**

Table 12

Cranial index

could be estimated were fairly tall. SK3469 had a stature of 173.4cm which is taller than the majority of males (with the exception of two males) and SK3378 measured 166.4cm and was one of the tallest females present, with the exception of one by 0.5cm.

The morphology of the femoral and tibial shaft is calculated using indices (*meric* and *cnemic* indices) and can indicate biomechanical variation, although the lack of clinical studies and the extent of influence from other factors including diet and genetics makes this association tentative (Jurmain 1999). Research has however shown that bones are far more prone to biomechanical influences during childhood and adolescence than in adult age, and therefore age at onset of activity is likely to have an influence on bone shape (Jurmain *et al.* 2011).

The *meric* index calculates the shape and robusticity of the femoral shaft; 17 individuals could be measured. The mean for male femora fell within the *eurymeric* range, but the female mean was *platymeric*, so that males had rounder femora while females' were broader or flatter in shape. A *platymeric* shape occurs frequently in earlier man and modern primitive groups (Brothwell 1981). Five individuals had one *platymeric* and one *eurymeric* femora including three with a flattened left femur and two a flattened right; studies have shown a *platymeric* index to be more common in the left than the right tibia (*ibid*.).

The degree of tibial shaft flatness is calculated using the *cnemic* index; 15 individuals had tibiae to measure. All tibiae, male and female, had no (*mesocnemeric*) or very little (*eurycnemic*) medio–lateral flattening. Tibial surfaces of approximately equal size are common in Blacks and Caucasians, whereas *Platycnmeric* tibiae are found in Native Americans, Indians and the Ainu of Japan (Martin & Saller 1959). It has also been found that *eurycnmeric* tibiae withstand bending and torsion strain in the medio–lateral plain compared to *platycnmeric* which are stronger in the anterio–posterior aspect (Lovejoy *et al.* 1976).

The shape of the cranium, calculated by the cranial index, is determined by genetics but climate and diet may also have a small affect (Mays 2000, Sparks & Jantz 2002). Eleven individuals had intact crania which could be measured; the majority of both males and females had long heads (9/12 *dolichocranic*), with a small proportion having an average head shape (3/12 *mesocranic*). The mean of the upper facial index (66.25, 7 individuals), nasal index (47.42, 7 individuals) and the orbit index (93.17, 17 orbits) indicate that the individuals buried at West Bromwich had slender faces with narrow noses and orbits.

4.6 NON–METRIC TRAITS

Non–metric traits are believed to suggest hereditary affiliation between skeletons, although some can be produced by factors such as mechanical stress (Kennedy 1989) or environmental factors (Trinkaus 1978). Non–metrical trait presence or absence was noted for the twenty–one adults analysed. Generally the analysis of these traits requires a large sample, the most frequent traits are considered below and the full prevalence of further traits can be found in Appendix 3 (Table A & B).

In the cranium the commonest occurring traits were ex–sutural mastoid foramen (60–73.7%), parietal foramen (33.3–66.7%) and ossicles in the lambdoid (22.2–23.5% – extra bones in the suture at the back of the head). A similar pattern of relatively high prevalence was found for the latter two traits within the assemblage from St Martin's, Birmingham (29.9–32.5% and 17.7–21.4% respectively). Palatal and maxillary tori were observed within two individuals at West Bromwich and these traits are associated with high levels of masticatory stress (Roberts & Manchester 1995, p.54).

Of the post–cranial non–metric traits, accessory transverse foramina in the cervical vertebrae (31.3–41.2%), femoral plaque (30–36.4%) and lateral tibial squatting facets (14.3–18.2%) were the most frequently observed. The pattern of a higher prevalence of these specific traits within the assemblage is again similar to St Martin's with a 18.75–35.6%, 14.4–16.1% and 17.3–14.4% prevalence respectively. The presence of squatting facets indicates some individuals undertook repetitive activity which required hyerflexation of their ankle.

5. PATHOLOGICAL ANALYSIS

The skeleton can be affected by a variety of pathological conditions which can be identified by characteristic lesions and the distribution of these lesions across the skeleton. Understanding the expression of such changes and the clinical impact that they had on the individual is of vital importance in understanding morbidity and life histories in past societies. This section presents the results of the pathological analysis of 41 individuals; the small sample size, especially when broken–down into differing age and sex categories, makes interpretation of the impact of differing pathologies on sections of the population limited and somewhat tentative.

5.1 TRAUMA

In the West Bromwich assemblage 10 individuals were affected by trauma; either a fracture to the bone or trauma to the soft tissue in the form of traumatic myostitis ossificans which is an exuberant ossification in muscle tissue at the site of attachment due to muscle trauma (Ortner 2003). Four males and five females were affected, along with one non–adult, an adolescent who had a healed fracture of the right MC2 (1/3 adolescents). The prevalence rate per bone is shown in Table 13.

Nine individuals suffered from a fracture in one or more of their bones during life, with a total of 29 fractured bones, the 21.95% CPR is similar to that found at St Martin's of 21.39% (108/505). The majority of individuals had healed fractures by the time of death. A scapula and several rib fractures in SK3461 were unhealed but this was likely due to underlying pathology in the form of osteomalacia (see below – metabolic disease) rendering them much more venerable to fracture and inhibiting the normal rate of healing. Furthermore six ribs were healed and nine healing indicating more than one event of trauma occurred in the rib cage conforming to the pattern expected should there be an underlying contributing factor of osteomalacia.

A further male individual SK3270 had a fracture of his proximal (upper) right femur shaft which had no evidence of healing but characteristic features indicating it had occurred peri–mortem (around the time of death). The site of the fracture exhibited 'hinging' when the section

Plate 1

Scapula fracture of individual suffering from osteomalacia

of bone is bent away from the direction of the blow, as well as radiating fracture lines from the point of impact and the shape of the broken ends were angled and jagged – all of which would not occur in dry bone (post–mortem) breaks (Byers 2002). Blood supply to the femoral shaft is extremely profuse and fractures often result in massive loss of blood, which can lead to hypovolemic shock and in severe cases this can cause death (Scheuer & Black 2000, p.379). This fracture could have however occurred just after death *eg* from rough handling.

Both sexes experienced ankle fractures however fractures of the lower limbs were more common in males than females; males may have been undertaking activities with a higher riSKof fracture to the lower limbs.

Frontal bone and nasal fractures are associated with interpersonal violence, however can also be the result of other accidents, for example sporting accidents. SK 3311 had a roughly circular shallow depression (6.58mm diameter) on her left frontal bone indicating healed blunt force trauma. SK3182 exhibited a possible healed fracture of both his nasal bones as they displayed a right deviation just below the mid–point of the bones with profuse ossification of the nasal cartilage (when cartilage turns to bone) at the lateral side of the left nasal bone extending down the border of the nasal aperture.

SK3182 had a left lateral wedge of his 11th thoracic vertebrae – compression fractures in the vertebrae are due to longitudinal impact to the vertebral axis, which produces axial compression and is characterised by crushing or wedging of the vertebral bodies (Nadalo 2011). This individual also exhibited trauma to the 5th lumbar vertebra as well as multiple fractures to his lower

Bone	Fracture			No. of elements			TRP (%)		
	M	F	All	M	F	All	M	F	All
Frontal bone	–	1	1	9	11	20	–	9.1	5
Nasal bone	2	–	2	16	14	30	12.5	–	6.7
Scapula	–	1	1	12	20	32	–	5	3.1
Thoracic body	1	1	2	46	69	115	2.2	1.4	1.7
Lumbar body	–	4	4	24	27	51	–	14.8	7.8
Lumbar arch	1	–	1	36	36	72	2.8	–	1.4
Ribs	1	15	16	73	125	198	1.4	12	–
Femur	1	–	1	16	24	40	6.3	–	2.5
Tibia	2	–	2	16	23	39	12.5	–	5.1
Fibula	2	–	2	13	17	30	15.4	–	6.7
Talus	–	1	1	10	14	24	–	7.1	4.2
Cuboid	1	–	1	9	7	16	11.1	–	6.3
Navicular	–	2	2	9	11	20	—	18.2	10
Metatarsal	1	–	1	45	56	101	2.2	–	1

Table 13

Fracture prevalence by bone in adults

legs; both tibiae and the right fibula had healed fractures. In his L5 this individuals exhibited spondylolysis which is a separation (lysis) of the body and arch of the vertebrae through the *pars interarticularis* (between the superior and inferior articular processes). This condition usually exhibits complete separation of the arch, as in another male in the assemblage, SK3270. The L5 of SK3182 had only left side involvement and also exhibits an anterior–posterior (coronal) fracture down the spinous process ('tail' of the vertebrae) – completely separating the left side of the vertebral arch from the rest of the vertebra. Spondylolysis is generally produced by fatigue or stress fracturing (Hutton *et al.* 1977, Cyron & Hutton 1978) however rare cases have been attributed to acute trauma (Smith *et al.* 1977, Cope 1988) – multiple trauma in the vertebra and in this individual may indicate the latter as a causative agent.

Plate 2

Spondylolysis

Compression fractures were present in the first to fourth lumbar vertebrae of SK3465 a 40–44 year old female. These fractures were biconcave in appearance and it was noted that the trabecular (spongy bone within the body of vertebrae) structure was wider (less dense) than normal. These features may suggest this individual suffered from osteoporosis, which is common in post–menopausal women (late 40–50s) due to hormonal changes resulting in accelerated bone loss (Brickley 2002).

Both adults in brick–lined graves exhibited multiple trauma. SK3469 displayed fractures of his left distal fibular epiphysis, left cuboid and right MT2, all healed. SK3378 exhibited a dislocation of her right shoulder (1/58 shoulder joints) creating a new joint surface on the anterior of the

Plate 3

Shoulder dislocation

scapula, adjacent to the normal joint surface, with secondary arthritic changes. This individual also exhibited traumatic myostitis ossificans of the intercostal muscle attachment at the neck areas (back of the ribs) of two adjacent right ribs (upper–mid position). This ossification joined the ribs together and fused them to the vertebrae. In this individual both the dislocation and muscle trauma were located on the right side of her body and it is possible that they were caused by the same incident – if the individual fell backwards onto her right side.

Activity related change

Soft tissue trauma can also be seen in the skeleton as bony formation (*enthesophytes*) and bone excavations (destruction) at the site of muscle or ligament attachments. These can be produced as a result of repetitive activity or strain and bioarchaeologists have used such markers to infer activities associated with occupations in living and prehistoric populations (Kennedy 1989, Hawkey & Merbs 1995). Interpretation however must be viewed speculatively given their multifactorial aetiology (Jurmain 1999), for example, enthesophytes may accompany some diseases such as Diffuse Idiopathic Skeletal Hyperostosis (DISH).

Overall 17 individuals exhibited evidence of muscle strain at one or more of their muscle attachment sites, including the two adults in brick–lined graves, and the majority being entheseal changes. Of the adults, seven males and seven females were affected; of those attachments with evidence of such changes males were affected to a greater extent (69/408 16.9%) than females (72/613, 11.7%). All individuals, with the exception of three individuals (one male and two females), had evidence of muscle strain on both their upper and lower bodies.

The majority of consistent micro–trauma was observed on the arms and especially at the pectoralis major attachment (18/33, 54.5%), which is primarily responsible for the movement of the shoulder joint. The radial biceps were also frequently put under stress with 42.9% (12/28) of these attachment sites showing bony changes, this muscle flexes the elbow and supinates (palm facing superior/upwards) the forearm (Abrahams *et al.* 2003). In the lower body, the tibial soleus attachment is affected by strain to a much greater extent than any other attachment (14/32, 43.8%). The soleus is a powerful muscle in the back part of the (calf) which is involved in the plantarflexion of the foot (*ibid.*) – the foot is pointed downwards, *eg* depressing a pedal when driving.

One adolescent and two older children (SK3458, SK 3005, SK3417) exhibited muscle strain to their upper bodies only, with either their humerus and/or clavicle being involved.

See Appendix 3 (Table C & D) for a full list of prevalences and the site archive for severity of changes.

5.2 JOINT DISEASE

Joint disease is one of the most common pathological ailments in skeletal material. The only type of joint disease observed in the West Bromwich population was degenerative joint disease including Degenerative Disc Disease and Schmorl's nodes which affect the vertebral bodies as well as osteoarthritis which can affect joints throughout the body. The prevalence and occurrence of joint disease can be influenced by advancing age, sex, physical activity and mechanical stress, or it may be secondary to pathological alteration, such as trauma.

Schmorl's nodes

Schmorl's nodes are associated with degeneration of the intervertebral discs; discs can rupture due to trauma, such as frequent lifting or carrying heavy loads, or other pathological processes may weaken them. The subsequent pressure of the herniated vertebral discs manifest as indentations in the vertebral body surfaces termed Schmorl's nodes (Aufderheide & Rodrigues–Martin 1998).

In the adult analysed sample of 21, 20 individuals had one or more vertebrae body to observe. Six adult individuals exhibited Schmorl's nodes (6/20) in their thoracic vertebrae, including two males and four females. Although more female individuals were affected, the true prevalence rate shows that males suffered to a greater extent as more vertebrae within their spines had Schmorl's nodes (11/107) compared to females (7/159). All individuals were over 40 years of age with the exception of one male aged 25–29 years at death.

Degenerative disc disease

Degeneration of the discs held between the vertebral bodies results in the discs losing their 'cushioning' and individuals can suffer from neck and back pain as well as possible pain in the corresponding ligaments – the latter symptoms arise as a result of strains or tears of spinal ligaments resulting from stresses produced by the narrow disc and the associated instability (Lawrence 1969). On the vertebrae degenerative changes can be seen in the form of osteophyte (bony projection) development around the margins or on the body surfaces, as well as porosity of the body surfaces (Rogers 2000).

Five adult individuals exhibited degenerative disc disease in the assemblage (5/20). Of these individuals two were male and three female and all were over the age of 40 years at death. The overall frequency of vertebral bodies affected was 4.5% (12/266). The first sacral vertebra (base of spine) was most frequently affected (2/12) however this is likely an effect of the small sample size for this vertebral body. In the rest of the spine, the cervical vertebrae (neck area) were involved to a greater extent (6.8%, 6/88), followed by the lumbar vertebrae (lower back, 5.9%, 3/51), and the thoracic (mid–back) vertebrae had very limited evidence of disease (0.9%, 1/115). The thoracic area of the spine has relatively little movement compared with the neck, and the degenerative changes in the lumbar area are a consequence of trauma imposed by weight bearing (Molleson & Cox 1993). It is interesting to note that only males were affected at the level of the lumbar spine.

Osteoarthritis

Osteoarthritis (OA) involves deterioration of the cartilage between joints, and the clearest diagnostic feature of osteoarthritis in bone is eburnation; when a polished surface is created from bone–to–bone contact. Further features of OA include osteophytes on or around the joint margin, porosity on the surfaces, and subchondral cysts (Rogers 2000). OA is characterised by the presence of at least two of these latter features or eburnation even if it occurs alone (*ibid.*).

Individuals suffering from OA can experience stiffness and pain in the affected joint, which may become swollen, and in some cases can cause disability and a reduction in the quality of life (Kean *et al.* 2004). Symptoms are not constant in this disease but instead flare up unpredictably and studies have shown no correlation between severity of pain experienced by the individual and the expression of OA (Cockburn *et al.* 1979). OA has been suggested as an indicator of occupational activity however many clinical studies have resulted in conflicting results suggesting that such an association is 'oversimplistic' (Jurmain 1999, p.103).

Osteoarthritis of the spine

In the spine, the posterior (back) of each vertebrae has four facets, two superior and two inferior (above and below), which connect with adjacent vertebral facets – creating the joints of the spine. Seven adults exhibited OA in their vertebral facets and 4.5% (52/1162) of apophyseal facets were affected all in individuals over 40 years of age. One individual from a brick–lined grave exhibited OA, SK3378, in her cervical spine.

Three males and four females suffered from spinal OA with very similar true prevalences (4.9% and 4.3% respectively). Males were affected to a greater extent in their lumbar (12/123) and sacral (2/12) facets than females (5/157 and 0/17). Conversely females exhibited the greatest prevalence of OA in the cervical region of their spines (20/209, males – 8/151).

Overall spinal degenerative changes are relatively uncommon in comparison to other contemporaneous sites. The CPR for Schmorl's nodes (30%) and degenerative disc disease (25%) are lower than that found at St Bride's (45.4% and 36.6%), St Marylebone (56.8% and 29.6%) and Cross bones (79.1% and 93%). The TPR of degenerative disc disease is an identical figure to that at St Marylebone (4.5%), with Schmorl's nodes and OA having a lower prevalence than individuals at this site, who exhibited an 11.9% and 6.5% prevalence respectively; a large number of 'gentlemen' and artisans were buried at St Marylebone (Miles *et al.* 2008).

