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Human remains from an Anglo-Saxon cemetery at Cuxton, Kent

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1 INTRODUCTION

Of the 36 excavated graves, 34 contained extant inhumation burials, including one context with the remains of two individuals. The excavators described six burials as 'slightly disturbed'. Unfortunately sample size prevents any statistically valid conclusions being drawn from the osteological or funerary data.

The artefactual evidence suggests that the cemetery was in use between c. AD580–700. Christianity became established in Kent in the 7th century (Chadwick Hawkes 1982), placing this cemetery in the transitional period. Initial information from the shield boss typology indicates an almost generational timescale between the male burials (Blackmore pers. comm.).

2 METHODS

Three provisional groups were identified within the cemetery (Table 1), based primarily on grave orientation. Some features from group 2 cut those in group 1.

Table 1: Inhumation groups

Grave Orientation	**Contexts**
1: NNW-SSE	168, 188, 240, 242, 261, 276, 280, 290, 299, 312, 315, 360, 372
2: NW-SE	166, 172, 178, 190, 193, 210, 214, 217, 246, 249, 285, 293, 296, 302
3: NE-SW	164, 282, 305, 318, 323, 378 (363?)

A Museum of London Specialist Services (MoLSS) osteologist recorded the skeletal data. Standard paper proformas and a project specific Access database were used, with reference to the general methodology outlined in the project design (CTRL Technical report No. 000-RUG-RLEVC-0000-AA). Although the bone was generally poorly preserved, a number of the individuals were reasonably complete allowing demographic and paleopathological analysis.

The preservation of the human remains was scored on a scale of 0 to 5, (very good to very poor) based on criteria adapted from Behrensmeyer (1978) and set out in Buikstra and Ubelaker (1994, 98). To determine the completeness of the individual burials, skeletal elements, or where appropriate, areas (e.g. distal shaft) were counted as present if 50% or more of the bone was extant. Skeletal inventory details were compiled using Excel to allow calculation of completeness and disease prevalence.

Subadult remains were aged using dental development data from Buikstra and Ubelaker (1994), and refined using Moorees *et al* (1963) and Gustafson and Koch (1974), the latter found to be the most accurate method of predicting age in infants from Spitalfields crypt (Liversidge 1994). Preservation of the skeletal elements prevented the use of diaphyseal length and epiphyseal fusion data.

An age estimate in years was produced and the results grouped as set out in the project method statement (CTRL Technical report No. 000-RUG-RLEVC-0000-AA) (Table 2).

Adult ages were estimated from a combination of pubic symphysis (Brooks and Suchey 1990), auricular surface (Lovejoy *et al* 1985), cranial suture closure (Meindl and Lovejoy 1985) and dental attrition (Brothwell 1981) data. Dental attrition was the most frequently used method.

Table 2: Age groups

Description	Age range
Neonate	<6mnths
Infant	<5yrs
Juvenile	5-12years
Sub-adult	13-18 years
Young adult	18 – 25 years
Mature adult	26 – 45 years
Older adult	≥ 46 years
"Adult"	> 18 years

Estimation of the sex of adult remains was carried out using the morphological characteristics of the pelvis and skull (Buikstra and Ubelaker 1994). Results were categorised as male or female with a level of confidence ascribed to the sex estimation. The terms used were 'certain', 'probable' and 'possible'.

Stature calculations were made for adult remains using the formulae created by Trotter (1970). Platymeric index was calculated using the equation (FeD1 x 100) / FeD2 and platycnemia (TiD2 x 100)/TiD1 (Bass 1995).

Where preservation allowed, measurements were taken of a number of cranial, dental and post-cranial features using landmarks identified in Brothwell (1981) and Buikstra and Ubelaker (1994).

Cranial, mandibular and post-cranial non-metric or epigenetic traits were examined (Berry and Berry 1967, Finnegan 1978, Brothwell 1981) and scored as '1' present, '0' absent or '9' unobservable, if the area was damaged or absent.

Pathological changes were recorded using guidelines set out by the British Association of Biological Anthropologists and Osteologists (Roberts and Connell 2004). Basic pathological information was obtained from Aufderheide and Rodríguez-Martín (1998) and Cox and Mays (2000) with supplementary references as required. Cribra orbitalia was scored according to Stuart-Macadam (1991).

3 RESULTS

3.1 Disturbance and condition

Truncation of was minimal: only the grave containing skeleton [280] was cut by other features, burials [285] and [258/302]. This affected the structural features of the grave rather than the skeleton. Analysis showed 26% (n=9) of the individuals were 10% complete or less, 74% (n=26) were 50% complete or less and 86% (n=30) were 75% complete or less. Only 14% (n=5) of the assemblage was more than 75% complete. The poor preservation and completeness of much of the assemblage limited the observation of some pathological, demographic and metric data.

The majority of the assemblage (77% or 27 individuals) was poorly preserved and 94% (33 individuals) had 'below average' preservation or worse. A single individual was in good condition and one further in 'average' condition. Despite the mildly alkaline, chalk sub-soil, the cortex of many skeletal elements was extremely eroded. In some cases the entire surface was absent, exposing the trabecular bone. Root impressions and flaking of the cortex was commonplace. Such conditions have been observed on many previously excavated burials from chalk soils in eastern Kent (Mays and Anderson 1995). The hillside location of the Cuxton cemetery may have lead to increased groundwater run-off, one of the primary factors effecting the preservation of archaeological bone (Nielsen-Marsh *et al* 2000).

The six 'slightly disturbed' contexts contained poorly preserved remains (a score of 4 or 5). Metal detectorists disturbed one burial [360]. The two burials in 'good' and 'average' condition respectively; both came from undisturbed contexts.

One burial [302], identified by the archaeologists as 'undisturbed', was found to contain the remains of two individuals. This, coupled with the site records, describing the adult burial as 'crouched' and occupying a surprisingly large grave cut, suggest that some level of disturbance had, in fact, occurred.

Coffined burials were no better preserved than those without coffins: of the six coffined inhumations three were in 'very poor' condition, two 'poor' condition and one 'below average'.

Copper salts (indicated by green staining) had a positive effect on cortical preservation. Bone that was heavily stained showed little or no surface erosion (Plate 1). This may be the result of replacement of the organic component of bone by inorganic mineral, but is perhaps more likely to be a consequence of the biocidal effect of the copper salts preventing the growth of roots in the areas adjacent to the copper objects (Gillard et al 1994). Green staining was noted on a large proportion of the remains from Great Chesterford, Essex (Waldron 1994) and Buckland, Dover (Powers and Cullen 1987), but unfortunately, the authors provided no further data on any affect this had on preservation.

As expected, the more robust elements of the skeleton were generally better preserved. Only 14% (n=57) of the possible number of left ribs and 16% (n=66) of the right ribs were identifiable and 18% of the maximum possible vertebrae present (n=213). This contrasts with the mid shaft of the humeri at 56% (right n=20) and 50% (left n=18) and the femora at 64% (right, n=23) and 72% (left, n=26). The bones of the hands and especially of the feet were under-represented; there were 17 foot phalanges present in the entire assemblage (1.7%). Only one individual [296] had the hyoid present.