Extra–spinal osteoarthritis

Six individuals suffered from OA in their extra–spinal joints during life, consisting of 30% of the adult population and identical numbers of males and females. These individuals consisted of three older adults, 2 older–middle adults and one adult (>18 years).

Bone	Male			Female			Total %		
	OA	N	%	OA	N	%	OA	N	%
TMJ	4	17	23.5	1	19	5.3	5	36	13.9
Shoulder	0	13	0	1	16	6.3	1	29	3.4
Elbow	1	12	8.3	1	17	5.9	2	29	6.9
Wrist	0	12	0	2	15	13.3	2	27	7.4
Hand	0	11	0	3	18	16.7	3	29	10.3
Hip	2	15	13.3	0	24	0	2	39	5.1
Knee	3	16	18.8	2	21	9.5	5	37	2.9
Ankle	1	16	6.25	0	15	0	1	31	3.2
Foot	0	12	0	2	13	15.4	2	25	8

TMJ = temporomandibular joint
Shoulder = gleno–humeral joint
Elbow = distal humerus, proximal radius and ulna
Wrist = distal radius,ulna and carpals
Hand = MCs and phalanges
Hip = acetabulum and proximal femur
Knee = distal femur, patella and proximal tibia
Ankle = distal tibia and tarsals
Foot = MTs and phalanges

Table 14

Extra-spinal OA by joint

Plate 4

Patellar OA (eburnation)

The most frequently involved joint was the temporal–mandibular joint (TMJ – articulation of the jaw and skull near the ear). Along with function and age, stress can also be placed on this joint from an imbalance in dental occlusion, by loss of teeth, severe attrition and/or by grinding habits produced by psychological stress (Molleson & Cox 1993). The two individuals with OA at the TMJ had a high degree of ante–mortem tooth loss which may have exacerbated OA at this site.

OA at the distal first metatarsal–phalangeal joints (big toes) in SK3461 was the result of hallux valgus (see below). OA observed in the (right) shoulder joint of SK 3378 and the ankle joints of SK3469 are secondary to trauma, the former a dislocation and the latter a fracture of the (left) cuboid; both these individuals were within the higher status graves and also exhibited OA at their knee joints.

Two older adult females exhibited OA in their wrists and hands; clinical examples of elderly individuals, especially women, with OA within their wrist and hand joints are fairly prominent (Dahaghin *et al.* 2005, Resnick 2002). Males suffered from OA mainly in their weight bearing joints including the hip and ankle joints, as well as at the elbow and knee to a greater extent than females.

The CPR figure is slightly higher that of the majority of comparable sites including the population at St Martin's (22.16%, 78/352), Spitalfields (26.3%), and St Marylebone (22%).

5.3 HALLUX VALGUS

Hallux valgus is commonly termed bunions, located at the first metatarsal–phalange joint/s (big toe/s) with the big toe pointing outwards towards the second digit. It is commonly associated with individuals wearing ill–fitting or pointed footwear (Mays 2005). Five adult individuals suffered from hallux valgus, including one male and four females; possibly indicating women wore restrictive shoes to a greater extent. Two were younger–middle adults, one older–middle and two older adults. All lesions were bilateral where both MT1–phalange were present (two individuals had one side damaged post–mortem and therefore unobservable). The CPR prevalence of 62.5% is higher in comparison to the 3.3% at St Marylebone (10/301) although this may be a misleading result produced by a small sample size.

5.4 METABOLIC DISEASE

Cribra orbitalia & porotic hyperostosis

Cribra orbitalia consists of pitting in the roof of the orbits and porotic hyperostosis pitting on the parietal and/or occipital bones. These conditions are indicators of general stress in childhood and is the result of iron deficiency anaemia (Stuart–Macadam 1992) due to a diet deficient in vitamin B12 (in animal products) and/or folic acid but can also be caused by chronic infection and scurvy (Walker *et al.* 2009). The porosity is a result of the thinning of the outer table of the cranium due to the expansion of the dipole (trabecular bone between the cranial tables) produced by the body's expansion of the marrow to increase production of red blood and iron levels (Roberts & Manchester 1995).

	L orbit			R orbit			Total orbits			Individuals (CPR)		
	CO	N	%	CO	N	%	CO	N	%	CO	N	%
Males	4	9	25	4	9	37.5	8	18	25	4	9	37.5
Females	0	9	0	1	10	10	1	19	5.3	1	11	9.1
Non–AD	5	13	38.5	5	14	34.7	10	27	39.3	6	15	40
Total	**9**	**31**	**29**	**10**	**34**	**29.4**	**19**	**64**	**29.7**	**11**	**35**	**31.4**

Table 15

Prevalence of cribra orbitalia

The overall CPR for cribra orbitalia was 31.4% (11/35) of those with one or more orbits present; the true prevalence for the total orbits affected with 29.7% (19/66) which corresponds closely to that at St Marylebone of 30.5% (112/367). The majority of lesions were bilateral (8/11) and all of the lesions observed were mild in severity consisting of a scattering of fine foramina (Stuart–Macadam 1991).

Non–adults exhibited a slightly higher prevalence of cribra orbitalia compared to the prevalence in the adult population, this was to be expected as cribra orbitalia is thought to be a disease of childhood and with age these lesions remodel and disappear (Stuart–Macadam 1992). Infant feeding practices at this time, including wet nursing or replacement of breast–milk with pap or panada (bread with milk, water and/or sugar) may have contributed to the prevalences of this disease in infants (Molleson & Cox 1993, p.44). In the adult population a higher proportion of males (4/9) were affected compared to females (1/11) suggesting that males were more susceptible to stress in childhood, however it has also been suggested that mild ana emia is an adaptive response to a stressful environment as it hinders the spread of bacterial infections (Redfern & Roberts 2005, p.126). The low red blood cell count decreases oxygen delivery to every tissue in the body and a variety of symptoms can occur including fatigue, weakness, dizziness, cold skin and palpitations; although if anaemia is chronic the body may adapt and compensate for change and in this case there may be no symptoms until the anaemia becomes more severe (Ludwig & Strasser 2001).

Porotic hyperostosis was present in six adults (6/21) and two non–adults (2/19) giving a 20% prevalence of those with either a parietal or occipital to observe. The lesions were always bilateral in the parietals and parietal lesions (8/39, 20.5%) were more prevalent than occipital (4/38, 10.5%).

Of the two non–adults an older child had mild lesions on the occipitals and an infant of approximately nine months exhibited severe porotic hyperostosis on the parietals and occipitals. Adult severity decreased with age; from a moderate expression in a younger–middle adult to mild or healed lesions in older adults (5). Between the sexes females were affected to a slightly lesser extent (3/10) than males (3/9), similar to cribra orbitalia; although orbit and cranial lesions only occurred together in one non–adult.

Of the three individuals analysed in the 'higher status' burials none had porotic hyperostosis and neither of the two adults had cribria orbitalia, with the non–adult (SK 3483) having no orbits present.

Rickets & Osteomalacia

Rickets is caused by a deficiency in vitamin D during infancy and childhood, causing newly formed bone in a growing skeleton to be insufficiently mineralised and therefore weak and prone to bending deformities and porosity. There was a great rise in rickets in the 19th century and this is mainly due to the high amounts of urban atmospheric pollution preventing sunlight, the major source of vitamin D, being absorbed through the skin, although inadequate nutrition and swaddling of infants may also have had an effect (Mays *et al.* 2006). Osteomalacia is the adult form of vitamin D deficiency and can cause buckling of bones and/or 'pseudofractures' (Brickley *et al.* 2005).

Three individuals within the non–adult population (20) suffered from Rickets, one of whom was buried within a brick–lined grave (SK3483). Two younger children were affected including SK3156 aged 1–1.5 years of age and SK 3483 at 1.5–3 years, as well as an adolescent individual, SK3344 aged 12–15 years at death. All individuals displayed diagnostic bending of the long bones with a consequential shortening in length and flaring of the long bone metaphyses (Mays *et al.* 2006). SK3156 had active rickets as marked roughening of the bone underlying the epipyseal growth plate was present which is indicative of the active form of this disease (*ibid.*). This feature was not observed on the other two individuals and SK3344 also exhibited deposition of porous new bone on the subperiosteal surface (beneath the periosteum – a membrane that lines the outer surface of bones) of the concave side of the curve deformity of the tibiae and such findings indicate both individuals had recovered from their vitamin D deficiency by the time of death (*ibid.*). Of the adult individuals four; three females and one male, exhibited mild bowing of their femoral or tibial bone shafts and this may represent residual bending deformities associated with childhood rickets (*ibid.*). Rickets would have affected the appearance and gait of individuals causing their walk to become 'clumsy' or more of a 'waddle–like' as well as causing weakness, bone pain and generalized convulsions (Narchi *et al.* 2001, Pedersen *et al.* 2003).

One female, SK3461, may have suffered from osteomalacia. She exhibited an incomplete unhealed fracture of the right scapula at the inferior border, just inferior to the glenoid cavity, with disorganised speckles of woven bone present around the break. The scapula body also exhibited a slight (abnormal) posterior curve. This individual also had ten right and five left rib fractures, the majority of which (nine) had only a fine disorganised woven bony–union.

In osteomalacia the accumulation of unmineralized osteoid replacing bone mineral leads to a generalised softening and weakening of the skeleton (Brickley *et al.* 2007). This weakening leads to 'pseudofractures' (or Looser's zones) which are streaks of decreased density, possibly the result of stress fractures that have failed to heal which can progress to full fractures with minimal trauma (*ibid.*). The inferior scapula and ribs are two of the predilect areas affected by this disease (*ibid.*). Along with the high riSKof fracture, symptoms include muscle

Plate 5
Rickets – bowing of the tibiae

and bone weakness and/or pain (Holick 2005). As well as pollution and low levels of nutrition, a loss of calcium and phosphorus due to closely spaced pregnancies and prolonged lactation in the past would have made females especially vulnerable to a vitamin D deficiency (Prentice 2003). This individual was also an older adult and in older individuals osteomalacia can also be a result of a decrease in intestinal absorption of vitamin D with age (Reginato & Coquia 2003). Seven individuals with osteomalacia were identified at St Martin's church (7/136, Mays *et al.* 2007), one individual at Cross Bones (1/44), and three at St Bride's (3/369).

Scurvy

Scurvy is due to a deficiency of ascorbic acid (vitamin C) which is present in citrus fruits, vegetables and marine fish. Deficiency causes impairment of collagen synthesis leading to defective osteoid formation and fragile blood vessels that rupture easily, resulting in haemorrhages (Aufderheide & Rodriguez–Martin 1998). Such changes can develop much more readily in children due to the demands of rapid growth (*ibid.*). Lesions include increased porosity and proliferative new bone formation as a response to haemorrhage (Brickley & Ives 2006). During the 1840s the potato crop the main source of vitamin C for the majority of the population, failed across Britain; marine fish and citrus fruits would have been available at this time although more costly (*ibid.*). The most diagnostic sign of scurvy is bleeding gums which can also become swollen and purple with other clinical symptoms include bruising, arthralgias and leg edema (Hirschmann & Gregory 1999).

One non–adult, SK3547, may have suffered from scurvy. The individual exhibited a new layer of woven bone formation coupled with an abnormal increase in porosity at the supraspinous fossa of the left scapula and in both orbit roofs. Abnormal porosity was also located on fragments of parietal bone, as well as the body and lesser wings of the sphenoid with new woven bone formation observable on the lateral and medial surfaces of left greater wing. Furthermore the right lamina of C5 and both lamina of C6 vertebrae had small areas of abnormal new (woven) bone formation observable. This individual was a foetus aged 36–40 weeks prenatal and would therefore indicate that the mother must have suffered from this condition giving indirect evidence of adult scurvy within the West Bromwich population.

5.5 INFECTIOUS DISEASE

Acute infectious disease results in death before any skeletal changes can be observed. Cholera, for example, can cause death within hours of the first symptoms appearing (Roberts & Cox 2003, p.337) and it is known that in 1832 Cholera spread through the area, with West Bromwich recording 297 cases of whom 62 died (Chitman 2009, p.107). Tuberculosis was also prevalent throughout the nineteenth century, as well as syphilis to a lesser extent (*ibid.* pp.338–340). These two diseases can develop to a chronic stage and are therefore identifiable in the skeleton. There was no evidence for such disease in the assemblage however other infections were observed, including those of the sinuses, meningeal reactions, Non-specific infection (where the cause cannot be determined) or secondary infection due to trauma.

Maxillary sinusitis

The maxillary sinuses are located in the area of the upper jaw below the eye sockets and behind the cheekbone. Inflammation occurs as a result of infection in the throat, ear, chest or sinuses themselves (Roberts & Manchester 1995) and can cause pain and pressure in the upper jaw and cheeks, mucus formation and headaches (Melen *et al.* 1986). In skeletal remains pitting and new bone formation within the sinus cavities indicates infection. Smoke, dust and environmental pollution can lead to sinusitis; urban sites have a higher incidence of the disease and it is thought to be due to atmospheric pollution in industrial cities and towns (Roberts & Manchester 1993).

Only adults suffered from maxillary sinusitis, with four individuals including one individual from a bricked vault (SK3378) affected out of seven individuals with at least one maxillary sinus observable. Nine individuals with both maxillary sinuses had intact crania and so sinuses could not be observed (without an endoscope) and therefore the prevalence of this disease should be taken as a minimum. All had bilateral involvement, except one individual whose left sinus was missing post–mortem. Sinusitis had a higher prevalence in females, with three females and one male affected. The 57.1% is much higher than the 5% found in Birmingham at St Martin's (14/279) and in London at St Marylebone (15/301), although small sample size may have inflated the West Bromwich prevalence.

Meningeal reactions

Two non–adult individuals had endocranial new bone formation of 20 with endocranial surfaces to observe. The endocranial area of the occipital (back of the head) around the cruciate ligament in SK3551, a younger child (*c.*2 years), had a small area of 'frosted' hair–on–end new bone formation with an adjacent area of smooth but very porotic lamellar bone (organised normal bone). This lesion was healed at the time of death and likely due to inflammation, perhaps secondary to infection (Lewis 2004). SK3018, an infant aged from birth to 1.5 months, exhibited white–grey porotic woven bone (disorganised new bone formation) with vascular impressions within the frontal, parietals and occipital bones. The widespread extent of the formation is indicative of pathology rather than the normal growth process, and may be due to inflammation or the result of inter–cranial haemorrhage due to mineral deficiency during the rapid growth period (*ibid.*).

Infection secondary to trauma

Osteomyelitis is an infection of the bone and the bone marrow resulting in inflammatory destruction of the bone (Ortner 2003). One individual, SK3182, exhibited osteomyelitis in both his tibiae and his right fibula which was limited and localised around healed fractures within these bones. Infection therefore was likely the result of compound (open) fractures which allowed direct contamination of the bone by bacteria. The area around the fractures was enlarged and cloacae present – drainage channels through which pus drains from the bone and then through sinuses that are formed in the overlying soft tissue. This individual would have been seriously ill with fever, pain and would have been immobile (Roberts & Manchester 1995). Osteomyelitis can persist for years as there was no cure for the disease until the advent of antibiotics; many underwent amputation of the affected area as several complications could occur including malignant change in the tract of the sinus, deposition of amyloid in the kidney or the spread of infection to other organs, all of which would cause death (Waldron 1999, p.86).

Non-specific infection

Periostitis is an inflammation of the periosteum and causes new bone formation on the cortical surface of the bone. In the assemblage no specific cause for such infection could be ascertained and bones affected included the tibiae, fibulae or femora. Of the 41 skeletons analysed, six individuals were affected by periostitis; five adults and one adolescent. The 14.6% CPR is lower than the mean prevalence of post–medieval sites of 26.3% (Roberts and Cox 2003), the 22.6% (112/496) at St Martin's and even the prevalence in the wealthy individuals of St Marylebone (19.6%, 59/301).

Three males, two females and one non–adult were affected by Non-specific periostitis, one of which was a 'higher status' individual, SK3469. The majority of individuals showed healed infection, with the exception of one adult male (SK3469) and one adolescent (SK3049), the latter had active infection on the right tibia and the former had both woven (active) and lamellar bone on his left tibia and fibula indicating a recurring chronic infection. The tibia was the most frequently affected bone, likely due to the fact this bone lies close to the skin and so can undergo minor injury more frequently (Roberts and Manchester 1993).