Six of the non-adult individuals were represented by tooth fragments alone ([186], [217], [242], [276], [293] and [258]) and adult [210] as teeth and a small tibial shaft fragment. Context [285] consisted of such small fragments of trabecular bone as to render it un-assessable.

3.2 Demographic data

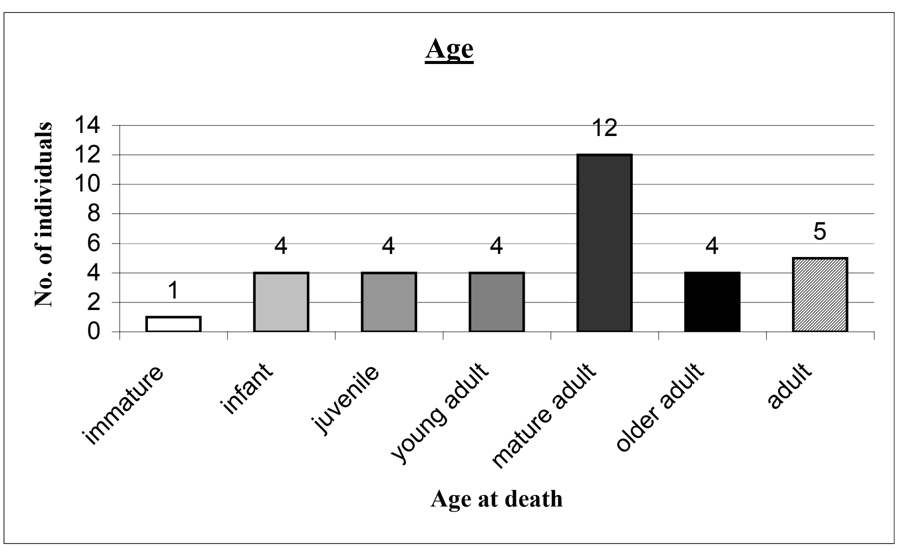
Minimum number of individuals

A total of 35 individuals were identified, including one context that could not be assessed [285]. All burials were from separate graves with the exception of burial [302], which contained an adult burial and a single intrusive juvenile tooth crown (renumbered [258]). Demographic calculations were carried out using the minimum number of analysed individuals (34) to ensure the integrity of the resulting data.

Age at death estimation

The analysed remains comprised 24 adults (70% of the 34 individuals analysed), five juveniles (15%), four infants (12%) and an immature individual of unknown age, categorised as 'infant-juvenile' (3%) between 2 and 9 years at death (Fig. 1).

Figure 1: Age at death



Of the adult burials, 4 (17%) were ‘young’ adults, 12 (49%) ‘mature’ adults and 4 (17%) fell within the ‘older’ adult range. Four burials ([178], [240], [282], and [323]) or 17% of the assemblage could not be ascribed an age and were simply described as ‘adult’.

The majority of individuals died between the ages of 26 and 45 years. However, adult age estimation was limited by the poor skeletal preservation, leading to reliance on the use of (less accurate) dental attrition. This is a population specific method, greatly affected by the coarseness of the diet. Since initial results from Saltwood indicate low rates of dental attrition (McKinley *pers. comm.)*, assuming a similar diet, a number of the adult remains from Cuxton may have been under-aged. However, for the four adults where more than one aging method could be used, the age ranges produce compared favourably in three cases (producing results in the same adult age category) and dental attrition only produced a lower age estimate in one burial. The demographic profile is similar to the cemetery at Berinsfield, Oxfordshire: removing ‘adult’ individuals gives proportions at Cuxton of 20% (n=4) ‘young’, 60% (n=12) mature and 20% (n=4) older. The adult population of Berinsfield breaks down as 27% (n=12) ‘young’, 53% (n=24) mature and 20% (n=9) older.

Juvenile age at death clusters around 4-7 years, the infant-juvenile age group, with 4 individuals (44% of the immature individuals) falling in this range. At Great Chesterford, Essex (Waldron 1994) almost half the population were subadult; 11 of the 167 individuals (6.5%) were aged between 2 and 6 years of age and most of the had died before the age of 10. Remains from Worthy Park, Hampshire showed 30.8% of the cemetery population had died before the age of 15 (Wells *et al* 2003) and the majority (53%) of the immature individuals fell into the 2-10 years age bracket. The absence of perinatal remains at other sites has been suggested to indicate interment elsewhere (Mays and Anderson 1995). Crawford (1993) found that of the 1271 Saxon skeletons examined, only 11% were under the age of 5 years at death (n=130). Further comparative site data can be seen in Table 3.

Table 3: Comparative data on infants and juveniles as a proportion of the entire assemblage.

Site	**% under 5 years**	**% under 12 years**	**Reference**
Berinsfield	12 (13/108)	27.8 (30/108)	Harman 1995
Great Chesterford	40 (67/167)	47 (79/167)	Waldron 1994
Edix Hill	10.1 (15/148)	19.5 (29/148)	Malim and Hines 1998 (cited in Buckberry 2000)
Spong Hill	-	6.3 (2/32)	McKinley 1994
Floral Street	-	20% (1/5)	Smith and Melikian (forthcoming)

When the three preliminary phases of the cemetery are taken into account, the following demographic profiles result (Table 4).

Table 4: Age at death by cemetery group

	Age group	No.	% of adults	Age group	No.	% of subadults
Group 1	'Adult'	1	14%	infant	3	50%
n = 13	Young adult	0	0	juvenile	3	50%
	Mature adult	4	57%			
	Older adult	2	29%			
	Total (% of group)	**7 (54%)**		**Total (% of group)**	**6 (46%)**	
Group 2	'Adult'	2	18.2%	infant	1	33.3
n = 14	Young adult	3	27.3%	juvenile	2	66.7
	Mature adult	5	45.5%			
	Older adult	1	9%			
	Total (% of group)	**11 (79%)**		**Total (% of group)**	**3 (21%)**	
Group 3	'Adult'	2	33%	infant	0	0
n = 6	Young adult	1	17%	juvenile	0	0
	Mature adult	3	50%			
	Older adult	0	0			
	Total (% of group)	**6 (100%)**		**Total (% of group)**	**0 (0%)**	

Sex Estimation

Sex could be estimated for half the adult burials: six males and six females (Table 5). This gives a ratio of *c.*1: 1 for the sexed remains, though little significance can be ascribed to this pattern, due to the small number of individuals involved. Comparative data is presented in Table 6.

Table 5: Adult sex estimation

Sex	Degree of certainty	No. of individuals	% of sex	% of adult assemblage
Male	Certain	1	17	4
	Probable	3	50	12.5
	Possible	2	33	8
Total		**6**	**100**	**25**
Female	Certain	2	33.34	8
	Probable	2	33.34	8
	Possible	2	33.34	8
Total		**6**	**100**	**24**
Unsexed		12	-	**51**
Overall Total		24	-	**100**

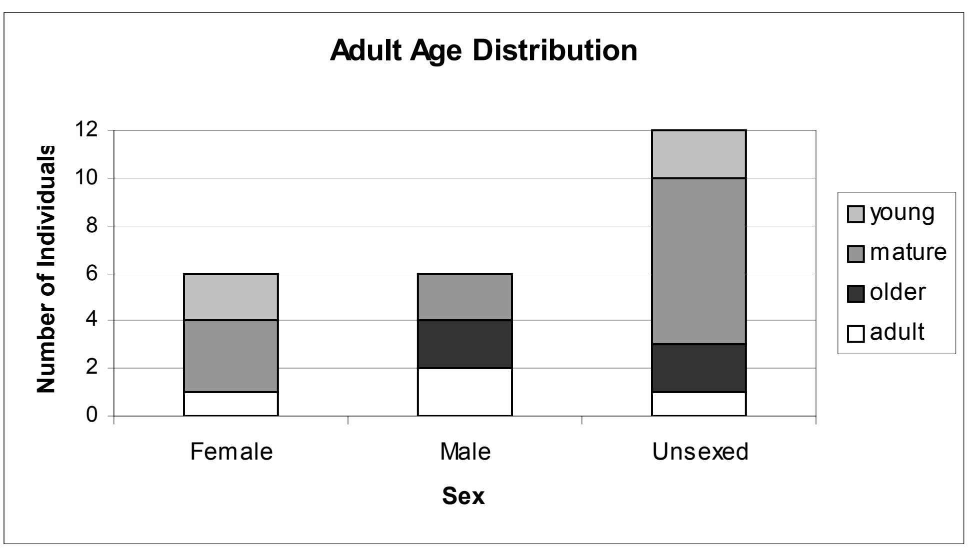
Again the cemetery population was examined in the three groups. In group one there were two males (28.5% of the adults), two females (28.5%) and three adults (43%) who could not be sexed. The ratio is, therefore, the same as for the site as a whole. Group two comprised three females (27% of the adults) and two (18%) males; the rest (6 or 55%) could not be sexed. Group three contained one male, one female and four unsexed adults. Due to the small sample sizes in each group it is not possible to determine if the demographic pattern has any significance.

Table 6: Comparative data for adult demographics.

Site	Male	Female	Undetermined	Total	Reference
Great Chesterford	35 (38.5%)	43 (47.2%)	13 (14.3%)	91 (100%)	Waldron 1994
Wally Corner, Berinsfield	30 (37.5%)	32 (40%)	18 (22.5%)	80 (100%)	Boyle and Dodd 1995
Buckland, Dover	19 (37%)	21 (41%)	11 (22%)	51 (100%)	Powers and Cullen 1987
Portchester Castle, Hampshire	10 (53%)	7 (37%)	2 (10%)	19 (100%)	Hooper 1976
Kingsworthy, Hampshire	32 (45%)	39 (55%)	-	71	Wells *et al* 2003

Combination of the age and sex data shows that male burials were evenly distributed between the 'older' and 'mature' categories and females lay in the 'young' and 'mature' groups (Fig 2).

Figure 2: Adult age distribution



At Great Chesterford, Essex, the men were seen to live longer, on average, than the women (Waldron 1994). It may be that a similar pattern is true here, however, it is more likely to be an artefact of the sample size and ageing methods used. With such a large proportion (51%) of the adults being impossible to sex, one cannot determine if there were genuine differences in age at death.

3.3 Metric and non-metric data

Stature estimates were calculated for four adult individuals for whom a sex could be determined and one unsexed adult (using the mean values obtained for each sex) (Table 7). The sample size (one probable female, one certain and one probable male) is too small to enable any conclusions to be drawn, but mean stature falls within the range shown at numerous other Saxon sites (Table 8).

Table 7: Estimated stature in metres

Skeleton	Male	Female	Unsexed
249	-	1.63	-
299	1.74	-	-
261	1.80	-	-
372	-	-	1.76
Mean	**1.76**	-	-

Table 8: Comparative data on stature in metres

	Male		emale		
Site	**Range**	**Mean**	**Range**	**Mean**	**Reference**
Great Chesterford	1.51 -1.83	1.66	1.46 - 1.71	1.61	Waldron 1994
Portchester Castle, Hampshire	1.62 - 1.83	1.76	1.60 - 1.72	1.65	Hooper 1976
Buckland, Dover	1.69 – 1.82	1.74	1.61 – 1.71	1.67	Powers and Cullen 1987
Berinsfield	-	1.73	-	1.62	Harman 1995
Kingsworthy, Hampshire	1.58 – 1.89	1.73	1.50 – 1.72	1.61	Wells *et al* 2003
Floral Street, London	-	1.72 (n=1)	-	-	Smith and Melikian (forthcoming)

It was possible to calculate the cranial index of only one individual. A young adult female, [214] was found to be mesocranic with an index of 78.3. No recent comparative studies of Saxon material exist and studies and cranial morphology is influence by a number of genetic and non-genetic factors, such as diet and climate (Mays 2000), therefore no further interpretation is possible. Femoral measurements were possible in five male, two female and one unsexed adult (Table 9). Four males and the two females were platymeric. The unsexed adult and one male were eurymeric. These are thought to be biomechanical differences related to muscle activity (Brothwell 1981; Townsley 1946). There was little difference in the mean values of the right and left sides. Mean values for the females, were slightly lower than the males (right 74.1, left 70.4 compared with 78.7 and 78.9 respectively) but given the small number of individuals, no significance can be assigned to this observation.

Table 9: Platymeric indices.

Context	**Sex**	**R Femur**	**L Femur**	
178	Male (probable)	80.5	-	Platymeric
190	Unsexed	-	85.7	Eurymeric
193	Male (probable)	78.7	79.0	Platymeric
214	Female (certain)	74.3	71.8	Platymeric
249	Female (probable)	73.8	69.0	Platymeric
261	Male (certain)	-	80.4	Platymeric
299	Male (probable)	90.9	86.5	Eurymeric
363	Male (possible)	64.7	69.7	Platymeric
n		**6**	**7**	**-**
mean		**77.2**	**77.4**	**-**

Table 10: Platycnemic indices.

Context	**Sex**	**R Tibia**	**L Tibia**	
299	Male (probable)	74.0	80.3	Eurcynemic
n		**1**	**1**	**-**
mean		**n/a**	**n/a**	**-**

Few non-metric traits were observable, but the following tables outline prevalence in the adult portion of the assemblage. These traits are considered to be of a non-pathological, epigenetic nature and have been used in the past to try and establish familial groupings and separate populations. However, the "level of heritability" of such morphological traits has not been established (Tyrrell 2000, 303). Evidence suggests shared environmental circumstances may have as much of an influence as genetic factors (Saunders 1989). Recent work has utilised multiple traits and multivariate statistics (Larsen 1997). All resulting data should, therefore, be treated with caution when trying to interpret patterns or compare between cemetery assemblages. Prevalence rates for many traits are artificially high due to the small number of observable elements present.

Table 11: Cranial non-metric traits.