Bone	Males			Females			Non–adults		
	Infec.	N	%	Infec.	N	%	Infec.	N	%
Femur	0	16	0	0	24	0	2	38	5.3
Tibia	5	16	31.3	3	23	13	1	37	2.7
Fibula	2	13	15.4	1	17	5.9	0	28	0

Table 16

TPR of Non-specific infection

5.6 NEOPLASTIC DISEASE

In the post–medieval period the London Bills of Mortality attributed death to cancers and tumours but the rate rarely exceeds 0.5% (Roberts & Cox 2003).

SK3465, an adult female, had a small button osteoma, which is benign and asymptomatic, situated on her frontal bone (1/20 adults with frontal bones).

SK3486 suffered from a malignant cancer and the distribution and form of lesions indicates a diagnosis of either metastatic carcinoma or Langerhans Cell Histiocytosis (LCH, formerly known as Histiocytosis–X, Willman *et al*. 2004). The young age of this (17–25 years) individual makes the latter a more likely diagnosis as metastatic carcinoma is largely a disease of the elderly (Assis & Codinha 2010, Aufgerheide & Rodriguez–Martin 1998, D'Ambrosio *et al*. 2008). LCH is a group term for three distinct clinical syndromes including Eosinophilic granuloma, Hand–Schuller–Christian disease and Letterer–Siwe disease. All have the common pathological feature of histiocytic proliferation however the latter two syndromes affect individuals from 2–5 years and birth–2 years respectively, whereas Eosinophilic granuloma affects predominately those of 5–10 years but can also be found in adolescent and younger adults – such as SK3465 (Aufgerheide & Rodriguez–Martin 1998).

Plate 6

Osteomyelitis

A circular lytic lesion was present on the endocranial surface of the skull on the right frontal at the region of the temporal line with only very slight penetration of the outer table (14.5x15mm). Endocranially it had internally scalloped margins and osteoblastic activity surrounding it creating a 'crater–like' lesion. Two further large scalloped lytic lesions, with no osteoblastic activity, destroyed the greater wing of the right sphenoid and endocranial surface of the left frontal bone superior to brow ridge (35.5x19.4mm), the latter exhibiting capillary impressions at its borders. A small lytic lesion could also be observed on the occipital posterior to sella tursica (5.5x2.6mm) as well as a circular lytic lesion present on the sella tursica. The left parietal fenestra displayed osteoblastic activity on its endocranial surface with capillary impressions at its borders and the spicules of bone present within the fenestra indicate that it may have been affected by the carcinoma.

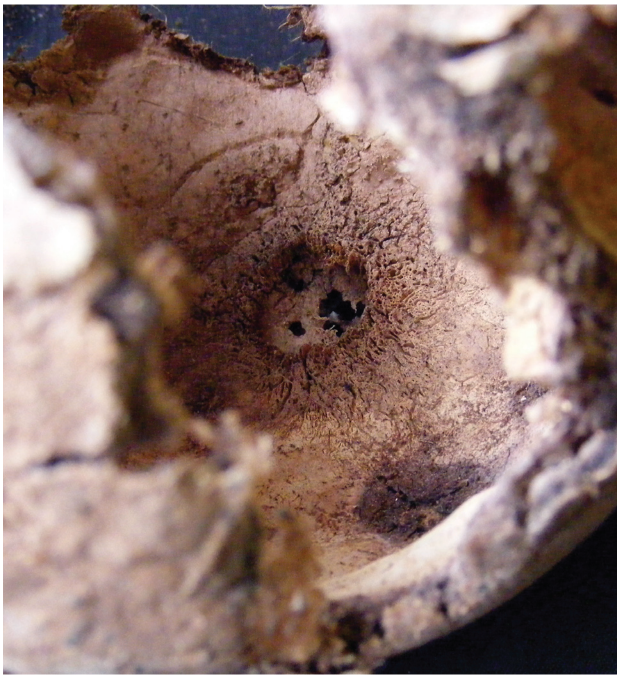

Plate 7

Lesion on the cranium due to LEH

Plate 8

LEH – lesion on ilium

Post–cranially a scooped–out lytic lesion was present on the anterior neck of the right femur (9.3x6mm) with very slight osteoblast activity. In the right pelvis a larger (32.9x20.8mm) but very similar lesion was observed with no osteoblastic activity at the area superior to the ischial tuberosity and a further lesion on the arcuate line (7.8x4.8mm), also scooped–out internally but which had just penetrated the cortical bone. The spine was also affected with scooped–out lytic lesions on C1, C5 and T7 pedicles and lamina (areas on the arch of the vertebrae), as well as on the bodies of T12, L1–2, and L4–5.

Six non–adult individuals exhibiting evidence of Histiocytosis–X were present within St Bride's burial grounds. In living patients the lytic area/s are occupied by a granulomatous inflammatory area demonstrating histiocytic proliferation (*ibid*.). In clinical observations of individuals with LCH symptoms include scalp and/or facial swelling, seizures, gingival bleeding, proptosis (bulging eyes), diabetes insipidus and cranial nerve palsies (D'Ambrosio *et al*. 2008). The spinal lesions may collapse the vertebral body and there is a riSKof fracture at other lytic sites (Aufgerheide & Rodriguez–Martin 1998). This individual was the only one found to have been buried within a mortsafe – a framework of iron bars positioned over the grave. It is possible that her unusual symptoms may have made her a target for dissection and her family wanted to prevent her body from being stolen for such purposes against their wishes.

5.7 ENDOCRINE DISORDERS

Hyperostosis frontalis interna (HFI) is a thickening of the endocranial (inner) surface of the frontal bone and has been associated with hormonal changes, especially in females due to pregnancy or menopause, and is asymptomatic (Aufderheide & Rodriguez–Martin 1998). HFI was present in two adult female individuals (including SK3587, see below), of 20 adult individuals with frontal bones.

One adult female, SK3587, exhibited erosions on the sella turcica of the sphenoid and a disproportionate development of her skull vault, with bilaterally enlarged parietal bosses and a noticeably small frontal bone and open cranial sutures. The post–cranial bones were gracile with thin cortices and she had a relatively short stature of 152.88cm. HFI was present on the frontal bone and similar 'lumps' of remodelled spicules of bone were present bilaterally on the endocranial surface of both parietals at the region of boss. Erosion of the sella are due to pressure from a contiguous mass and active destruction occurring most commonly due to malignant tumours which originate in the bony structures or may involve them secondarily by extension from a contiguous soft–

tissue mass (Aufderheide & Rodriguez–Martin 1998, Camp 1949), although infection may also be an agent (Berger *et al.* 1986). The sella turcica is a saddle–shaped depression in sphenoid bone, with the seat of this saddle known as hypophyseal fossa which holds the pituitary gland – an endocrine organ regulating hormones. The irregular size and shape of bones within SK3587 may be related to the adjacent destruction of the functioning pituitary gland causing hypopituitarism with a deficiency in growth hormone, although a variety of other hormones may also be affected. The short stature of this individual however may be a result of nutritional deficiencies during childhood and unrelated to the destruction seen in the sella turcica.

Plate 9

Craniotomy

5.8 AUTOPSY

SK3458, an adolescent individual excavated at West Bromwich had undergone a surgical autopsy. Oblique cuts were made through the circumference of the skull – one cut through the frontal bone immediately superior to brow ridges and another cut made along the squamous suture of one parietal bone though the occipital bone, just superior to nuchal crest, to the opposite parietal. This action left a small spur of bone at each side of the frontal–parietal suture where the calvarium had been snapped/lifted off. A 'nick' mark was present near the right lambdoid suture, indicating where the tool may have slipped or the practitioner stopped and restarted cutting. The surface of the cuts were smooth, indicating the use of a flat–bladed saw, but it is interesting to note that the innermost edge was ragged and exhibited occasional small bone spurs, indicating that the saw did not fully penetrate the skull in sections showing that the practitioner took care not to saw too deep and damage the brain and instead levering the calvarium off. Two long parallel vertical cuts were also made down the arches (back) of the spine through C4 to L4 at the laminae, so that the spinous processes were separated from the rest of the vertebrae; with T4 to T10 having 'nick' marks. No obvious skeletal pathology was present in this individual and therefore the reason for performing the autopsy remains unclear, perhaps sudden or unexplained death in such a young individual may have prompted investigation. Thirty–one examples of autopsy

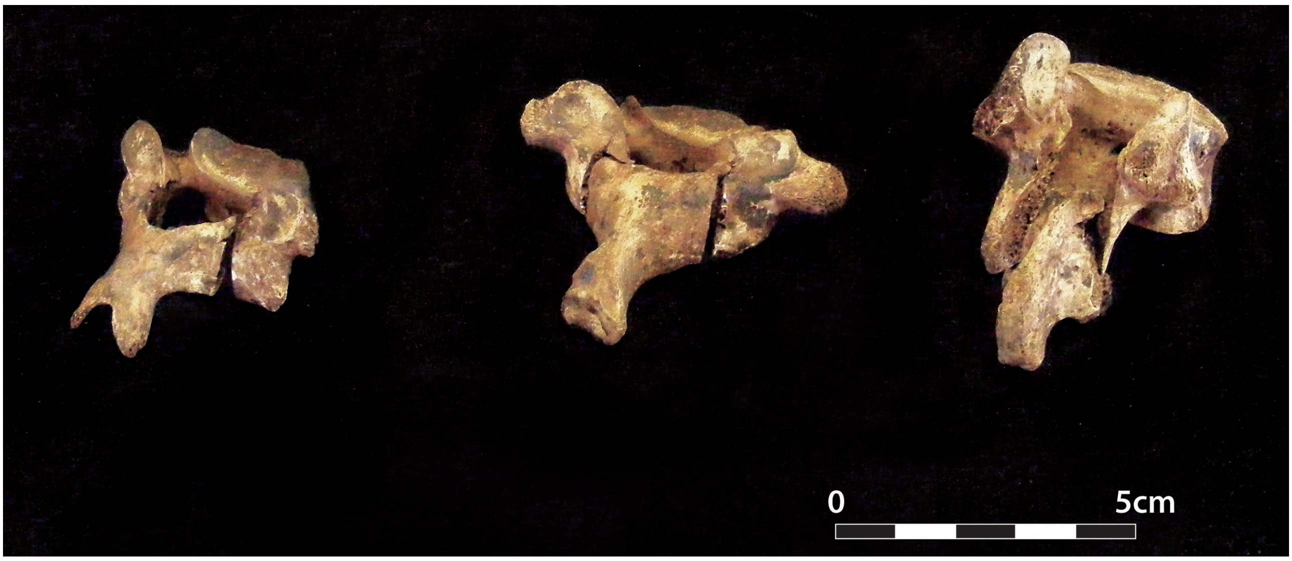

Plate 10

Autopsy investigation of the spine

have been found from this period (Roberts & Cox 1993, 315) and are largely cranial, however individuals from Spitalfields, St Martin's and St Marylebone had evidence of autopsy at other locations within the body.

5.9 CONGENTIAL CONDITIONS

Congenital defects or anomalies occur during embryological development and can be influenced by hereditary and environmental factors (Barnes 1994). In archaeological populations minor abnormalities are usually observed and they are asymptomatic (*ibid*.).

In the West Bromwich assemblage the majority of defects occurred in the spine as either supernumery vertebrae or transitional vertebrae. Transitional vertebrae are those that incorporate the morphological characteristics of parts, or all, of adjacent vertebrae creating a 'border shift' in the spine (Aufderheide & Rodrigues–Martin 1998). If the transitional vertebrae has fully taken on the characteristics of the adjacent vertebral section, differentiating between transitional or supernumery vertebrae is difficult without an intact spine and therefore prevalence is calculated from the number of individuals with spines containing 24 vertebral segments (C1–L5).

SK3360, a young–middle adult female, had a border shift at the thoracic–lumbar junction, with her T12 being fully lumbar in character, upper facets directed inwards, lower facets outwards and no costal facet was present (1/14). Two younger children had supernumerary vertebrae (2/14).

Spina bifida occulta (SBO) is the most common of all spinal congenital defects in which incomplete midline bony closure is present in one or more neural arches of the sacrum (Aufderheide & Rodrigues–Martin 1998). SBO was observed in five adult individuals of 13 with sacral neural arches present. The meningeal or neural structures do not protrude through the defect, unlike the more severe form – spina bifida aperta or cystica, and are asymptomatic (*ibid*.).

SK3486, the mort–safe female, had parietal fenestrae present bilaterally on the posterior parietal bones (1/39 with one or more parietals). Parietal fenestrae are thought to occur as a result of a defect in parietal bone ossification during the second month of gestation, but the cause of the defect is unknown although they may be genetically determined (Kaufman *et al*. 1997).

5.10 DENTAL DISEASE

The study of the dentition of individuals from archaeological contexts can reveal information on health and diet as well as social and cultural practices. Tables 17 and 18 show the true prevalence rates of dental pathology within the West Bromwich assemblage. Partially erupted teeth (14 deciduous and 16 permanent teeth) were not included in the calculation of prevalence rates due to problems of observing dental disease in partially obscured teeth but were included in the number of tooth positions for an examination of alveolar pathology rates. The severity of calculus and periodontal disease were recorded following Brothwell (1981). The tooth surface affected was also noted for both calculus and caries and this information can be found in the site archive.

Calculus

Calculus (tartar) is mineralised plaque and forms concretions around the crowns or roots of teeth; the build up of plaque is associated with carbohydrate consumption and a lack of oral hygiene (Hillson 1996). The teeth closest to the salivary glands (anterior teeth of the mandible) tend to have the greater calculus deposits as saliva is a source of minerals (Hillson 1996, p.255). The figures found within the assemblage should be taken as a minimum as calculus, although solidly attached to the tooth during life, can be dislodged during excavation and cleaning even if great care is taken.

The fourteen adult individuals (7 males and 7 females) with at least one tooth observable all had calculus deposits present. The TPR is lower than the majority of comparative sites including St Martin's at 68.9% (3489/5079). Male teeth were affected to a greater extent than females, however this is likely due to the fact that females had a higher degree of ante–mortem tooth loss as in living populations a consistent pattern arises where females have a higher caries rate than males (Hillson 1996, p.260). Calculus prevalence increases with age as seen in modern populations (Hillson 1996, p.260) and although younger adults only had slight calculus, severity varied considerable (slight to severe) in the other age categories. Of all the teeth with calculus 76.5% (117/153) had a slight expression, 20.9% (32/153) had moderate and 2.6% (4/153) had severe deposits. The majority (69.9%, 107/153) of deposits were supra–gingival with 15%

Plate 11

Maxilla exhibiting calculus, caries, DEH and rotation of second incisor

(23/153) being sub–gingival and another 15% exhibited calculus both above and below the gum line.

Five non–adults were affected by calculus out of thirteen with teeth present. The 38.5% is similar to the 38.94% (77/95) found at St Martin's, however the TPR is lower than St Martin's at 24% (3684/5893). Four older children and one adolescent were affected, and the majority of teeth affected were permanent with only a small percentage of deciduous teeth involved. All calculus present was supra–gingival, and also slight in severity with the exception of one adolescent with a moderate expression in three teeth.

Caries

Bacteria within dental plaque cause destruction of the tooth leading to the formation of a cavity in the crown or root surface (Hillson 1996). Carious lesions can cause severe pain, infection (see below – abscess) and tooth loss. Caries are multifactorial in aetiology however sugar is the main cause of caries; and is found occurring naturally in foods such as fruits, vegetables and honey as well as in carbohydrates such as cereals and in its processed refined form. Sugar imports increased dramatically around 1700 because of imperialist policies (Molleson & Cox 1993) and in 1845, near the end of burial at the Baptist Chapel at West Bromwich, import duties were removed on refined sugars (Corbett & Moore 1976) which may have increased rates of tooth decay during this period. Caries prevalence is not linked to social status as both the wealthy Spitalfield individuals and the paupers from Cross Bones had high prevalences, both higher than at St Martin's (51.3%) and in this assemblage (44.5%).

The thirty–five carious adult teeth (35/246) were from a total of nine individuals out of fourteen with at least one tooth present (64.3%). Both the CRP and TPR are most comparable to the adults at St Martin's (CRP 62.3%, 175/281; TPR 11.1% 468/4227). Caries prevalence roughly increased with age and five males and four females exhibited lesions with the number of teeth affected in both sexes being similar.

In the non–adult population three individuals had caries of 13 with teeth, 23.1% similar to the 22.7% at Cross Bones. The deciduous teeth affected all came from one younger child with 5 affected teeth and the permanent carious dentition from one older child and one adolescent individual.

Abscesses

Dental abscesses form as a result of caries, high levels of wear, trauma to the teeth or periodontal disease, as all of these can allow bacteria to enter the pulp cavity. The bacteria cause inflammation and pus accumulates; once pressure builds up the pus is drained out by the formation of a hole in the surrounding bone (Roberts & Manchester 1995, Hillson 1996).