Cranial Trait	**Present**		**Absent**		**Unobservable**		**Prevalence**	
Metopism	1		11		12		8%	
Lambdoid bone	0		7		17		0%	
Inca bone	0		7		17		0%	
Bregmatic bone	0		5		19		0%	
	R	L	R	L	R	L	R	L
Asteronic bone	1	0	4	5	19	19	**20%**	0%
Epiteric bone	0	0	4	4	20	20	0%	0%
Sagittal wormians	1		7		16		**13%**	
Coronal wormians	0	0	8	7	16	17	0%	0%
Lambdoid wormians	0	0	4	5	20	19	0%	0%
Squamo-parietal wormians	0	0	4	2	20	22	0%	0%
Supraorbital foramen	5	3	4	6	15	15	**56%**	**33%**
Supraorbital groove	4	6	5	3	15	15	**44%**	**67%**
Accessory infra-orbital foramen	2	1	0	0	22	23	**100%**	**100%**
Posterior ethmoid foramen	0	0	2	2	22	22	0%	0%
Parietal foramen	3	4	5	5	16	15	**38%**	**44**
Mastoid foramen	1	0	4	4	19	20	**20%**	0%
Foramen of Huschke	0	0	4	4	20	20	0%	0%
Accessory palatine foramen	0	0	5	4	19	20	0%	0%
Foramen ovale incomplete	0	0	2	1	22	23	0%	0%
Double anterior condylar canal	0	0	2	2	22	22	0%	0%
Posterior condylar canal	0	1	2	1	22	22	0%	**50%**
Parietal notch bone	0	0	6	6	18	18	0%	0%
Zygomatico-facial foramen	5	5	0	0	19	19	**100%**	**100%**
Os japonicum	0	0	2	2	22	22	0%	0%
Torus auditivi	0	0	10	9	14	15	0%	0%
Torus maxillaris	0	0	7	6	17	18	0%	0%
Torus palatinus	0		6		18		0%	
Palatal suture variation	0	0	4	3	20	21	0%	0%
Pterion form	0	0	3	3	21	21	0%	0%
Double occipital condyles	0	0	5	5	19	19	0%	0%
Precondylar tubercle	0	0	3	2	31	22	0%	0%

Table 12: Mandibular non-metric traits

Mandibular trait	Present		Absent		Unobservable		Prevalence	
	R	L	R	L	R	L	R	L
Multiple mental foramina	0	0	11	9	13	15	0%	0%
Torus mandibularis	0	0	11	11	13	13	0%	0%
Mylohyoid bridge	4	3	3	3	17	18	**57%**	**50%**
Pterygoid spurs	1	1	7	7	16	16	**13%**	**13%**

Table 13: Post-cranial non-metric traits

Post Cranial Trait	Present		Absent		Unobservable		Prevalence	
Sternal foramen	0		3		21		0%	
Manubrio-corpal synostosis	0		5		19		0%	
	R	L	R	L	R	L	R	L
Os acromiale	1	0	1	2	22	22	**50%**	0%
Acromial articular facet	1	2	1	0	22	22	**50%**	**100 %**
Supra scapular - notch	3	2	0	0	21	22	**100%**	**100 %**
foramen	0	0	3	2	21	22	0%	0%
none	0	0	3	2	21	22	0%	0%
Atlas: posterior bridge	0	0	4	4	20	20	0%	0%
Lateral bridge	0	0	5	5	19	19	0%	0%
Transverse f. bipartite	0	0	5	5	19	19	0%	0%
Facet double	2	1	6	5	16	18	**25%**	**17%**
Cervical rib	0	0	8	8	16	16	0%	0%
Accessory iliac/sacral facets	0	0	2	2	22	22	0%	0%
Lumbosacralisation	0		6		18		0%	
Sacrolumbarisation	0		6		18		0%	
Acetabular crease	0	0	8	7	16	17	0%	0%
Septal aperture	1	1	6	5	17	18	**14%**	**17%**
Supracondylar process	0	0	11	10	13	14	0%	0%
Third trochanter	0	0	6	7	18	17	0%	0%
Allen's fossa	0	0	8	7	16	17	0%	0%
Poirier's facet	0	0	8	7	16	17	0%	0%
Poirier's plaque	2	1	4	4	18	19	**33%**	**20%**
Hypotrochanteric fossa	0	0	4	5	20	19	0%	0%
Exostosis in trochanteric fossa	1	0	4	3	19	21	**20%**	0%
Patella: vastus notch	0	0	4	3	20	21	0%	0%
Bipartite	0	0	5	5	19	19	0%	0%
Tibia: medial squatting facet	0	0	4	4	20	20	0%	0%
Lateral squatting facet	2	2	2	2	20	20	**50%**	**50%**

Post Cranial Trait	Present		Absent		Unobservable		Prevalence	
Calcaneus: facet absent	0	1	4	3	20	20	0%	**25%**
Facet double	0	0	4	4	20	20	0%	0%
Talus: os trigonum	0	0	4	4	20	20	0%	0%
Facet double	0	0	4	4	20	20	0%	0%
Squatting facet	0	0	4	4	20	20	0%	0%

3.4 Palaeopathology

A total of nineteen adults had dental or skeletal changes as the result of pathological conditions. All but one immature individual had no pathological changes. A summary of pathological data by skeleton can be found in the catalogue.

Dental disease

All analysed individuals had at least partially observable dentitions. Of these, 19 adults (79%) and one juvenile (11%) exhibited pathological changes (Table 14 and 15).

A total of 466 adult teeth were collected and 225 sockets were observable. The position of the teeth present did not always reflect the area of alveolar bone preserved. From observations of the sockets, a minimum of 20 teeth had been lost post mortem. No alveolar bone was extant in the juvenile portion of the assemblage but 109 teeth were recovered. A single adult tooth (0.2% of adult teeth present) was observed to be congenitally absent. Calculus deposits were observed on the dentitions of 15 (63%) of the adults; 109 teeth (23%). Most deposits were slight and lay above the cemento-enamel junction. No calculus was present in the immature portion of the assemblage.

One subadult had a small occlusal carious lesion in the centre of the right mandibular first permanent molar, a prevalence of 20% (1 of 5 of this tooth). Five males, four females and three unsexed adults had carious lesions in one or more tooth (30 adult teeth or 6%). Of the carious teeth, 20 (67%) were from males, 5 (16.5%) females and 5 (16.5%) unsexed. These figures give an overall rate of 4.1% (5/123 teeth) for females and 15.3% (20/131 teeth) for males. Only one anterior tooth was affected, a canine with a small lesion located on the neck. The highest incidence was in the left mandibular first molar where four teeth were affected, with all other molar teeth affected in one or two cases. Prevalence of caries by tooth position is outlined in table 14 and 15.

Table 14: Caries prevalence in adult maxillary teeth.

Position	18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
Teeth with caries	1	2	1	0	1	1	0	0	0	0	0	1	2	2	2	2
Total no of teeth	12	13	14	14	16	16	9	10	15	12	16	12	12	13	12	9
%	**8**	**15**	**7**	**0**	**6**	**6**	**0**	**0**	**0**	**0**	**0**	**8**	**17**	**15**	**17**	**22**

Table 15: Caries prevalence in adult mandibular teeth.

Position	48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38
Teeth with caries	1	1	2	1	1	0	0	0	0	0	1	0	2	4	1	1
Total no of teeth	12	13	15	16	20	19	16	17	17	16	21	20	16	17	14	12
%	**8**	**8**	**13**	**6**	**5**	**0**	**0**	**0**	**0**	**0**	**5**	**0**	**13**	**24**	**7**	**8**

Of the 30 carious teeth 15 (50%) had gross caries, widespread destruction of the crown preventing identification of the site of origin. The interproximal surfaces of 11 teeth (36%) and the neck of three more (10%) also had carious lesions. One mandibular third molar had a small hole on the occlusal surface. Gross caries was present in 3% of the total (466) adult teeth with an overall caries prevalence rate of 6%. The rate appears significantly higher than the caries rate at Berinsfield of 3.2% (32/986 adult teeth) (Harman 1995) and Worthy Park: 3.3% (Wells *et al* 2003) but is comparable to figures given by various authors for the Saxon period as a whole cited in Roberts and Cox (2003 p. 189). It is important to consider that the small sample size at Cuxton may have artificially inflated results, particularly amongst the males, indeed a single adult male [299] accounted for 11 of the carious teeth.

A total of 31/225 adult tooth sockets indicated that teeth had been lost ante-mortem (14%). Of these, seven teeth (23%) were from females, 13 (42%) from males and the remainder from adults for whom sex could not be estimated.

Slight periodontal disease was noted at a single tooth position (26) in the dentition of [193], a mature male. In addition, alveolar recession was present in 5 adult individuals (21%). Slight (2-3mm) of recession affected the whole area of 34 tooth positions (15% of the total observable), whilst more severe (3-5mm) changes affected 14 tooth positions (6%).

An unusual pattern of dental abrasion was noted on the anterior maxillary teeth of [299]. The incisors were worn away in an arc leaving a concave occlusal pattern. No corresponding wear was seen in the mandible, but it is interesting to note that this individual also had a high number of carious teeth. It is possible that this represents the use of the teeth as a tool (Freeth 2000).

Comparative data from Great Chesterford showed one third of the population (n= 18) had no calculus deposits on the teeth, though over a quarter of the population had moderate to severe deposits. The author suggested that this indicated poor dental hygiene (Waldron 1994). Although dental disease is multi-factoral (Freeth 2000), the low rate of calculus and caries at Cuxton suggests the expected diet of coarse carbohydrates and unrefined sugars was consumed. A high intake of milk and dairy produce in particular (containing casein, calcium and phosphorus shown to inhibit caries), proteins or fats could also have contributed to the low rate of caries (Hillson 1996). Extensive wear on the teeth of the older adults supports the theory of a coarse diet. A good level of dental hygiene may also have contributed to this pattern.

Congenital pathology

No major congenital pathology was present in the assemblage but the neural arches of the sacral vertebra of [299] lay open, indicating spina bifida occulta. This is asymptomatic and relatively common, present in 5-25% of the modern population (Aufderheide and Rodríguez-Martín 1998). The right apophyseal joint of the second and third cervical vertebrae of [193] was ankylosed and smooth and regular nature suggested this resulted from a congenital segmentation failure (Barnes 1994).

Infection

A single, unsexed adult [166] displayed the skeletal manifestations of infectious disease (1 of 24 adults or 4%). The proximal third of the shaft of the right tibia was enlarged in all dimensions creating a rather oval cross section (*c.* 43mm medio-lateral compared with 24mm in the left tibia). Areas of striated and spiculated new bone had formed. Smooth sclerotic bars of bone were visible in the remaining medullary bone together with shallow circular depressions, representing the initial stages of the formation of cloacae. Severe post mortem damage had occurred and the articular surface was absent (Plate 2). None of the new bone formation was active at death, although fragile, woven bone would be particularly susceptible to taphonomic factors. There were no obvious direct injuries to the leg and this non-specific infection may have been the result of haematogenous spread of bacteria from elsewhere in the body leading to osteomyelitis. The knee is a commonly reported site of such infection (Aufderheide and Rodríguez-Martín 1998). This represents 1 of 6 observable adult proximal right tibiae (17%). A prevalence of osteomyelitis in adults of 0.3% (n=22) has been reported for the period as a whole (Roberts and Cox 2003) and the higher prevalence at Cuxton is predominantly likely to be the result of the small sample size.

Joint Disease

As is often the case, this was the most common form of pathology noted. However, observation of both spinal and extra-spinal joint disease was adversely affected by poor preservation and may not accurately reflect disease in the living population. Accordingly, no attempt has been made to compare the data with other cemetery sites.

Ten adults (42%) displayed the characteristics of degenerative joint disease in the vertebral column. No immature individuals were affected. No severe osteoarthritic changes were noted, but all ten individuals mentioned had grade 1 or 2 changes.

Six individuals (25% of the adults) had evidence of disc herniation in the form of Schmorl's nodes, once again; none of the changes were severe. This affected one 'young' three 'mature' and two 'older' adults, the young adult showing the least severe changes.

Intervertebral disc disease (IVD) affected the vertebrae of just two individuals (8% of the adults): one mature male and one older male [299] with severe IVD in the lumbar spine.

Osteophytes were present in six individuals (25% of the adults), three 'mature', two 'older and one 'adult'. Osteophyte formation in the lower thoracic and lumbar spine of [299] is likely to have an underlying traumatic aetiology as was the IVD mentioned above (see trauma).

Further details of the number of each vertebra affected and prevalence of spinal joint disease are shown in the following tables (16) and the appendix.

Table 16: Severity and prevalence degenerative joint disease of the vertebrae.

OA		**Cervical**							**Thoracic**												**Lumbar**					**Sacrum**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
Grade:	**1**	1	1	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	2	2	0
	2	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	2	1	1	0	0	0	0	0	1
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
total affected		2	2	1	1	2	1	1	1	1	0	0	0	0	0	1	1	2	2	1	1	1	0	2	2	1
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		**17**	**17**	**11**	**11**	**18**	**14**	**17**	**20**	**14**	**0**	**0**	**0**	**0**	**0**	**14**	**14**	**33**	**33**	**17**	**13**	**13**	**0**	**25**	**25**	**14**

SN		**Cervical**							**Thoracic**												**Lumbar**					**Sacrum**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
Grade:	**1**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	1	1	0	0	0
	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
total affected		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	2	1	2	1	1	0	0	0
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**0**	**14**	**33**	**33**	**17**	**25**	**13**	**13**	**0**	**0**	**0**

IVD		**Cervical**							**Thoracic**												**Lumbar**					**Sacrum**
		1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
Grade:	**1**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	1	0
total affected		0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	1	0
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		**0**	**0**	**0**	**11**	**18**	**14**	**17**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**17**	**33**	**13**	**13**	**13**	**13**	**13**	**0**

OP		Cervical							Thoracic												Lumbar					Sacrum
		1	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
Grade:	**1**	0	0	3	2	1	1	2	2	1	1	1	2	0	3	1	0	0	0	1	0	0	0	0	1	2
	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	2	0	1	0
	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	1	1	0	0
total affected		0	1	5	2	2	2	2	2	1	1	1	2	0	3	1	0	2	2	2	2	2	3	1	2	2
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		**0**	**8**	**56**	**22**	**18**	**29**	**33**	**40**	**14**	**13**	**13**	**25**	**0**	**38**	**14**	**0**	**33**	**33**	**33**	**25**	**25**	**38**	**13**	**25**	**29**

Figure 3: Age and sex of adults with vertebral joint disease.