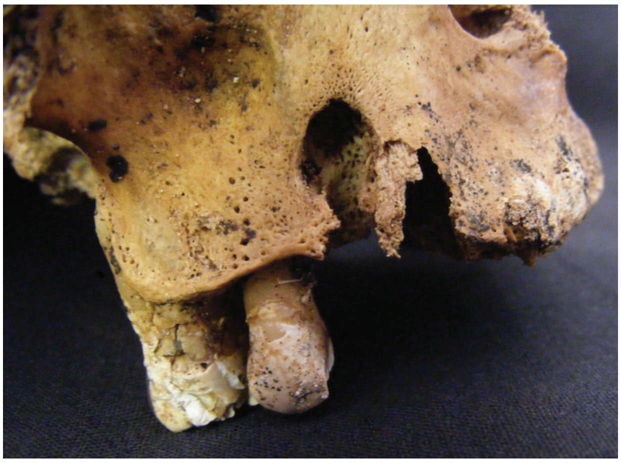

Plate 12

Abscess

All adults had at least one tooth position present to observe the presence of any abscesses. Four adult individuals, two males and two females, suffered from an abscess during life and one individual SK3584 experienced seven abscesses in total. Of the 16 non–adults with at least one tooth position present two individuals had abscesses. The two individuals were an older child and an adolescent and both abscesses occurred at the position of permanent teeth. In total, molar tooth positions were the most frequently affected (7/13), followed by incisor (4/13) and premolar (2/13) with no canine positions involved. Overall the total prevalence of abscesses was 1.5% of tooth positions (13/881) lower than the mean of 2.2% for a range of post–medieval sites (Roberts & Cox 2003).

Ante–mortem tooth loss (AMTL)

Fifteen individuals (15/21) lost one or more tooth during life and in total 44.6% (241/540) of teeth were affected. The proportion of teeth lost ante–mortem in the West Bromwich population is much higher than the 23.41% prevalence of combined post–medieval sites (Roberts & Cox 2003) and higher than the 29.2% prevalence at St Martin's Churchyard. This may be partly due to the high number of older adults in the West Bromwich skeletons analysed. AMTL increased with age with 90.1% (136/151) of teeth affected in the older adult age group and females lost more teeth ante–mortem than males. It is possible that some such teeth would have undergone dental extraction, a relatively common practice during this period with a range of instruments in widespread use (Whittaker 1993). Formal training in dentistry began in 1856 (Roberts & Cox 2003, p.323) and so if these individuals did have teeth extracted it would have been from individuals who set themselves up as dentists with variable levels of training and expertise (Whittaker 1993).

Periodontal disease

The bacteria within accumulations of plaque and tartar can infect the gingival tissues and cause inflammation – gingivitis (Hillson 1996). In consequence, the bone around the tooth is resorbed (destroyed) creating an increasing distance between the bone and the cemento–enamel junction of the tooth, and the tooth is eventually lost. This process is largely painless although symptoms include swelling of the gums and halitosis (Scully & Cawson 1996).

Of the teeth affected 37.1% (26/70) exhibit slight periodontal disease, 41.4% (29/70) had a moderate expression and 21.4% (15/70) had a severe form, all ages exhibited slight to moderate expressions but only older–middle and older adults had teeth with severe periodontal disease. It must be remembered that teeth may also continue to slowly erupt during life resulting in possible exposure of the roots of teeth above the alveolar bone making it difficult to assess the actual amount of bone loss due to periodontal disease (Hillson 1996, p.263).

Eleven individuals out of 14 adults with at least one tooth in a socket were affected by periodontal disease (78.6%), and 29.3% of adult teeth. More male individuals were affected but this was likely due to higher female ante–mortem tooth loss in older age considering the strong link between this disease and age found in clinical investigations (Hillson 1996, p.266). The adult CPR is higher than the majority of comparable sites, except Cross Bones (94.1%) and is most similar to the 75.2% at St Marylebone.

Dental enamel hypoplasia (DEH)

Dental defects of enamel are an important indicator of general health in a population as they represent a growth disruption in the enamel, resulting from stress such as malnutrition, disease or low birth weight (Lewis 2000). Defects are only accumulated during enamel formation, up to around the age of approximately twelve years and defects are observable as lines, grooves or pits on the surface of the crown (Hillson 1996). The number and type of defect was recorded as well as measurements of the location of the defect on each tooth (found in the site archive).

Pathology	Affected			Observable			TPR (%)		
	D	P	All	D	P	All	D	P	All
Calculus	5	22	27	102	88	190	4.9	25.0	14.2
Caries	5	4	9	102	88	190	4.9	4.6	4.7
Abscess	0	2	2	177	164	341	0	1.2	0.6
DEH	18	40	58	102	88	190	17.7	45.5	30.5

D = deciduous teeth
P = permanent teeth

Table 17

Non–adult dental pathology

Twelve adults (12/14) were affected by DEH and the lack of heavy wear and severe calculus in this assemblage made DEH visible even within the older age categories. The suggestion that individuals who suffered stress in the past do not live as long (Lewis 2007, p.106) is contradicted here as DEH does not decrease with age and a relatively high prevalence of DEH is present in older adults (5/8 older adults), although again this may be a result of small sample size which may have skewed the results. Defects were slightly more common in females teeth compared to male teeth and this was also found to be the case at St Martin's Church (33.73% versus 26.88%). Females therefore suffered to a greater extent from stress during childhood compared to males, or conversely they survived the period of stress whereas their male counterparts did not (Wood 1992). In the non–adult population seven individuals out of 13 with teeth had DEH including three young children, two older children and two adolescents. Two of these children (SK3158 & SK3551), both younger children, displayed the only pit type enamel hypoplasia in the assemblage, the rest being linear in form.

The most commonly affected permanent teeth were the canines in which there was a 67.4% prevalence (33/49). These teeth develop approximately between the ages of 6 months to seven years (Scheuer & Black 2004) and therefore children experienced stress to a greater extent during this time in their lives. In the deciduous dentition the canine was also the most commonly affected tooth (35.3%, 6/17) which develops from 5 months *in utero* until approximately nine months after birth (*ibid*.).

The overall prevalence of DEH is 74.1% (19/27) individuals affected and 29.8% of teeth. The West Bromwich population has a much greater prevalence than the 0.57% prevalence by individual for post–medieval sites in Britain (Roberts & Cox, 2003), and is more in line with the 68.82% CPR found at St Martin's Church.

Pathology	Affected			Observable			TPR (%)		
	M	F	All	M	F	All	M	F	All
Calculus	87	66	153	133	113	246	65.4	58.4	62.2
Caries	18	17	35	133	113	246	13.5	15	14.2
Abscess	8	3	11	235	305	540	2.6	0.6	2
AMTL	88	153	241	235	305	540	37.5	50.2	44.6
Periodontal disease	53	17	70	131	108	239	40.5	15.7	29.3
DEH	37	35	72	133	113	246	27.8	31	29.3

Table 18

Adult dental pathology

Dental wear

Occlusal wear was recorded using the system set out in Buikstra and Ubelaker (1994) and details are available in the site archive. One individual, skeleton (SK3182), had grooves present bilaterally between his mandibular canine and premolar teeth which are caused by habitual smoking of a clay pipe which was common in the 18th and 19th centuries. Four adults from Cross Bones and eleven from St Martin's had evidence of pipe grooves within their dentition At the latter site grooves were only observed in the dentition of those from earth–cut grave and not in those from vaulted burials which led Brickley *et al.* (2006, p.145) to conclude that 'smoking clay pipes was a lower status activity'.

Dental anomalies

Four adult individuals had congenitally absent third molars with 9.7% (7/72) of the total number of third molar tooth positions affected. Rotation of teeth occurred in three adults and one older child and in total six adult teeth of those in sockets (7/239) and one non–adult tooth (1/170) were affected. Four canines (mandibular) and three incisors were all rotated distally 35–50 degrees. Canines usually only have a single root however two individuals had a two–rooted left lower canine, an adolescent (SK3485) and a male adult (SK3270). The anomalies described above will have had little impact on the affected individual.

6. CONCLUSION

This Baptist community from West Bromwich seemed to have suffered an array of conditions that were prevalent during the 19th century, the diagnosis of which has increased our understanding of the life experience of these individuals. The amount of pathology present may be a result of high numbers of older adults, who having lived longer would have had more time to accumulate pathology (the osteological paradox). However the presence of child morbidity and a high child mortality rate may indicate a relatively harsh environment. Younger children would have succumbed to epidemics like cholera which swept through West Bromwich in the 1830s; such acute infection caused death before any skeletal changes could occur. It is however surprising that there was a relatively low prevalence of infection (apart from maxillary sinusitis, see below) observed in the skeletal remains.

Dental enamel hypoplasia certainly indicates that individuals were undergoing systematic stress from the initial stage of dental development *in utero* through to later childhood. This maybe a reflection of huge fluctuations in food prices, which were not reflected in wage rates in the early years of the 19th century (Roberts & Cox 2003). Adult height was similar to contemporary populations however children who are malnourished can undergo a period of catch–up growth once such stress has been overcome and still attain a normal adult stature. Iron deficiency was high, which may be related to a poor diet or malnutrition, as well as fashionable infant feeding practices during this period including wet nursing and the use of artificial feeds which replaced breast milk. The high prevalence of non–adult caries may support unhealthy infant feeding practices with excessively sweetened artificial feeds being employed.

West Bromwich was part of the 'Black Country' where a rapid increase in coal mining and large industry (especially iron) occurred during the 19th century and it is likely that many of its inhabitants were employed in such work. There were 14 iron–founding firms in 1834, probably employing over 1,500 workers, and by 1851 there were about 20 (Greenslade *et al.* 1976). Chimneys and factory smoke blocked out most of the sunlight in the towns; the use of steam to power machines meant burning coal which produced a lot of dirty, black smoke. A high degree of maxillary sinusitis in this population highlights the detrimental affected of such industry. The lack of sunlight may also have produced rickets and osteomalacia, although diet and cultural practices, such as swaddling of infants may also have had an effect on the prevalence of these diseases.

Degenerative changes in the spine were low although extra–spinal osteoarthritis rates relatively high. This may suggest that individuals within this population performed less labouring and carrying of heavy goods but could have been involved in labour–intensive works during this period such as spring, nail and gun making – the latter in 1820 was the principle source of employment in West Bromwich (Greenslade *et al.* 1976). Furthermore, within iron foundries both heavy and light industry was represented *eg* dressers' and polishers' work was performed in an upright position, was fairly strenuous but heavy lifting was uncommon (Partridge *et al.* 1968). However, it must be remembered that degenerative changes have a stronger correlation with advanced age (than activity) and the small sample size may have skewed results.

The presence of trauma and muscle strain within the community also indicates a working population and possible workplace injuries. Industrial accidents were frequent in ninetieth century factories with changes beginning in 1844 with a Factories Act passed which in effect was the first health and safety act in Britain. The presence of trauma and strain within the older children and adolescents in the assemblage indicates that they may have been undertaking manual labour; in the census of 1851 it states 'that children from the age of ten were often no longer scholars' but did their stint of work' (cited in Chitham 2009, p.121). Child labour was common in the early 19th century throughout Britain, when children worked as hard as adults but were cheaper to employ and easier to discipline (Kerby 2003).

Facial trauma and multiple fractures found within some individuals in the assemblage, could be work–related or could have occurred due to different mechanisms including social activities and 'injury recidivism' – where several injuries occur in the same individual over a period of time. Especially in young males of lower socio–economic status it is often associated with interpersonal violence (Judd 2002). Social activities in West Bromwich at the time did include riSKof injury with bull baiting as well as bare knuckle fighting being popular (Malcolmson 1973).

Financial means (social status) would have been critical in determining the nature of the environment to which an individual was exposed, with differing access to adequate food, water and health care as well as living and working conditions. The 'higher status' individuals however based on osteological evidence are very similar to the rest of the population. The sample size of these individuals is however very small and therefore patterns in the data cannot be seen, unlike for example at St Martin's where individuals from vaults experienced less trauma than those in earth–cut graves. The infant child exhibited healed rickets and the young adult female within the mort–safe suffered from a relatively rare malignant cancer. The other two adults examined had multiple pathologies, one exhibited Non-specific infection and both showed evidence of muscle strain, osteoarthritis and multiple fractures. They likely reflect the 'middling sort' in the 19th century which consisted of individuals who were involved in trades (rather than professions) and 'would have come from relatively humble backgrounds, and would have worked hard to establish their business' (Brickley *et al.* 2006, p.91). It is interesting that SK3378 had a dislocated shoulder that was not reduced and therefore she had not sought medical attention.

In West Bromwich a hospital was opened in the former Revivalist chapel in Spon Lane during the cholera epidemic, many hospitals were open in Birmingham (5 miles away) and a doctor could be employed privately in the 19th century if they could be afforded (Brickley *et al.* 2006). Furthermore, friendly societies were in existence from the 18th century to the late 19th century and subscription would have provided medical treatment to its members if required (Lane 2001). All healed fractures were well–aligned and although fractures can heal in a satisfactory manner with no medical intervention (Jurmain 1989), splits and casts (made with various substances *eg* plaster of Paris or starch) were used at this time (Hunt 1855, cited in Brickley *et al.* 2006). One adolescent individual underwent an autopsy in the assemblage, a practice which was increasingly popular during this period. A profuse amount of anatomy schools opened their doors during this period including one in Birmingham in 1825. The young (17–25 years) individual from the mort–safe exhibited a rare condition with unusual symptoms indicating that such individuals may have been targeted by 'body–snatchers' for dissection and advancement of medical knowledge.

Differences in health and activity between the sexes is hard to discern from such small a sample size and very tentative evidence indicates males had a greater degree of degenerative disease within their lower backs, a higher incidence of OA in their weight bearing joints as well as trauma to their lower legs. This may possible indicate differing activities between the sexes with differing risks involved. Females had a higher incidence of stress (enamel hypoplasia) during childhood, however male children suffered to a greater extent from iron deficiency (cribra orbitalia).

Poor dental health was rife during this period (Whittaker 1993) and the West Bromwich population was no exception; this was likely due to the higher degree of processed foods and cheaper sugar in the ninetieth century. Interestingly despite the high ante–mortem tooth loss and prevalence of caries no evidence of fillings or dentures were found. Such dental work has been observed in other contemporaneous sites *eg* Spitalfields and St Martin's, and their absence within this population may indicate that they could not be afforded.

There is both evidence to complement and refute information obtained from historical sources, but the analysis of the skeletal material from West Bromwich has given us an insight into the environment, health and mortality of a small Baptist community within this area during the 19th century.