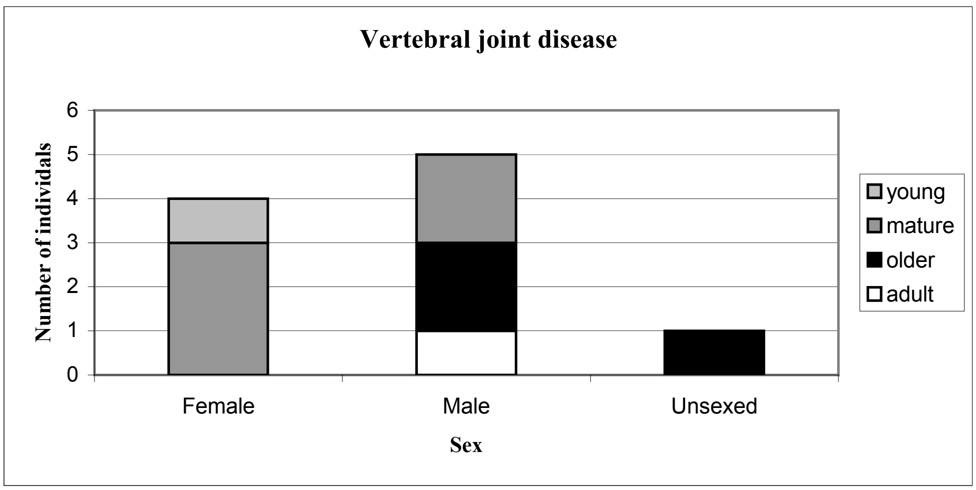


Figure 3 shows the demographic profile of those adults affected by all categories of vertebral joint disease. It appears likely that joint degeneration is directly correlated with age, as is the generally reported pattern (Rogers *et al* 1987). There is no significant difference between the sexes.

Few extra-spinal joint surfaces were observable. Secondary changes associated with trauma were seen in the right elbow and hip of [261] a mature adult male (see below). Extra-spinal joint disease was present in 1 of 8 observable right femoral heads (13%) and 1 of 5 right distal humeri (20%).

Trauma

Four of 24 adults (17%) had traumatic injuries

A single ‘teardrop’ osteophyte on the left side of the inferior margin of L2 extending to L3 [296] is likely to be the result of minor trauma, possibly and avulsion injury as the result of hyper-flexion, leading to the ossification of soft tissues (Maat and Mastwijk 2000).

Older male [299] displayed extensive osteophyte formation in the lower thoracic and lumbar vertebrae. The right anterior portion of the superior body of L3 had collapsed causing lateral wedging, although no serious changes to the shape of the spine (kyphosis or scoliosis) had resulted. This compression fracture was associated with callus formation (Aufderheide and Rodríguez-Martín 1998) on the right anterior body of L2 and L3 leading to ankylosis, secondary osteophytosis and severe disc degeneration (see joint disease). Such fractures result from forceful flexion of the spine (Resnick and Goergen 2002).

A number of skeletal changes as the result of a traumatic event were noted in mature male [261]. The vertebral column had extensive osteophyte formation resulting in the fusion of T10 and T11. A smooth plaque of bone covered the left surface of the body of both vertebrae and the lower body of T11 had indications of severe disc degeneration with anterior 'step off' and cavitation (Maat and Mastwijk 2000). Pitting and irregularity of the superior surface of T12 was also consistent with intervertebral disc disease. Disorganised proliferative bone was present on the right vertebral bodies of all three vertebrae. Despite the presence of considerable quantities of ossified costal cartilage; the vertebral changes do not appear consistent with a diagnosis of D.I.S.H., rather indicating a traumatic cause. Significant soft tissue damage resulted in inflammation and probably capillary bleeding, whilst disc herniation caused the collapse of the anterior body of T11. The smooth bone may represent callus formation. According to the classification proposed by Maat and Mastwijk (2000) this is likely to represent a compression injury acquired during adulthood with crushing of the annular epiphysis.

The joint surface of the distal right humerus was enlarged with new bone formation at the margins and changes to the morphology of the joint surface resulting in an irregular appearance to the trochlea, capitulum and the medial epicondyle. This was directly associated with similar changes in the proximal epiphysis of the right ulna where the olecranon process and trochlear notch had become poorly defined (Plate 3). Porosity and marginal bone formation was present in the femoral head and acetabulum. Nodules of new bone had formed within the acetabulum and eburnation was present on the superior border. All changes are consistent with a diagnosis of osteoarthritis (Aufderheide and Rodríguez-Martín 1998) secondary to trauma. The right radius and ulna appear to have been displaced posteriorly and laterally, resulting in the proximal ulna articulating only with the medial surface of the distal articulation of the humerus where a small pseudo facet could be seen: the olecranon process lying within the malformed remains of the lateral condyle. The radial head had a small nodule of bone in the centre, but no indications of joint disease, suggesting it was not in direct articulation with the humerus. Unfortunately the coronoid process of the ulna was absent, but heterotopic bone formation as the result of damage to blood vessels had occurred around the lateral epicondyle of the humerus. Such an injury may have damaged the brachial artery, the median or ulnar nerves (Resnick 2002; Gosling *et al* 1996). However, no indications of atrophy as the result of disuse of the limb or of secondary osteoarthritis were present. In life the right forearm would have been held at an angle across the body.

The same individual had a widened acetabulum and both intra-capsular and heterotopic bone formation in the right hip (see joint disease). Changes appear consistent with a dislocation of the femoral head, as so much proliferation would not be expected if it were simply osteoarthritis. Bone formation on the roof of the acetabulum presumably results from damage to the labrum. The acetabular notch was perforated with a linear fissure extending anteriorly. A large sinus 28mm x14mm lay anterior to the acetabular notch and contained several bony nodules. The femoral head lay within the acetabulum suggesting reduction of the injury had taken place (Plate 4). Changes to the lower thoracic vertebrae were also consistent with a traumatic event (see joint disease).

Dislocation of the elbow is relatively common and can result from hyperextension (such as a fall on an outstretched hand) or by extremes of pronation or supination of the ulna, whilst dislocation of the femoral head requires considerable force and is often associated with other injuries (Resnick 2002). Landing heavily on one's feet would also put extreme stress on the weight bearing thoracic-lumbar junction. It seems likely that the injuries seen in [261] are the result of a single traumatic event, quite probably a fall from some height. Copper staining around the elbow area relates to a number of buckles from clothing and dress accessories (Blackmore *pers. comm.*), rather than any indications of bracing or treatment.

An older male [363] had a number of fractures. Four mid rib fragments including three unsided fragments with well-healed calluses (three of which had two adjacent fractures each) were found. The proximal left femur had a proliferation of disorganised and sclerotic bone. The femoral neck was c. 10mm shorter than the left side and the head had deviated inferiorly, lying at an approximate right angle to the femoral shaft. This indicates a fracture of the femoral neck and is consistent with a type III fracture as classified by the Gardner system (Resnick 2002). No secondary joint degeneration had occurred but extensive heterotopic bone formation was present (Plate 5). The fracture may have been the result of direct injury to the greater trochanter or the lateral rotation of the distal portion of the bone. This is common in elderly adults as a complication of osteopenia, but given the well-healed nature of the fracture itself and the associated thoracic trauma, this injury may have occurred some years prior to death and in the younger adult would have required an increased force (Resnick 2002).