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APPENDICES

Appendix 1 – Catalogue of on-site assessed skeletons

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
001	3001	25–50	Poor	Mod	No	–	–	Subad	Yes	–	–	–	–	–	–
002	3005	>75	Poor	Mod	Yes	–	9–12y	Oc	Yes	Dental erup, fusion	Hum: 215mm	–		–	–
003	3009	>75	Poor	High	No	–	–	Subad	Yes	–	–	–		–	–
004	3013	>75	Poor	High	No	–	<2y	Subad	Yes	Fusion	–	–		–	–
005	3017	>75	Good	Low	Yes	–	1.5–2m	N	Yes	Dental	–	–	Double burial with SK3018 in same coffin	–	–
006	3018	>75	Good	Low	Yes	–	B–1.5m	N	Yes	Dental	–	–	Double burial with SK3017 in same coffin	–	–
007	3022	50–75	Good	Low	Yes	–	30–32wks pn	P	Yes	Dental	–	–	Double burial with SK3023 in same coffin	–	–
008	3023	>75	Good	Low	Yes	–	B (40wkspn)	P	Yes	Dental	–	–	Double burial with SK3022 in same coffin	–	–
009	3029	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	Double burial with SK3096	–	–
010	3036	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Size of coffin indicates young juvenile
011	3040	>75	Good	Low	Yes	–	8–9y	Oc	Yes	Dental + fusion	L fem: 30.75cm	–	–	–	–
012	3045	50–75	Poor	High	No	–	2–3	Yc	Yes	Dental eruption	–	–	–	–	–
013	3053	25–50	Poor	High	No	–	6m +/–	I	Yes	Dental	–	–	–	–	–
014	3049	>75	Good	Low	Yes	F?	12–16y	Ao	Yes	Epip fusion	L fem 37.5cm	–	–	–	–
015	3057	>75	Poor	High	No	–	15–17	Ao	Yes	Epip fusion	–	–	–	–	–
016	3067	E	–	–	No	–	–	Subad	Yes	–	–	–	–	–	Coffin size – est neonate/ young juv
017	3065	E	–	–	No	–	–	Subad	Yes	–	–	–	D/t burial ? (With SK3579 + SK3587)	–	Coffin size – est neonate/ young juv
018	3074	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
019	3082	<25	Poor	High	No	–	1–2	Yc	Yes	Dental eruption	–	–	–	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
020	3078	<25	Poor	High	No	–	3y +/–	Yc	Yes	Dental eruption	–	–	–	–	–
021	3070	>75	Poor	High	No	M	–	Ad	No	–	–	–	Triple burial with SK3446 + SK3513	–	–
022	3086	<25	Poor	High	No	–	6m +/–	I	Yes	Dental	–	–	–	–	–
023	3096	E	–	High	No	–	–	Ad	No	–	–	–	Double burial with SK3029	–	–
024	3100	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Likely neonate by size of coffin
025	3094	50–75	Poor	High	No	M	35–44	O–m ad	No	R auricular	L fem: 44.5cm	–	–	–	–
026	3060	>75	Mod	Low	Yes	F	25–29	Y–m ad	No	–	–	–	–	–	–
027	3088	50–75	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	–
028	3124	E	–	–	No	–	–	Subad	Yes	–	–	–	–	–	–
029	3120	>75	Poor	High	No	F	17–25	Y ad	No	Dental wear + auricular	L fem: 42cm	–	–	–	–
030	3104	50–75	Poor	High	No	F	–	Ad	No	–	–	–	Double burial with SK3106	–	–
031	3106	<25	Poor	High	No	–	9m +/–	I	Yes	Dental	–	–	Double burial with SK3104	–	–
032	3110	50–75	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	–
034	3116	50–75	Poor	High	No	F	–	Ad	No	–	–	–	–	–	–
035	3132	25–50	Poor	High	No	–	3y +/–	Yc	Yes	Dental eruption	–	–	–	–	–
036	3148	E	–	–	No	–	–	Subad	Yes	–	–	–	–	–	–
037	3152	E	–	–	No	–	–	Subad	Yes	–	–	–	–	–	–
038	3136	>75	Good	Low	Yes	–	2–3y	Yc	Yes	Dental eruption	–	–	–	–	Hair
039	3138	25–50	Poor	High	No	–	–	Ad	No	–	L fem: 34cm, l tib: 32cm	–	–	–	–
040	3144	25–50	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
041	3159	<25	Poor	High	No	–	9m +/–	I	Yes	Dental	–	–	–	–	–
042	3126	>75	Poor	High	No	–	–	Ad	No	–	R fem: 48cm	–	Double burial with SK3505	–	Duplicate context number
043	3163	>75	Poor	High	No	M	–	Ad	No	–	R fem: 48cm	–	–	–	–
044	3170	<25	Poor	High	No	–	6–9m	I	Yes	Dental	–	–	–	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
045	3176	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	–
046	3156	>75	Good	Low	Yes	–	1y–18m	Yc	Yes	Dental eruption	–	–	Double burial with SK3158	–	Hair
047	3158	>75	Good	Low	Yes	–	1.5–2y	Yc	Yes	Dental eruption	–	–	Double burial with SK3156	–	–
048	3174	>75	Poor	Mod	Yes	M	50–59y	O ad	No	Auricular	L fem: 46.9cm	–	D/t burial with SK3522 (+ SK3266?)	–	Hair
049	3188	50–75	Poor	High	No	M	–	Ad	No	–	–	–	Double burial with SK3376	–	–
050	3192	E	–	–	No	–	–	Subad	Yes	–	–	–		–	–
051	3198	50–75	Poor	High	No	M	–	Ad	No	–	–	–	Double burial with SK3544	–	–
052	3204	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	Triple burial with SK3214 + SK3368	–	Coffin size suggest young juvenile
053	3182	>75	Good	Low	Yes	M	35–44	O–m ad	No	Auricular	–	–	Triple burial with SK3184 + SK3458	–	Mould
054	3184	>75	Poor	High	No	–	6m +/–	I	Yes	Dental eruption	–	–	Triple burial with SK3182 + SK3458	–	Mould
055	3196	>75	Poor	High	No	M?	25–29	Y–m ad	No	Auricular + medial clav	–	–	–	–	–
056	3212	E	–	–	No	–	–	Subad	Yes	–	–	–	–	–	–
057	3208	25–50	Poor	High	No	M?	–	Ad	No	–	–	–	–	–	–
058	3217	25–50	Poor	High	No	–	–	Ad	No	–	L fem: 49cm	–	–	–	–
059	3222	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	–
060	3214	>75	Poor	High	No	M	–	Ad	No	–	R fem: 41.8cm	–	Triple burial with SK3204 + SK3368	–	–
061	3228	<25	Poor	High	No	–	3y +/–	Yc	Yes	Dental eruption	–	–	–	–	–
062	3232	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
063	3236	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Size of coffin suggests young juvenile
064	3246	>75	Poor	High	No	M	–	Ad	No	–	R fem: 43cm	–	Double burial with SK3372	–	–
065	3252	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Size of coffin suggests a young juvenile

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
066	3244	50–75	Poor	High	No	M	–	Ad	No	–	L fem: 45cm	–	–	–	–
067	3240	E	–	–	No	–	–	Ad	No	–	–	–	–	–	–
068	3254	<25	Mod	High	No	–	–	Ad	No	–	–	–	–	–	–
069	3276	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Size of coffin indicates a juvenile
070	3256	<25	Poor	High	No	–	–	Ad	No	–	R fem: 43.3cm	–	–	–	–
071	3266	>75	Poor	Mod	Yes	M	45–49y	O ad	No	Pubic sym	L fem: 46cm	Enthesophytes	D/t burial ? (with SK3522 + SK3174)	–	Hair
072	3272	E	–	–	No	–	–	Subad	Yes	–	–	–	Triple burial with SK3270 + SK3499	–	–
073	3260	25–50	Poor	High	No	F	17–25	Y ad	No	Dental eruption + wear	–	–	Double burial with SK3262	–	–
074	3262	E	–	–	No	–	–	Subad	Yes	–	–	–	Double burial with SK3260	–	–
075	3279	E	–	–	No	–	–	Subad	Yes	–	–	–	Double burial with SK3311	–	–
077	3270	>75	Mod	Mod	Yes	M	25–29	Y–m ad	No	Dental wear + auricular	L fem: 43.9cm, L ct 35.72cm	–	Triple burial with SK3272 + SK3499	–	–
078	3296	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	Size of coffin + bone frags suggest younger child
079	3287	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
080	3284	50–75	Poor	High	No	M	–	Ad	No	–	–	–	–	–	–
081	3292	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
082	3300	E	–	–	No	–	–	Ad	No	–	–	–	–	–	–
083	3308	<25	Poor	High	No	–	–	Ad	No	–	–	–	Double burial with SK3584	–	–
084	3311	50–75	Mod	Mod	Yes	F	45–44	O–m ad	No	Auricular	L fem: 43cm	–	Double burial with SK3279	–	Hair
085	3316	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
086	3303	25–50	Poor	High	No	M	12–15y	Ao	Yes	Epip fusion	–	–	–	–	–
087	3320	>75	Poor	High	No	F	<30y	Ad	No	Dental wear	–	–	Double burial with SK3327	–	–
088	3327	25–50	Poor	High	No	F	–	Ad	No	–	–	–	Double burial with SK3320	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
089	3324	>75	Poor	High	Yes	–	10–11y	Oc	Yes	Epip fusion	L fem: 302cm	–	–	–	Hair
090	3332	<25	Mod	High	No	–	–	Ad	No	–	–	–	Double burial with SK3539	–	–
091	2011	50–75	Mod	High	No	–	–	Ad	No	–	–	–	–	–	From Phase 2– previously revealed
092	3335	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
093	3340	>75	Good	Low	Yes	–	2–3y	Yc	Yes	Dental eruption + fusion	L hum 119.1cm	–	–	–	–
094	3347	25–50	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
095	3344	>75	Poor	Mod	Yes	–	12–15y	Ao	Yes	Dental eruption	–	–	–	–	–
096	3351	50–75	Mod	High	No	–	12y +/–	Oc	Yes	Dental eruption	–	–	Double burial with SK3355	–	–
097	3364	25–50	Poor	High	No	–	–	Subad	Yes	–	–	–	–	–	–
098	3360	>75	Good	Low	Yes	F	25–29	Y–m ad	No	–	–	–	–	–	–
099	3368	25–50	Poor	High	No	F	–	Ad	No	Dental wear	L fem: 40.5cm, L tib: 32.5cm	–	Triple burial with SK3214 + SK3204	–	–
100	3372	25–50	Poor	High	No	–	–	Ad	No	–	–	–	Double burial with SK3246	–	–
101	3376	E	–	–	No	–	–	Ad	No	–	–	–	Double burial with SK3188	–	–
102	3378	>75	Good	Low	Yes	F	50–59	O ad	No	–	L fem 44.6cm, L tib: 36.65cm	–	Double burial with SK3469	Brick–lined tomb	–
103	3355	50–75	Poor	Mod	Yes	M	35–44	O–m ad	No	Auricular	–	–	Double burial with SK3351	–	–
104	3385	25–50	Poor	High	No	F	–	Ad	No	–	–	–	–	–	–
105	3393	50–75	Poor	High	No	F	50+	O ad	No	–	–	–	–	–	–
106	3401	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
107	3399	<25	Mod	High	No	–	1–3mths	N	Yes	Dental	–	–	–	–	–
108	3387	>75	Good	Mod	Yes	–	2–3y	Yc	Yes	Fusion	–	–	Double burial with SK3390	–	–
109	3390	25–50	Good	Mod	Yes	–	9m +/–	I	Yes	Dental	–	–	Double burial with SK3387	–	–
110	3409	<25	Mod	High	No	–	–	Subad	Yes	–	–	–	–	–	–
111	3414	50–75	Poor	Mod	Yes	F	45–49y	O ad	No	Auricular	–	–	–	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
112	3417	>75	Good	Mod	Yes	–	7–8y	Oc	Yes	Dental eruption + epip fusion	–	–	–	–	–
113	3437	50–75	Poor	High	No	M	–	Ad	No	Dental wear	–	–	–	–	–
114	3434	25–50	Mod	Mod	Yes	F	50+	O ad	No	–	–	–	–	–	–
115	3441	<25	Poor	High	No	F?	–	Ad	No	Dental wear	–	–	–	–	–
116	3449	E	–	–	No	–	–	Ad	No	–	–	–	–	–	–
117	3446	25–50	Poor	High	No	F	–	Ad	No	–	–	–	Triple burial with SK3070 + SK3513	–	–
118	3453	<25	Poor	High	No	–	3–5mths	I	Yes	Pars basilar length	–	–	–	–	–
119	3421	25–50	Poor	High	No	–	1–2y	Yc	Yes	Dental eruption	–	–	Triple burial with SK3425 + SK3429	–	–
120	3425	<25	Mod	High	No	–	–	Subad	Yes	–	–	–	Triple burial with SK3421 + SK3429	–	–
121	3429	>75	Mod	Mod	Yes	F	30–34	Y–m ad	No	–	–	–	Triple burial with SK3421 + SK3425	–	–
122	3469	50–75	Good	Mod	Yes	M	–	Ad	No	Dental wear only	–	–	Double burial with SK3378	Brick–lined tomb	Hair on mand– beard
123	3474	<25	Poor	High	No	–	3–5y	Yc	Yes	Fusion	–	–	–	–	–
124	3461	>75	Mod	Mod	Yes	F	50–59	O ad	No	Auricular	–	–	–	–	? SK3461 querry on sheet
125	3458	>75	Good	Low	Yes	M	14–16	Ao	Yes	Epip fusion	–	Craniotomy, sbo 4–5, stress leions clav+hum	Triple burial with SK3184 + SK3182	–	Caniotomy
126	3465	>75	Good	Low	Yes	F	40–44	O–m ad	No	No indicatorors but am loss/djd	–	Enthesophtes R+L, stress lesion r rad	–	–	–
127	3479	<25	Mod	High	No	M?	–	Ad	No	–	L fem: 46.7cm	–	Double burial with SK3483	Brick–lined tomb	–
128	3483	25–50	Mod	Low	Yes	–	1.5–3y	Yc	Yes	Epip fusion	–	L tib (+fem) ant bowing– signs of rickets	Double burial with SK3479	Brick–lined tomb	–
129	3490	50–75	Poor	High	No	–	7–8y	Oc	Yes	Dental eruption	–	–	–	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
130	3493	>75	Poor	High	No	M	–	Ad	No	–	R fem: 45cm	–	–	–	–
131	3500	<25	Mod	High	No	F	24+	Ad	No	Third molar present	–	–	–	–	–
132	3505	E	–	–	No	–	–	Ad	No	–	–	–	Double burial with SK3126	–	–
133	3509	<25	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
134	3513	E	–	–	No	–	–	Ad	No	–	–	–	Triple burial with SK3070 + SK3446	–	–
135	3522	E	–	–	No	–	–	Ad	No	–	–	–	D/t burial with SK3174 (+ SK 3266?)	–	–
136	3526	E	–	–	No	–	–	Ad	No	–	–	–	–	–	–
137	3529	50–75	Poor	High	No	M	25–40	Ad	No	–	–	–	–	–	–
138	3534	50–75	Mod	High	No	F	–	Ad	No	–	–	–	–	–	–
139	3519	50–75	Poor	High	No	–	–	Ad	No	–	–	–	–	–	–
140	3499	>75	Mod	Low	Yes	F	20–24	Y ad	No	Auricular + fusion	–	–	Triple burial with SK3272 + SK3270	–	Hair
141	3539	E	–	–	No	–	–	Ad	No	–	–	–	Double burial with SK3332	–	–
142	3547	25–50	Good	Mod	Yes	–	36–40wks pn	P	Yes	Dental	–	–	Triple burial with SK3551 + SK3555	–	–
143	3551	50–75	Good	Low	Yes	–	2y +/–	Yc	Yes	Dental	–	–	Triple burial with SK3547 + SK3555	–	Hair. Shroud.
144	3555	<25	Poor	High	No	–	–	Subad	Yes	–	–	–	Triple burial with SK3547 + SK3551	–	Infant/juvenile from size of grave
145	3486	25–50	Poor	Mod	Yes	F	17–25	Y ad	No	3rd molar erupting	–	Malignant cancer, parietal fenestrae	–	Mortar–safe	Hair.
146	3573	>75	Good	Low	Yes	M	35–44	O–m ad	No	Dental wear + fus	–	Ethesophytes	–	–	No context sheet
147	3579	>75	Good	Low	Yes	M	40–44	O–m ad	No	Auricular	–	–	D/t burial with SK3587 (+ SK3065?)	–	No context sheet
148	3544	Unexcav.	–	–	No	–	–	–	No	–	–	–	Double burial with SK3198	–	Only skull kept– rest of coffin not exca so % unknown
149	3569	50–75	Poor	High	No	M	–	Ad	No	–	–	–	–	–	–

SK no.	Context	%	P.	Frag.	Ana.	SEX	Age	Age cat.	Subad.	Technique	Long bone	SK other	Burial Type 1	Burial Type 2	Comments
150	3584	>75	Good	Low	Yes	M	–	Ad	No	Dental wear only	–	–	Double burial with SK3308	–	Only skull kept rest of body very poor
151	3587	>75	Good	Mod	Yes	F	50–59	O ad	No	Auricular	–	Enlarged parietals	D/t burial with SK3579 (+ SK 3065?)	–	Hair.

Appendix 2 – Summary catalogue of analysed skeletons

SK id	3005		
Preservation	G4	**Age category**	Older child
Completeness	>75%	**Age est.**	9–12 yrs
Fragmentation	Moderate	**Est. sex**	–
SK orien.	E–W	**Stature**	–
SK pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
12	PO	31	PO
13	PO	32	PO
14	PO	–	–
33	PO	–	–
15	PO	–	–
16	PO	34	PO
17	PO	35	PO
18	PU	36	PO
23	PO	–	–
37	PO	–	–
25	PO	–	–
26	PO	38	PU
27	PO	41	PO
42	PO	–	–
43	PO	–	–
44	PO	–	–
45	PO	–	–
46	PO	–	–
47	PO	–	–
48	PU	–	–

Dental pathology notes	24 teeth all PO; 27 tooth positions with 3 PU. 12/24 teeth with linear DEH; 3/24 with slight calculus.		
Skeletal pathology	Mild CO – R orbit (L–NP) fine foramina with vascular impressions. Bilateral humeral furrow stress lesions at pectorialis major attachment.		
Analysed by	JM	**Analysis date**	05/10/2011

SK id	3017		
Preservation	G2	**Age category**	Neonate
Completeness	>75%	**Age est.**	1.5–2 mths
Fragmentation	Low	**Est. sex**	–
SK orien.	E–W	**Stature**	–
SK pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
51	PU	71	PM
52	PU	72	PM
53	PM	–	–
73	PM	–	–
54	PM	–	–
55	PM	74	PM
75	PU	–	–
81	PU	–	–
82	PM	–	–
83	PM	–	–
84	PM	–	–
85	PU	–	–

Dental pathology notes	0 teeth; 15 deciduous tooth positions with 10 PM + 5 PU.		
Skeletal pathology	No skeletal pathology.		
Analysed by	TD	**Analysis date**	05/10/2011

SK id	3018		
Preservation	G2	**Age category**	Neonate
Completeness	>75%	**Age est.**	Birth–1.5 mths
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
51	PU	71	PM
52	PU	72	PM
53	PM	–	–
73	PM	–	–
54	PM	–	–
55	PM	74	PM
61	PM	75	PM
62	PM	81	PM
63	PM	–	–
82	PM	–	–
64	PM	–	–
65	PM	83	PM
84	PM	–	–
85	PM	–	–

Dental pathology notes	0 teeth; 20 deciduous tooth positions with 18 PM + 2 PU.		
Skeletal pathology	Endocranial new bone formation – lamellar bone with vascular impressions (healed) within frontal, parietals (frags) and occipital (cruciate) – widespread therefore poss. indictive of pathology rather than normal growth – poss. intercranial haemorrhage due to mineral deficiency.		
Analysed by	TD	**Analysis date**	05/10/2011

SK id	3022		
Preservation	G2	**Age category**	Perinate
Completeness	50–75%	**Age est.**	30–32 wks Prenatal
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty
71	PM
72	PM
73	PM
74	PM
75	PM
81	PM
82	PM
83	PM
84	PM
85	PM

Dental pathology notes	0 teeth; 10 deciduous tooth positions all PM.		
Skeletal pathology	No skeletal pathology.		
Analysed by	TD	**Analysis date**	05/10/2011

SK id	3023
Preservation	G2
Completeness	>75%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Perinate
Age est.	Birth
Est. sex	–
Stature	–

Dental inventory

Tooth	Q-ty
51	PM
52	PU
53	PU

Dental pathology notes	0 teeth; 3 deciduous tooth positions with 1 PM + 2 PU.
Skeletal pathology	No skeletal pathology.
Analysed by	TD
Analysis date	05/10/2011

SK id	3040
Preservation	G2
Completeness	>75%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Older child
Age est.	8–9 yrs
Est. sex	–
Stature	–

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
12	P	31	PO
32	PU	–	–
33	PU	–	–
36	PO	–	–
37	PU	–	–
41	PO	–	–
42	PU	–	–
43	PU	–	–
44	PU	–	–
46	PO	–	–
47	PU	–	–
74	PO	–	–
75	PO	–	–
84	PO	–	–
85	PO	–	–

Dental pathology notes	8 teeth – 4 deciduous + 4 permanent tooth all PO; 15 tooth positions – 4 decidious + 11 permanent teeth with 7 permanent teeth PU. 7/8 teeth – 3 permanent + 4 deciduous with slight calculus deposits.
Skeletal pathology	No skeletal pathology.
Analysed by	JM
Analysis date	05/10/2011

SK id	3049		
Preservation	G2	**Age category**	Adolescent
Completeness	>75%	**Age est.**	12–16 yrs
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental pathology notes	0 teeth; 0 tooth positions.		
Skeletal pathology	Non-specific infection – active woven bone on proximal medial R tibia and distal R fibula, as well as healed (unremodelled) lamellar bone on bilateral proximal posterior femoral surfaces.		
Analysed by	JM	**Analysis date**	05/10/2011

SK id	3060		
Preservation	G3	**Age category**	Younger middle adult
Completeness	>75%	**Age est.**	25–29
Fragmentation	Low	**Est. sex**	F
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PO	–	–	23	PO	38	PO
12	PO	31	PO	24	PO	41	PO
13	PO	32	PO	25	PO	42	PO
14	PM	–	–	26	PO	–	–
33	PO	–	–	43	PO	–	–
15	PO	–	–	27	PO	–	–
16	PO	34	PO	44	PO	–	–
17	PO	35	PO	28	PO	–	–
18	CA	36	PO	45	PO	–	–
21	PO	–	–	46	PO	–	–
37	PO	–	–	47	PO	–	–
22	PO	–	–	48	PE	–	–

Dental pathology notes:	29 teeth all PO; 32 tooth positions with 1 CA, 1 PM + 1 PE. 25/29 teeth with slight to moderate calculus; 7/29 with slight periodontal disease; 11/29 with linear DEH. Distal rotation of mandibular R central incisor and both canines and maxillary lateral incisors.		
Skeletal pathology	Mild CO– fine foramina.		
Analysed by	JM	**Analysis date**	19/10/2011

SK id	3136		
Preservation	G2	**Age category**	Younger child
Completeness	>75%	**Age est.**	2–3 yrs
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
16	PU	36	PU
26	PU	46	PU
51	PM	–	–
71	PO	–	–
52	PM	–	–
53	PO	72	PO
54	PO	–	–
55	PO	73	PO
61	PM	74	PO
62	PO	–	–
75	PO	–	–
63	PO	–	–
64	PO	81	PO
65	PO	82	PO
83	PO	–	–
84	PO	–	–
85	PO	–	–

Dental pathology notes	17 deciduous teeth all PO; 24 tooth positions – 20 decidious + 4 permanent with 3 deciduous PM + 4 permanent PU.		
Skeletal pathology	Slight medial bowing of the R + L fibulae.		
Analysed by	TD	**Analysis date**	05/10/2011

SK id	3156		
Preservation	G2	**Age category**	Younger child
Completeness	>75%	**Age est.**	1–1.5 yrs
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
13	PU	36	PU
23	PU	46	PU
51	PO	–	–
71	PO	–	–
52	PO	–	–
53	PE	72	PO
54	PE	73	PE
55	PU	74	PE
61	PO	–	–
75	PU	–	–
62	PM	–	–
63	PE	81	PM
64	PE	82	PO
65	PU	83	PM
84	PE	–	–
85	PU	–	–

Dental pathology notes	6 deciduous teeth all PO; 22 tooth positions – 20 decidious with 3 PM, 7 PE + 4 PU and 2 permanent PU.		
Skeletal pathology	Mild bilateral CO – fine foramina. Active rickets – posterior bending deformity of femora, tibiae and ulnae, bilateral coxa vara, shortened femur lengths for age, flaring of sternal rib ends, marked roughening of bone underlying epiphyseal growth plates at distal femora and prox radi.		
Analysed by	JM	**Analysis date**	06/10/2011

SK id	3158		
Preservation	G2	**Age category**	Younger child
Completeness	>75%	**Age est.**	1.5–2 yrs
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
16	PU	36	PU
26	PU	46	PU
51	PO	–	–
71	PO	–	–
52	PO	–	–
53	PO	72	PO
54	PO	73	PO
55	PO	74	PO
61	PO	–	–
75	PE	–	–
62	PO	–	–
63	PO	81	PO
64	PO	82	PM
65	PO	83	PO
84	PO	–	–
85	PE	–	–

Dental pathology notes	17 deciduous teeth all PO; 24 tooth positions – 20 decidious with 1 PM + 2 PE and 4 permanent all PU. 4/17 deciduous teeth with pit-type DEH.		
Skeletal pathology	Mild bilateral CO – fine foramina.		
Analysed by	TD	**Analysis date**	05/10/2011

SK id	3174		
Preservation	G4	**Age category**	Older adult
Completeness	>75%	**Age est.**	50–59
Fragmentation	Moderate	**Est. sex**	M
SK. orien.	E–W	**Stature**	173.032
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PM	31	PM	23	AM	41	PO
12	AM	32	PO	24	AM	42	PO
13	AM	–	–	25	AM	–	–
33	PO	–	–	43	PO	–	–
14	PO	–	–	26	AM	–	–
15	AM	34	PO	44	PO	–	–
16	AM	35	AM	27	AM	–	–
17	PO	36	AM	28	AM	45	AM
18	PO	–	–	46	AM	–	–
37	AM	–	–	47	AM	–	–
21	PM	–	–	48	AM	–	–
22	AM	38	AM				

Dental pathology notes	10 teeth all PO; 32 tooth positions with 18 AM + 4 PM. 8/10 teeth with slight to severe calculus; 4/10 with caries; 1/32 with an abscess; 4/10 with severe periodontal disease; 5/10 with linear DEH.		
Skeletal pathology	Bilateral maxillary sinusitis – speculed bone formation. Enthesophytes – L		
Analysed by	JM	**Analysis date**	07/10/2011

SK id	3182
Preservation	G1
Completeness	>75%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Older middle adult
Age est.	40–44
Est. sex	M
Stature	162.322

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	AM	31	PM	41	PO	–	–
12	AM	32	PM	23	AM	–	–
13	AM	33	PO	24	AM	42	PO
14	AM	34	AM	25	AM	43	PO
15	AM	–	–	26	AM	44	PO
35	PO	–	–	27	AM	–	–
16	AM	–	–	45	PO	–	–
17	AM	36	PM	28	AM	–	–
18	AM	37	AM	46	AM	–	–
21	AM	38	AM	47	AM	–	–
22	AM	–	–	48	AM	–	–

Dental pathology notes	7 teeth all PO; 32 tooth positions with 21 AM + 4 PM. 7/7 teeth with slight to moderate calculus; 5/7 PO with severe periodontal disease; 5/7 teeth exhibit linear DEH; Pipe smoking facet present on mandibular L canine and right Pm4
Skeletal pathology	Healed fractures to both tibiae and the right fibula, with secondary infection – osteomyelitis of both tibiae with cloacae at fracture sites. Healed nasal fracture – distal section of bones deviate to the right below
Analysed by	JM
Analysis date	03/11/2011

SK id	3266
Preservation	G4
Completeness	>75%
Fragmentation	Moderate
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Older adult
Age est.	45–59
Est. sex	M
Stature	170.89

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	AM	31	AM
12	AM	41	AM
13	AM	–	–
47	AM	–	–
14	AM	–	–
15	AM	48	AM
21	AM	–	–
22	AM	–	–
23	AM	–	–
24	AM	–	–

Dental pathology notes	0 teeth; 13 tooth positions with 13 AM.
Skeletal pathology	Mild CO-bilateralfine foramina. OA– bilateral acetabula, left knee (fem + Tib) , right knee (patella + fem – grooved surfaces), c1–c2 articulation.
Analysed by	TD
Analysis date	07/10/2011

SK id	3270		
Preservation	G3	**Age category**	Younger middle adult
Completeness	>75%	**Age est.**	25–29
Fragmentation	Moderate	**Est. sex**	M
SK. orien.	E–W	**Stature**	165.892
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PO	22	PO	38	PO
12	PO	32	PO	23	PO	41	PO
13	PO	–	–	24	PO	42	PO
33	PO	–	–	25	PO	–	–
14	PM	–	–	43	PO	–	–
15	PM	34	PO	26	PO	44	PO
16	PO	35	PO	27	PO	45	PO
17	PO	36	PO	28	PO	–	–
18	PO	–	–	46	PO	–	–
37	PO	–	–	47	PO	–	–
21	PO	–	–	48	PO	–	–

Dental pathology notes	30 teeth all PO; 32 tooth positions with 2 PM. 29/30 teeth with slight to severe calculus; 4/30 with caries; 6/30 with slight periodontal disease; 2/30 exhibiting linear DEH. Double rooted lower L canine.		
Skeletal pathology	Mild bilateral CO – fine foramina. PO – moderate expression on occipitals and healed on parietals. Schmorl's nodes T8–11. Complete spondylolysis L5. Peri-mortem fracture of R prox-mid shaft femur – sharp edges, hinging, fracture lines radiating sup and inf from break, broken ends are angled and jagged. Mild lateral bowing of tibiae – healed rickets. Muscular stress lesions – L costoclav (strong), bialteral pectoralis major (mod).		
Analysed by	JM	**Analysis date**	07/10/2011

SK id	3311		
Preservation	G3	**Age category**	Older middle adult
Completeness	50–75%	**Age est.**	40–44
Fragmentation	Moderate	**Est. sex**	F
SK. orien.	E–W	**Stature**	160.31
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	AM	31	PM
12	AM	33	PO
13	PM	–	–
34	PO	–	–
14	PO	–	–
15	AM	41	PM
16	AM	42	PM
17	AM	43	PO
18	AM	–	–
44	AM	–	–
22	PM	–	–
23	PO	45	AM
24	AM	46	AM
25	AM	47	AM
26	AM	–	–
48	AM	–	–
27	AM	–	–
28	AM	–	–

Dental pathology notes	5 teeth all PO; 26 tooth positions with 16 AM + 5 PM. Linear DEH. 3/5 with slight to moderate calculus; 3/5 with caries; 4/5 with moderate to severe periodontal disease.		
Skeletal pathology	Schmorl's node T4. Healed depression fracture (?) to the left frontal bone. Enthesophyte – R ulna brachialis (faint).		
Analysed by	TD	**Analysis date**	07/10/2011

SK id	3324		
Preservation	G4	**Age category**	Older child
Completeness	>75%	**Age est.**	10–12 yrs
Fragmentation	Moderate	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PM	31	PM	23	PE	41	PM
12	PE	32	PM	24	PU	42	PO
13	PE	–	–	25	PE	–	–
33	PM	–	–	43	PE	–	–
14	PU	–	–	26	PO	–	–
15	PE	34	P	44	PO	–	–
16	PO	35	P	27	PO	–	–
17	PO	36	PO	28	PU	45	PE
18	PO	–	–	46	PO	–	–
37	PM	–	–	47	PE	–	–
21	PM	–	–	48	PM	–	–
22	PM	38	PM	85	PO	–	–

Dental pathology notes	11 teeth – 10 permanent with 8 PO + 1 deciduous PO; 31 tooth positions – 1 deciduous + 30 permanent with 10 PM, 8 PE and 4 PU. 1/11 teeth with slight calculus; 1/11 with caries; 1/31 with an abcess. Distal rotation of lower permanent R canine. Overcrowding R maxilla – erupting second incisor forcing canine to erupt in a distal direction.
Skeletal pathology	Mild PO– bilateral occipital.

Analysed by	JM	**Analysis date**	07/10/2011

SK id	3340		
Preservation	G2	**Age category**	Younger child
Completeness	>75%	**Age est.**	2–3 yrs
Fragmentation	Low	**Est. sex**	–
SK. orien.	E–W	**Stature**	
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
16	PU	36	PU
26	PU	46	PU
51	PM	–	–
71	PM	–	–
52	PM	–	–
53	PM	72	PO
54	PO	73	PM
55	PO	74	PO
61	PM	–	–
75	PO	–	–
62	PO	–	–
63	PM	81	PM
64	PO	82	PO
65	PO	83	PO
84	PO	–	–
85	PO	–	–

Dental pathology notes	20 deciduous teeth all PO; 24 tooth positions – 20 deciduous with 8 PM + 4 permanent all PU. 5/20 teeth exhbiting linear DEH.
Skeletal pathology	Mild bilateral CO– fine foramina.