Most of those with traumatic lesions were males at the older end of the spectrum, giving a prevalence of 50% of the males in the assemblage. Data for the period as a whole indicates more males than females are subject to traumatic assaults with a population prevalence of 5.9%, although only six individuals (3 male and 3 female) with dislocations have previously been reported on (Roberts and Cox 2003).

Table 17: Prevalence of trauma per element involved

Context	Age and sex	Location	Observable (adult)	%
261	Mature male	Right femur	8	13
		Right elbow	5	20
		T11	6	17
296	Mature female	L2	8	13
299	Older male	L3	8	13
363	Older male	Left femoral neck	8	13
		Ribs x 4	215	2

Metabolic disorders

Four right and six left orbits were observable from seven individuals (Table 18). Two from each side showed indications of cribra orbitalia (Stuart-Macadam 1991) giving a prevalence of 50% for the right orbit and 33% for the left. The small number of bones involved creates an artificially high result, which prevents useful comparison with other sites, although Wells *et al* (2003) reported a frequency of 27.9% at Worthy Park. One case [280], a mature adult, was bilateral with capillary like lesions on the right orbit and more marked changes on the left. Young adult [214] had unilateral fine foramina and a 4-6 year old infant [168], had one observable orbit with grade 2 changes. The reported pattern is of 90% of cases being bilateral (Aufderheide and Rodríguez-Martín 1998).

Table 18: Prevalence of cribra orbitalia

Grade (Stuart-Macadam 1991)	**Number of orbits**	
	Right orbit	**Left orbit**
0	2 (50%)	4 (66%)
1	1 (25%)	1 (17%)
2	1 (25%)	1 (17%)
Unobservable	31	29
Total	**35**	**35**

Orbital roof lesions are generally regarded as an indicator of iron deficiency anaemia, forming as the result of the thinning of the outer table and subsequent diploic expansion in an attempt to produce greater numbers of red blood cells. Such anaemia is likely to be the result of a combination of dietary and genetic factors, but may also result from severe blood loss, though disease or injury (Roberts and Manchester 1995). The presence of such lesions in adults indicates that they suffered a period or period of deficiency during childhood as lesions are only acquired at this time (Aufderheide and Rodríguez-Martín 1998).

4 DISCUSSION

The apparent peak in deaths of 4-7 year olds is intriguing. However, the absence of pathological lesions at Cuxton may be an artefact of preservation rather than a genuine reflection of health status. Modern health statistics compiled by the World Health organisation (www.who.int) indicate that acute infectious diseases, which would not be visible skeletally, accounted for 63% of deaths in children under 4 years of age in 1998. Diarrhoeal diseases alone accounted for nearly 2 million deaths in the under fives. The clustering of deaths at Cuxton in older infanthood may also reflect a late weaning time and subsequent drop in immune status.

Although a "surprisingly high" proportion of infants were noted at Lechlade and Wally Corner, Berinsfield had a subadult population of 29% (33) of the whole assemblage (Boyle and Dodd 1995; Crawford 1993, 85), there is a reported under representation of infants from other Saxon cemeteries. This is based on the assumption that the demographic pattern should be similar to modern pre-industrialised groups (Crawford 1993, Evison 1987, Buckberry 2000). A number of authors have suggested cultural and taphonomic factors to account for this (Buckberry 2000, Lewis 2000). The poor condition of subadult remains at Cuxton appears to support differential taphonomy as the major causative factor.

Preservation alone does not account for the absence of neonates in the assemblage. The subadult demographic profile at Cuxton may reflect a high status group with low infant mortality however, given the small sample size, this remains speculative.

The apparent demographic differences between the three inhumation groups outlined in Table 1 are intriguing. In particular the absence of non-adults in group three. However, given the small number of burials involved and the number of adults who could not be ascribed an age, no firm conclusions can be drawn. There is insufficient data, to determine whether the demographic profile of the site is significant, whether it is temporally or culturally influenced or, an artefact of the excavation area itself as the site was truncated by the construction of railway lines and post-medieval quarrying.

The heritability of morphological traits is not fully understood but so far non-metrics have indicated no evidence of large-scale migration (Mays 2000). The sparse nature of both metric and non-metric data for this site prevents the examination of possible kinship differences.

It is interesting that two males had evidence of traumatic injuries that would have required some force. Whilst skeletal trauma is often looked to for evidence of interpersonal violence (associated with the migration of peoples) the injury patterns demonstrated are more likely to represent falls onto outstretched limbs and could be the result of the hazards of everyday life.

Paleopathological conditions associated with migration may include interpersonal violence and an increase in infectious illnesses (Roberts and Cox 2003). None were definitively identified at Cuxton, though perhaps the high prevalence if trauma in the male portion of the assemblage (50%) may be related to migration stresses.

Given the richness of the grave goods and importance of the cemetery setting within a ritual landscape, does this cemetery represent an elite group? Whilst combinations of grave goods may be indicative of social status or differences (Roberts and Cox 2003), there is no osteological evidence to confirm or deny this theory. High status individuals would be expected to have good access to nutritional resources and consequently have good immune status. The survival of the individual with osteomyelitis and two with severe trauma perhaps support this. Undernourished children will become shorter adults (Larsen 1997) but there is insufficient stature data from this assemblage to draw any conclusions, however the absence of enamel hypoplasia provides no evidence of periods of dietary stress.

Two of the five (40%) burials without grave goods contained the remains of immature individuals ([217] aged between 2 and 9 years at death and [242] a 1-2 years old infant). One infant and two juveniles were found with spears. Two of these individuals were below the age thought to represent adulthood: 4-5 years and 6-7 years. Several authors have suggested that the move into adulthood was made between 10 and 12 years old (Buckberry 2000) based on the inclusion of grave goods. Spears are highly symbolic in nature and a badge of adulthood. Given the poor preservation of many remains from Saxon sites and that the juvenile remains appear to suffer most (Buckberry 2000), it is possible that this practice may be more common than presently believed. However, perhaps it reflects an incoming or socially different group attempting to define or reinforce their social identity through their funerary practices.

The archaeologists described the adult burial [302] as ‘crouched’ and occupying a surprisingly large grave cut. This grave was found to contain a single juvenile tooth. Closer inspection of the site plans suggested that the lower half of the adult burial might have been disturbed, rather than lying in a crouched position. Since the subadults at Cuxton survived only as teeth, further elements of the second, unexpected, subadult individual present within the grave of [302], may have been missed. It would not have been recovered without sieving of the entire grave fill. The size of the grave cut suggests there could have been two closely intercutting and closely contemporary graves, but infants are found in multiple burials elsewhere (Crawford 1993). It is not possible to ascertain if secondary re-use of the grave, two original occupants or contemporary grave robbing had occurred.