Analysed by	JM	**Analysis date**	10/10/2011

SK id	3344		
Preservation	G4	**Age category**	Adolescent
Completeness	>75%	**Age est.**	12–15 yrs
Fragmentation	Moderate	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
12	PM	31	PM
13	P	32	PM
14	PO	–	–
33	PM	–	–
15	PO	–	–
16	PO	34	PM
17	PO	35	PO
18	PE	36	PO
22	PM	–	–
37	PO	–	–
23	PM	–	–
24	PM	38	PU
25	PO	41	PM
26	PO	42	PM
27	PO	–	–
43	PO	–	–
28	PO	–	–
44	PO	–	–
45	PO	–	–
46	PO	–	–
47	PO	–	–
48	PU	–	–

Dental pathology notes	16 teeth with 15 PO; 29 tooth positions with 10 PM, 2 PE + 2 PU. 5/16 teeth with linear DEH.		
Skeletal pathology	Rickets – L femur anterior bowing and M–L flattening (R femur normal), flattening of the bone beneath the femur heads (coxa vara), proximal tibiae slight medial bowing with woven bone on concave side of bend-healing/healed rickets.		
Analysed by	TD	**Analysis date**	10/10/2011

SK id	3355		
Preservation	G4	**Age category**	Older middle adult
Completeness	50–75%	**Age est.**	35–44
Fragmentation	Moderate	**Est. sex**	M
SK. orien.	E–W	**Stature**	165.56
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	P	31	PO
21	P	32	PO
33	PO	–	–
34	PO	–	–
35	PO	–	–
36	AM	–	–
41	PO	–	–
42	PO	–	–
43	PO	–	–
44	PO	–	–
45	PO	–	–
46	AM	–	–
47	AM	–	–
48	PO	–	–

Dental pathology notes	13 teeth with 11 PO; 14 tooth positions with 3 AM. 2/13 teeth with slight calculus; 6/13 with linear DEH.		
Skeletal pathology	Mild PO bilateral parietals. Non-specific infection – L tibia anterio-medial mid-shaft exhibits a raised area of irregular lamellar bone-healed.		
Analysed by	JM	**Analysis date**	10/10/2011

SK id	3360		
Preservation	G2	**Age category**	Younger middle adult
Completeness	>75%	**Age est.**	25–29
Fragmentation	Low	**Est. sex**	F
SK. orien.	E–W	**Stature**	156.336
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PM	22	PO	38	CA
12	PO	32	PM	23	PO	41	PO
13	PO	–	–	24	PO	42	PO
33	PO	–	–	25	PO	43	PO
14	PO	–	–	26	PO	44	PM
15	AM	34	PO	27	PO	–	–
16	AM	35	PO	45	PO	–	–
17	PO	36	PO	28	CA	–	–
18	CA	–	–	46	PO	–	–
37	AM	–	–	47	AM	–	–
21	PO	–	–	48	CA	–	–

Dental pathology notes	21 teeth all PO; 32 tooth positions with 4 CA, 4 AM + 3 PM. 12/21 teeth with slight to severe calculus; 12/21 with caries; 2/32 with an abscess; 3/21 with slight to moderate periodontal disease; 9/21 with linear DEH. Distal rotation of upper L seconf incisor.
Skeletal pathology	Maxillary sinusitis– bilateral specules of new bone formation. Hallux valgus left MT1–phalange (R – NP). T12 transitional vertebra. SBO S1–S2.

Analysed by	TD	**Analysis date**	10/10/2011

SK id	3378		
Preservation	G2	**Age category**	Older adult
Completeness	>75%	**Age est.**	50–59
Fragmentation	Low	**Est. sex**	F
SK. orien.	E–W	**Stature**	166.424
SK. pos.	Extended Supine		
Grave type	2		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	AM	31	AM	23	AM	41	AM
12	AM	32	AM	24	AM	42	AM
13	AM	–	–	25	AM	–	–
33	AM	–	–	43	AM	–	–
14	AM	–	–	26	AM	–	–
15	AM	34	AM	44	AM	–	–
16	AM	35	AM	27	AM	–	–
17	AM	36	AM	28	AM	45	AM
18	AM	–	–	46	AM	–	–
37	AM	–	–	47	AM	–	–
21	AM	–	–	48	AM	–	–
22	AM	38	AM				

Dental pathology notes	0 teeth; 32 tooth positions all AM – edentulous maxilla and mandible.
Skeletal pathology	Dislocation of R shoulder joint – formation of new joint anterior to glenoid, humeral head deformation and humeral shaft displays lateral–anterior bowing as a result + secondary OA. T3–T4 fusion of R facets and ossification of costotransverse ligament fusing R transverse processes of T2–T4 and fusion to ribs to T3–4 vertebrae – MOT – related to the right–side trauma that resulted in dislocation of the shoulder (?). Hallux Valgus. Maxillary sinusitis– bilateral specule formation and porosity. SBO S3–5. Enthesophytes across the skeleton recorded. Accessory facet on L.

Analysed by	JM	**Analysis date**	10/10/2011

SK id	3387		
Preservation	G2	**Age category**	Younger child
Completeness	>75%	**Age est.**	2–3 yrs
Fragmentation	Moderate	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
16	PU	36	PU
26	PU	46	PU
51	PM	–	–
71	P	–	–
52	PM	–	–
53	PM	72	P
54	PO	73	PO
55	PO	74	PO
61	PO	–	–
75	PO	–	–
62	PO	–	–
63	PO	81	PO
64	PO	82	PO
65	PO	83	PO
84	PO	–	–
85	PO	–	–

Dental pathology notes	17 deciduous teeth with 15 PO; 22 tooth positions – 18 deciduous with 3 PM + 4 Permanent all pu.		
Skeletal pathology	Long bone length short for dental age. Supernunnary thoracic vertebra.		
Analysed by	TD	**Analysis date**	11/10/2011

SK id	3390		
Preservation	G2	**Age category**	Infant
Completeness	25–50%	**Age est.**	9 mths
Fragmentation	Moderate	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty
63	PU
64	PU
65	PU

Dental pathology notes:	0 teeth; 3 deciduous tooth positions all PU.		
Skeletal pathology	Mild CO L orbit (R – NP) – fine foramina and capillary–like impressions. Moderte PO bilateral parietals and left frontal bone. Flared rib ends.		
Analysed by	TD	**Analysis date**	11/10/2011

SK id	3414		
Preservation	G4	Age category	Older adult
Completeness	50–75%	Age est.	45–49
Fragmentation	Moderate	Est. sex	F
SK. orien.	E–W	Stature	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty
31	AM
32	AM
33	AM
34	AM
35	AM
36	AM
37	AM
38	AM
41	AM
42	AM
43	AM
44	AM
45	AM
46	AM
47	AM
48	AM

Dental pathology notes	0 teeth; 16 tooth positions all AM – edentulous mandible.		
Skeletal pathology	Slight posterior lateral bowing of tibiae – possibly healed rickets.		
Analysed by	JM	Analysis date	11/10/2011

SK id	3417		
Preservation	G2	Age category	Older child
Completeness	>75%	Age est.	7–8 yrs
Fragmentation	Moderate	Est. sex	–
SK. orien.	E–W	Stature	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	PO	31	P
12	PE	32	P
15	PU	–	–
33	PE	–	–
16	PO	–	–
17	PU	36	PO
21	PO	37	PU
22	PE	41	P
23	PU	–	–
42	P	–	–
24	PU	–	–
26	PO	43	PE
27	PU	46	PO
53	PO	47	PU
54	PO	–	–
74	PO	–	–
55	PO	–	–
75	PO	–	–
63	P	–	–
64	P	83	P
65	PO	84	PO
85	PO	–	–

Dental pathology notes	21 teeth – 10 permanent with 6 PO + 11 deciduous with 7 PO; 24 tooth positions – 7 deciduous and 17 permanent with 4 PE + 7 PU. 1/21 teeth with slight calculus; 10/21with linear DEH.		
Skeletal pathology	Stress lesions – bilateral clavicles at costoclavicular attachment (strong).		
Analysed by	JM	Analysis date	11/10/2011

SK id	3429		
Preservation	G3	**Age category**	Younger middle adult
Completeness	>75%	**Age est.**	30–34
Fragmentation	Moderate	**Est. sex**	F
SK. orien.	E–W	**Stature**	166.934
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PO
12	PO	32	PO
13	PO	–	–
33	PO	–	–
14	PO	–	–
15	PO	34	PO
16	PO	35	PO
17	PO	37	P
21	PO	–	–
41	PO	–	–
22	PO	–	–
23	P	42	PO
24	P	43	PO
26	P	44	PO
28	P	–	–
45	PO	–	–
47	PO	–	–

Dental pathology notes	25 teeth with 20 PO; 20 tooth positions. 8/25 teeth with slight calculus; 1/25 with caries; 2/25 with linear DEH.		
Skeletal pathology	Maxillary sinusitis – right sinus (L– NP). Hallux valgus.		
Analysed by	TD	**Analysis date**	11/10/2011

SK id	3434		
Preservation	G3	**Age category**	Older adult
Completeness	25–50%	**Age est.**	50+
Fragmentation	Moderate	**Est. sex**	F
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty
31	AM
32	AM
33	AM
34	AM
35	AM
36	AM
41	AM
42	AM
43	AM
44	AM
45	AM
46	AM
47	AM
48	AM

Dental pathology notes	0 teeth; 14 tooth pos.itios all AM.		
Skeletal pathology	PO-bilateralparietals, healed. Schmorl's node T4/5? Degenerative disc disease S1, fused fragments of thoracic vertebral bodies (unkown pos.ition– mid–thoracic). OA– facets of C5 + L4, fusion of L rib (mid–thoracic) to vertebral coastal facets. Bilateral slight lateral bowing of the femora and M–L flattening – pos.sibly healed rickets. Enthesophytes – bilateral humeral deltoid (moderate), tibial soleus (strong), costoclavicular (moderate), rectus femoris R patella (moderate). Stress lesion – bilateral faint furrow at.		
Analysed by	TD	**Analysis date**	11/10/2011

SK id	3458		
Preservation	G2	Age category	Adolescent
Completeness	>75%	Age est.	14–16 yrs
Fragmentation	Low	Est. sex	M?
SK. orien.	E–W	Stature	–
SK. pos.	Extended Supine		
Grave type			

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	AM	31	PO	22	PO	–	–
12	PM	32	PO	23	PO	41	PO
13	PO	–	–	24	PO	42	PO
33	PO	–	–	25	PO	43	PO
14	PO	–	–	26	PO	–	–
15	PO	34	PO	44	PO	–	–
16	PO	35	PO	27	PO	–	–
17	PO	36	PO	45	PO	–	–
21	AM	–	–	46	PM	–	–
37	PO	–	–	47	PO	–	–

Dental pathology notes: 24 teeth all PO; 28 tooth positions with 4 PM. 15/24 teeth exhibit slight to severe calculus; 3/24 with caries; 1/28 tooth positions with an abcess present; 13/24 teeth with linear DEH. Distal rotation of mandibular R Pm4. L mandibular canine double rooted.

Skeletal pathology: Mild bilateral CO – fine foramina. Mild PO bilateral parietals + occipitals. Craniotomy– an oblique cut has been made through the skull immediately superior to brow ridges, along sqamous suture of parietal bones, to area just superior to nuchal crest. ; 'nick' marks seen on R parietal superior to mastoid where tool may have slipped. Two long parallel vertical cuts were also made down the arches of C4 to L4 – at the laminae so that the spinous processes were sperated; T4–T10 have 'nick' marks. DJD– prox MT. Well.

Analysed by	JM	Analysis date	12/10/2011

SK id	3461		
Preservation	G2	Age category	Older adult
Completeness	>75%	Age est.	50–59
Fragmentation	Moderate	Est. sex	F
SK. orien.	E–W	Stature	158.39
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty
31	AM
32	AM
33	AM
34	AM
35	PM
36	AM
37	AM
38	AM
41	AM
42	AM
43	AM
44	AM
45	AM
46	AM
47	AM
48	AM

Dental pathology notes: 0 teeth; 16 tooth positions with 15 AM + 1 PM.

Skeletal pathology: Poss. osteomalacia – fracture of R scapula with an incomplete brake at inferor border just inferior to glenoid extending in a diagonal direction towards the superior angle to a pos.ition just inferior to the blade, two radiating fracture lines from the inferior edge of the brake towards the medial border, woven bone is present around the brake indicating the beginning stages of callus formation. The scapula body also exhibits a slight (abnormal) posterior curve. Furthermore multiple rib fractures – 10 healing R Rib fractures– 3 with lamellar and woven bone callus + 7 with thin woven callus; 5 L rib fractures– 3 lamellar and woven callus + 2 thin woven callus– this is evidence of two episodes of rib fracturing (unknow rib numbers as frags only). Healed avulsion fracture of the posterior process.

Analysed by	TD	Analysis date	12/10/2011

SK id	3465		
Preservation	G1	**Age category**	Older middle adult
Completeness	>75%	**Age est.**	40–44
Fragmentation	Low	**Est. sex**	F
SK. orien.	E–W	**Stature**	156.069
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	AM	31	AM	23	AM	41	AM
12	AM	32	AM	24	AM	42	AM
13	AM	–	–	25	AM	–	–
33	AM	–	–	43	PM	–	–
14	AM	–	–	26	AM	–	–
15	AM	34	PM	44	PO	–	–
16	AM	35	PM	27	AM	–	–
17	AM	36	AM	28	AM	45	AM
18	AM	–	–	46	AM	–	–
37	AM	–	–	47	AM	–	–
21	AM	–	–	48	AM	–	–
22	AM	38	AM				

Dental pathology notes	1 tooth PO; 32 tooth positions with 28 AM and 3 PM. 1/1 with slight calculus; 1/32 with an abscess; 1/1 with slight periodontal disease.
Skeletal pathology	Mild PO-bilateraloccipitals. Button osteoma R frontal bone at region of frontal boss. T8 + L4– mild lateral wedging to right side of body; L1–4 mild biconcave compression fractures – poss. osteoporosis. Healed non–speific infection– R tibial shaft and L distal fibular shaft. Schmorl's nodes T7–9. Marginal vertebral body osteophytes T4,T10,L1–2, L4 + S1. OA – T4–5 and T9 facets and right hand (prox phalange of MC1). SBO S4–5. Enthesophytes – Bilateral humerii c. flexor origin, bilateral pectoralis major inserts, L radial biceps (all moderate) and bilateral radii pronator teres attachments (faint). MT2,3 and 4– dorsal interosseous muscel attchments (moderate).

Analysed by	JM	**Analysis date**	12/10/2011

SK id	3469		
Preservation	G2	**Age category**	Younger middle adult
Completeness	50–75%	**Age est.**	25–35
Fragmentation	Moderate	**Est. sex**	M
SK. orien.	E–W	**Stature**	173.372
SK. pos.	Extended Supine		
Grave type	2		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PO	23	PO	41	PO
12	PO	32	PO	24	PO	42	PO
13	PO	–	–	25	AM	–	–
33	PO	–	–	43	PO	–	–
14	PO	–	–	26	PO	–	–
15	AM	34	PO	44	PO	–	–
16	PO	35	PO	27	PO	–	–
17	PO	36	AM	28	AM	45	PO
18	PO	–	–	46	PO	–	–
37	AM	–	–	47	PO	–	–
21	PO	–	–	48	AM	–	–
22	PM	38	AM				

Dental pathology notes	24 teeth all PO; 32 tooth positions with 7 AM + 1 PM. 10/24 with slight to moderate calculus; 4/24 with caries; 16/24 with slight to moderate periodontal disease; 8/24 with linear DEH.
Skeletal pathology	Patches of hair present on Mandible – beard. Non-specific infection– Left proximal tibia active woven bone; L fibula woven and lamellar bone– chronic; R tibia and fibula enlarged shaft and irregular porotic lamellar on bone surface (healed). Fracture of distal epiphysis of L fibula– healed transverse fracture. Fracture of left cuboid– at superior asepect through the superior area of medial facet and calcaneous facet– healed with secondary OA in tarsals (cuboid + calcaneus). Fracture of right proximal MT2 shaft– healed with slight angulation in plantar direction. OA– left distal.

Analysed by	TD	**Analysis date**	12/10/2011

SK id	3483
Preservation	G3
Completeness	25–50%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	2
Age category	Younger child
Age est.	1.5–3 yrs
Est. sex	–
Stature	–

Dental pathology notes	0 teeth; 0 tooth positions.
Skeletal pathology	Rickets– Left tibia anterior bowing; Right tibia has some pos.t–mortem alteration but anterior bowing and M–L flattening – sabre shin; L distal epiphyseal surface of tibia some pos.t–mortem damage but central indentation of surface present. No porosity or roughening of bone under epiphyseal surface of L tibia – not active.
Analysed by	TD
Analysis date	13/10/2011

SK id	3486
Preservation	G4
Completeness	25–50%
Fragmentation	Moderate
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	3
Age category	Young adult
Age est.	17–25
Est. sex	F
Stature	–

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PM	31	PO	37	PO	–	–
12	PO	32	PO	21	PM	–	–
13	PO	–	–	22	PO	38	PE
33	PO	–	–	23	PM	41	PO
14	PM	–	–	24	PM	42	PO
15	PO	34	PO	25	PO	–	–
16	PO	35	PO	26	PO	–	–
17	PO	36	PO	27	PO	–	–
18	PM	–	–	28	PU	–	–

Dental pathology notes	18 teeth all PO; 26 tooth positions with 6 PM, 1 PE + 1 PU. 13/18 with slight calculus; 2/18 with moderate periodontal disease; 7/18 with linear DEH. Distal rotation of R + L canines in maxilla and mandible.
Skeletal pathology	Langerhans Cell Histiocytosis (LEH) – circular lesion on endocranial surface of skull at R frontal at region of temporal line, it has internally scalloped margins and osteoblastic activity surrounding the lesion 'crater–like' lesion (14.47x14.97mm), it has just penetrated the outer table ; large lytic lesion which has dest. royed the greater wing of the right sphenoid; another lesion on the left frontal superior to brow ridge and posterior to lesser sphenoidal wing (damaged pos.t–mortem but a partial lesion still remians) consisiting of a longer scalloped lesin with no osteoblastic activity but with capillary impressions at its borders (*c.* 35.50x19.41mm); small lytic lesion on occipital, posterior to sella tursica (5.54x2.58mm); circular lytic lesion also present on sella tursica; Left parietal fenest. rae displays osteoblastic activity on endocranial surface with capillary impressions at its borders– specules of bone within fenest. rae may have been affected by disease; scooped–out lytic lesion with osteoblast activity on right femur anterior neck (9.26x5.94mm); Right pelvis scooped–out lytic lesion superior to ischial tuberosity (32.85x20.79mm) and another lesion on arcuate line – a acooped–out appareance is identifiable internally which has just penetrated the cortical bone; vertebral scooped–out lytic lesions – C1,C5,T7 pedicles and lamina and T12,L1–2, L4–5 bodies affected. Parietal fenest. rae – bilateral at region of parietal foramen with bevelled margins, oval in shape with.
Analysed by	JM
Analysis date	13/10/2011

SK id	3499		
Preservation	G3	**Age category**	Young adult
Completeness	>75%	**Age est.**	20–24
Fragmentation	Low	**Est. sex**	F
SK. orien.	E–W	**Stature**	155.05
SK. pos.	Extended Supine		
Grave type	1		

Dentan inventory

Tooth	Q-ty	Tooth	Q-ty
11	PM	31	PM
12	PM	32	PM
13	PM	–	–
33	PO	–	–
14	PO	–	–
15	PO	34	PM
16	PO	35	PO
17	PO	36	PO
18	CA	–	–
37	PO	–	–
21	PM	–	–
22	PM	38	PU
23	PM	41	PM
24	PM	42	PM
25	PM	–	–
43	PM	–	–
26	PO	44	PO
27	PO	45	PO
46	PO	–	–
47	PO	–	–
48	PU	–	–

Dental pathology notes	14 teeth; 31 tooth positions with 1 CA, 14 PM + 2 PU. 4/14 with slight calculus; 1/14 with caries; 5/14 with linear DEH.
Skeletal pathology	Shroud or coffin fabric adhering to skull. Ethesophytes– bilateral calcaneal achilles tendon inserts and triceps of ulnae (faint). Muscular stress lesions– bilateral brachialis of ulnae (faint). Accesory sacral facet left (R– NP).

Analysed by	TD	**Analysis date**	13/10/2011

SK id	3547		
Preservation	G1	**Age category**	Perinate
Completeness	25–50%	**Age est.**	36–40 wks prenatal
Fragmentation	moderate	**Est. sex**	–
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type			

Dental inventory

Tooth	Q-ty
71	P
74	P
81	P
84	P
85	P

Dental pathology notes	5 decidious teeth all PO; 0 tooth positions.
Skeletal pathology	Possible Scurvy– new layer of woven bone formation at superaspinous fossa of L scapula, in orbital roofs (bilateral) coupled with mild pos.rosity, on endocranial surface of frontal at region of R + L frontal bosses (although this may be noraml growth). There is also mild porosity on an ectocranial skull fragment (parietal?), moderate porosity on the body and lesser wings of sphenoid and new bone formation on the lateral + medial surfaces of L greater wing. C5 R lamina and C6 R+L lamina have small areas of new.

Analysed by	JM	**Analysis date**	13/10/2011

SK id	3551
Preservation	G2
Completeness	50–75%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Younger child
Age est.	2 yrs
Est. sex	–
Stature	–

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
16	PU	36	PU
26	PU	46	PU
51	PO	–	–
71	PO	–	–
52	PO	–	–
53	PO	72	PO
54	PO	73	PE
55	PE	74	PO
61	P	–	–
75	PE	–	–
63	P	–	–
64	P	81	PO
65	PE	82	PM
83	PM	–	–
84	PO	–	–
85	PE	–	–

Dental pathology notes	12 deciduous teeth with 9 PO; 20 tooth positions – 16 deciduous with 2 PM + 5 PE and 4 permanent all PU. 5/12 teeth with caries; 9/12 with linear (2) and pit–type (7) DEH.
Skeletal pathology	Occiptal – endocranial area around cruciate ligament (centro–left) has a small area of 'frosted' Hair–on–end new bone formation (healed) with an adjacent area of smooth but very porotic lamellar (healed + remodelled)–evidence of inflammation. Supernunnary thoracic vertebra.Shroud/coffin fabric adhering to skull.

Analysed by	TD	**Analysis date**	13/10/2011

SK id	3573
Preservation	G2
Completeness	>75%
Fragmentation	Low
SK. orien.	E–W
SK. pos.	Extended Supine
Grave type	1

Age category	Older middle adult
Age est.	35–44
Est. sex	M
Stature	165.892

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PO	41	PO	–	–
12	PO	32	PO	23	PO	–	–
13	PO	33	PO	24	PO	42	PO
14	PO	34	PO	25	PO	43	PO
15	PO	–	–	26	PO	44	PO
35	PO	–	–	27	PO	–	–
16	PO	–	–	45	PO	–	–
17	PO	36	PO	28	PM	–	–
18	PM	37	PO	46	PO	–	–
21	PO	38	CA	47	PO	–	–
22	PO	–	–	48	PO	–	–

Dental pathology notes	29 teeth all PO; 32 tooth pos.itins with 2 PM + 1 CA . 29/29 teeth with slight to moderate calculus; 3/29 exhibiting caries; 18/29 PO with slight to severe.
Skeletal pathology	Moderate CO – bilateral large and small isolated foramina. SBO S1–4. Healed Non-specific infection on lateral shafts of R + L tibiae. Enthesophytes– bilateral pectoralis major (moderate), bilateral subscapularis (faint), bilateral radial biceps (l–strong; R–moderate), bilateral clavicles deltoid inserts (L–faint; R–moderate), R fibula tibialis posterior insert (strong), R soleus (strong) and spur (strong) on posterior laterial border of L articular surface of navicular – site of bifurcate ligament (mod).

Analysed by	JM	**Analysis date**	14/10/2011

SK id	3579		
Preservation	G2	**Age category**	Older middle adult
Completeness	>75%	**Age est.**	40–44
Fragmentation	Low	**Est. sex**	M
SK. orien.	E–W	**Stature**	176.247
SK. pos.	Extended Supine		
Grave type			

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
21	AM	35	AM
22	AM	36	AM
23	AM	–	–
37	AM	–	–
24	AM	–	–
25	AM	38	AM
26	AM	45	AM
27	AM	–	–
46	AM	–	–
28	AM	–	–
47	AM	–	–
48	AM	–	–

Dental pathology notes	0 teeth; 16 tooth positions all AM.
Skeletal pathology	Healed PO-bilateralparietals. Degenerative disc disease C4–5 and L4–5; OA– facets of L1–2; left elbow humerus (trochlea + capitulum) and radius. 1x Healed right rib fracture on lateral–anterior rib fragment. Muscular stress lesions– L costoclavicular (moderate). Ethesophytes– bilateral clavicular conoid attchments, Left ulnar triceps and brachalis, L radial biceps insert, bilateral tibial soleus, bilateral gluteus maximus (all moderate expression). R Fibula is bowed medially –likely pos.t–mortem alteration.

Analysed by	TD	**Analysis date**	15/10/2011

SK id	3584		
Preservation	G2	**Age category**	Younger middle adult
Completeness	<25%	**Age est.**	25–35
Fragmentation	Low	**Est. sex**	M
SK. orien.	E–W	**Stature**	–
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty
11	PO	31	PM
12	PO	32	PO
13	PO	–	–
33	PO	–	–
14	PO	–	–
15	PO	34	PO
16	PO	35	PO
17	AM	36	AM
18	AM	–	–
37	PO	–	–
21	PO	–	–
22	AM	38	AM
23	PM	41	PO
24	PO	42	PO
25	PO	–	–
43	PO	–	–
26	PO	–	–
44	PO	–	–
27	AM	–	–
28	AM	45	PO
46	AM	–	–
47	AM	–	–
48	AM	–	–

Dental pathology notes	20 teeth all PO; 32 tooth positions with 10 AM + 2 PM. 2/20 with calculus; 3/20 carious teeth; 7/32 tooth positions with an abscess observed; 4/20 PO slight to severe periodontal disease.
Skeletal pathology	No skeletal pathology.

Analysed by	TD	**Analysis date**	14/10/2011

SK id	3587		
Preservation	G2	**Age category**	Older adult
Completeness	>75%	**Age est.**	50–59
Fragmentation	Moderate	**Est. sex**	F
SK. orien.	E–W	**Stature**	155.074
SK. pos.	Extended Supine		
Grave type	1		

Dental inventory

Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty	Tooth	Q-ty
11	AM	31	AM	23	AM	–	–
12	AM	32	AM	24	AM	38	AM
13	AM	–	–	25	AM	41	AM
33	AM	–	–	26	AM	42	AM
14	AM	–	–	43	AM	–	–
15	AM	34	AM	44	AM	–	–
16	AM	35	AM	45	AM	–	–
21	AM	36	AM	46	AM	–	–
22	AM	–	–	47	AM	–	–
37	AM	–	–	48	AM	–	–

Dental pathology notes	0 teeth; 28 tooth positions all AM – endentulous mandible.
Skeletal pathology	Erosions of the sella turcica of sphenoid; disproportionate deveopment of the skull vault relative to frontal bones (no facial bones remain) with bilateral enlarged parietal bosses and a noticeably small frontal bone; gracile but normal shaped long bones; tubular long bones; cranial sutures are open; cortices of long bones are thin; relatively short stature – Hypopituitorism?. HFI and 'lump' on endocranial surface of R + L parietal at region of boss– remodelled spicule bone (same as frontal, both pos.s. related to hormone changes due to erosions of sella turcica/ pituatory). OA– C1–C2 articulation. Healed infection L tibia medial shaft. Enthesophytes– bifurcate ligament attachment on L + R navicular (strong), popliteus muscel insert of L tibia (strong), MT2–4 bilateral interosseous insertions on medial + lateral diaphysis (moderate), R radial biceps insert (moderate), R clavicular deltoid (faint), bilateral tibial soleus lines (strong), L humeral subscapularis. Stress lesions– R humeral pectoralis major, teres major.

Analysed by	JM	**Analysis date**	14/10/2011

Appendix 3 – Tables

Table A – Cranial non-metric traits

Midline Traits	P	N	%
Ossicle at Lambda	2	15	13.3%
Ossicle at Bregma	0	21	0%
Metopic Suture	2	19	10.5%
Ossicles(S) in Saggital	1	21	4.8%

Paired trait	Right			Left		
	P	N	%	P	N	%
Ossicle(S) in Lambdoid	4	17	23.5%	4	18	22.2%
Ossicle(S) in Coronal	0	21	0%	0	21	0%
Occip-Mastoid Suture Ossicle(S)	1	16	6.3%	1	15	6.7%
Fronto-Temporal Articulation	0	14	0%	0	12	0%
Parietal Foramen	12	18	66.7%	6	18	33.3%
Parital Notch Bone	1	14	7.1%	0	14	0%
Epipteric Bone	0	15	0%	0	15	0%
Asterionic Bone	3	16	18.8%	3	15	20%
Multiple infraorbital Foramen	1	13	7.7%	0	11	0%
Mastoid Foramen Exsutural	14	19	73.7%	12	20	60%
Auditory Torus (Exostosis)	0	19	0%	0	21	0%
Double Hypoglossal Canals	0	20	0%	0	20	0%
Palatine Torus	2	18	11.1%	2	18	11.1%
Max. Torus	2	18	11.1%	2	18	11.1%
Mand. Torus	0	18	0%	0	17	0%

Table B – Post-cranial non-metric traits

Midline traits:	P	N	%
Sternal Foramen	0	6	0%

Paired Trait:	Right			Left		
	P	N	%	P	N	%
Suprascap Foramen	0	10	0%	1	11	9.1%
Septal Aperture	1	15	6.7%	0	13	0%
Supracondylar Process	0	17	0%	0	15	0%
Femoral Plaque	3	10	30%	4	11	36.4%
Third Trochanter	0	15	0%	0	13	0%
Lat. Tibial Squatting Facets	2	11	18.2%	2	14	14.3%

Paired Trait:	Right			Left		
	P	N	%	P	N	%
Med. Tibial Squatting Facets	1	11	9.1%	0	13	0%
Double Superior Atlas Facet	2	16	12.5%	2	14	14.3%
Posterior Atlas Bridge	1	15	6.7%	2	13	15.4%
Acces Trans For Cerv Vert	7	17	41.2%	5	16	31.3%
Vastus Notch	0	9	0%	0	5	0%
Emarginate Patella	0	9	0%	1	6	16.7%

Table C – Adult activity related changes (enthesophyte and bony excavations)

Attachment	Female			Male			Total			By individual (P/N)	
	P	N	%	P	N	%	P	N	%	M	F
Costoclavicular	1	14	7.1	2	6	33.3	3	20	15	2/4	1/7
Clav. Deltoid	1	16	6.25	2	12	16.7	3	28	10.7	1/6	1/10
Clav. Conoid Lig	0	16	0	2	12	16.7	2	28	7.1	1/6	0/16
Hum. Subscapularis	3	20	15	2	13	15.4	5	33	15.2	2/7	2/12
Hum. Suprascapularis	1	20	5	0	13	0	1	33	3	0/7	1/12
Hum. Pec. Major	9	20	45	9	13	69.2	18	33	54.5	5/7	5/12
Hum. Deltoid	3	20	15	1	13	7.7	4	33	12.1	1/7	2/11
Hum. Teres Major	2	20	10	2	13	15.4	4	33	12.1	1/7	2/12
Hum. L Head Triceps	1	20	5	2	13	15.4	3	33	9.1	1/7	1/12
Hum. C. Flexor Orig	6	12	50	2	11	18.2	8	23	34.8	1/7	3/8
Hum. C. Extensor Orig	0	14	0	2	11	18.2	2	25	8	1/7	0/9
Ulna Triceps	4	16	25	3	12	25	7	28	25	2/8	2/10
Ulna Bracialis	6	18	33.3	3	10	30	9	28	32.1	3/6	3/11
Radius P. Teres	2	15	13.3	2	10	20	4	25	16	1/6	1/9
Radius Biceps	6	17	35.2	6	11	54.5	12	28	42.9	4/7	4/10
Mc1 Opponens Pollicis	0	8	0	1	8	12.5	1	16	6.3	1/5	0/5
Semimembranosus + Semitendinosus (Ischial Tuberosity)	2	18	11.1	1	13	7.7	3	31	9.7	1/7	1/10
External + Internal Oblique (Iliac Crest)	0	22	0	2	14	14.3	2	36	5.6	1/7	0/12
Ilium Ref. Head Of Rectus Femoris	0	22	0	3	14	21.4	3	36	8.3	2/7	0/12
Fem. Psoas Major + Iliacas (Lesser Troch)	0	20	0	3	14	21.4	3	34	8.8	2/7	0/10
Fem. Iliofemoral Lig.	0	20	0	1	14	7.1	1	34	2.9	1/7	0/10
Fem. Gluteus Max	2	20	10	4	14	28.6	6	34	17.6	2/7	1/10

Attachment	Female			Male			Total			By individual (P/N)	
	P	N	%	P	N	%	P	N	%	M	F
Tibia Soleus	6	21	28.6	8	11	72.7	14	32	43.8	5/6	3/12
Tibia Pat. Ligament	0	21	0	2	11	18.2	2	32	6.3	1/6	0/12
Tib. Popliteus Posterior	1	21	4.8	0	11	0	1	32	3.1	1/6	0/12
Fibula Soleus	2	17	11.8	1	11	9.1	3	28	10.7	1/6	1/9
Patella Rectus Fem.	1	6	16.7	1	6	16.7	2	12	16.7	1/4	1/4
Calcaneous Achillies	5	13	38.5	0	13	0	5	26	13.9	0/7	3/7
Calc. Abductor Hallicus	2	13	15.4	0	13	0	2	26	7.7	0/7	1/7
Navicular Bifurcate Lig.	0	11	0	1	9	11.1	1	20	5	1/6	0/7
Mt Peroneus Longus	0	59	0	1	39	2.6	1	98	1	1/7	0/7
Mt Dorsal Interosseous	6	43	14	0	20	0	6	63	9.5	0/5	2/7

Table D – Non-adult activity related changes (enthesophyte and bony excavations)

Attachment	P	N	%
Costoclavicular	3	27	11.1
Clav. Deltoid	2	27	7.4
Hum. P. Major	2	28	7.1
Hum. Teres Major	2	28	7.1
Hum. Latissinous Dorsi	2	28	7.1

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