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APPENDICES

Distribution of spinal joint disease

OA		**Cervical**							**Thoracic**												**Lumbar**					**Sacrum**
Site code	**context**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
CXT98	178	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
CXT98	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	1	0	0
CXT98	261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	1	0	0	1	1	0
CXT98	280	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	299	1	2	2	2	2	1	2	2	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
CXT98	302	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0
Totals	1	1	1	0	0	1	1	0	0	1	0	0	0	0	0	1	0	0	1	0	1	1	0	2	2	0
	2	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	2	1	1	0	0	0	0	0	1
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total affected		2	2	1	1	2	1	1	1	1	0	0	0	0	0	1	1	2	2	1	1	1	0	2	2	1
	0	8	8	9	9	8	9	9	9	9	10	10	10	10	10	9	9	8	8	9	9	9	10	8	8	9
Total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		17	17	11	11	18	14	17	20	14	0	0	0	0	0	14	14	33	33	17	13	13	0	25	25	14

Distribution of spinal joint disease (cont'd)

SN		Cervical							Thoracic												Lumbar					Sacrum
Site code	**context**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
CXT98	178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0
CXT98	249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
CXT98	280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
CXT98	299	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0
CXT98	302	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
CXT98	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	2	1	1	0	0	0
	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
total affected		0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	2	2	1	2	1	1	0	0	0
	0	10	10	10	10	10	10	10	10	10	9	10	10	10	10	10	9	8	8	9	8	9	9	10	10	10
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		0	0	0	0	0	0	0	0	0	13	0	0	0	0	0	14	33	33	17	25	13	13	0	0	0

Distribution of spinal joint disease (cont'd)

IVD		Cervical							Thoracic												Lumbar					Sacrum
Site code	**context**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
CXT98	178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	261	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
CXT98	280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	296	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	299	0	0	0	1	2	3	2	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	0
CXT98	302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	1	0
total affected		0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	1	1	0
	0	10	10	10	9	8	9	9	10	10	10	10	10	10	10	10	10	10	9	8	9	9	9	9	9	10
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		0	0	0	11	18	14	17	0	0	0	0	0	0	0	0	0	0	17	33	13	13	13	13	13	0

Distribution of spinal joint disease (cont'd)

OP		Cervical							Thoracic												Lumbar					Sacrum
Site code	**context**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**	**5**	**1**
CXT98	178	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
CXT98	193	0	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	249	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	261	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	0	3	3	1	0	0	0	0	0	0
CXT98	280	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CXT98	296	0	0	2	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	3	2	0	1	1
CXT98	299	0	0	1	1	2	2	1	0	0	0	0	0	0	0	0	0	2	2	2	2	3	3	3	0	1
CXT98	302	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	2	0
CXT98	363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	1	0	0	3	2	1	1	2	2	1	1	1	2	0	3	1	0	0	0	1	0	0	0	0	1	2
	2	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	1	2	0	2	0	1	0
	3	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	1	1	0	0
total affected		0	1	5	2	2	2	2	2	1	1	1	2	0	3	1	0	2	2	2	2	2	3	1	2	2
	0	10	9	5	8	8	8	8	8	9	9	9	8	10	7	9	10	8	8	8	8	8	7	9	8	8
total adult		12	12	9	9	11	7	6	5	7	8	8	8	8	8	7	7	6	6	6	8	8	8	8	8	7
% affected		0	8	56	22	18	29	33	40	14	13	13	25	0	38	14	0	33	33	33	25	25	38	13	25	29

Cranial metrics: (Measurable individuals only shown) (All metrics in mm.)

Skeleton	178	190	193	210	214	249	261	280	296	299	302	305
Max Length	x	x	x	x	175.0	x	x	x	x	186.0	x	x
Max breadth	x	x	x	x	137.0	x	x	x	x	x	x	x
Basion bregma height	x	x	x	x	x	x	x	x	x	130.0	x	x
Basi nasal length	x	x	x	x	x	x	x	x	x	99.0	x	x
Max circumference	x	x	x	x	505.0	x	x	x	x	x	x	x
Upper facial height	x	x	x	x	65.3	x	x	x	x	x	x	x
Bimaxillary breadth	x	x	x	x	88.7	x	x	x	x	x	x	x
Nasal height	x	x	x	x	47.4	x	x	x	x	x	x	x
Nasal breadth	x	x	x	x	23.0	x	x	x	x	x	x	x
Bi-dacryonic chord	x	x	x	x	18.3	x	x	x	x	x	x	x
Bi-dacryonic arc	x	x	x	x	33.0	x	x	x	x	x	x	x
Total facial height	x	x	x	x	114.8	x	x	x	x	x	x	x
Frontal breadth	x	x	x	x	95.3	x	x	x	x	95.4	x	x
Palatal length	x	x	x	x	43.8	x	x	41.0	x	x	x	x
Palatal breadth	x	x	x	x	40.6	x	x	39.5	x	x	x	x
External length	x	x	x	x	50.2	x	x	x	x	x	x	x
External breadth	x	x	x	x	66.0	x	x	x	x	x	x	x
Simiotic chord	x	x	x	x	11.2	x	x	x	x	x	x	x
Symphyseal height	29.0	x	32.0	x	30.4	22.9	33.8	26.2	21.4	x	x	24.7
Biforamen breadth	37.4	x	50.0	x	43.7	x	x	39.3	44.7	x	x	x
Bigonial breadth	x	x	x	x	x	x	x	x	x	x	x	x
Frontal arc	x	142.0	118.0	x	134.0	122.0	x	x	x	129.0	x	120.0
Frontal chord	x	110.4	105.8	x	114.7	107.6	x	x	x	x	x	111.0
Parietal arc	x	x	121.0	x	120.0	x	x	x	x	126.0	x	x
Parietal chord	x	x	103.9	x	109.0	x	x	x	x	x	x	x
Occipital arc	x	x	x	x	x	x	x	x	x	111.0	x	x
Occipital chord	x	x	x	x	x	x	x	x	x	98.0	x	x
Foraminal breadth	x	x	26.7	x	x	x	x	30.4	x	39.7	x	x
Frontal breadth	x	x	93.0	x	x	x	x	x	x	29.4	x	x

Adult cranial metrics (cont'd)

Skeleton	**178**		**190**		**214**		**246**		**249**		**261**		**280**		**296**		**299**		**302**		**305**		**360**		**363**	
Side	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
Ramus breadth	32.3	x	x	x	x	30.3	x	x	x	28.3	31.8	34.2	x	x	x	x	32	30.9	x	x	32.3	x	x	x	x	x
Coronoid height	62.5	x	x	x	63.4	x	x	x	x	x	80	75	x	x	x	x	67.1	68.9	x	x	61.7	x	x	x	x	x
Ramus height	x	x	x	x	58.7	x	x	x	x	60.7	74.4	x	x	x	x	x	63.8	64.9	x	x	56.8	x	x	32	x	x
M1/2 Body Height	25.5	19.7	x	x	21.4	24.2	23.2	x	x	x	29	29.8	13.8	18.9	x	25.9	24.7	28.3	x	x	26	x	x	31.9	x	28
M1/2 Body thickness	16	14.3	x	x	13	13.2	17.8	x	x	x	17.4	15.4	15.2	10	x	13.2	17.8	14.6	x	x	15.2	x	x	16.6	x	17.2
Orbital length	x	x	34.5	x	34.8	31.4	x	x	x	x	x	x	x	x	x	x	X	x	x	x	x	x	x	x	x	x
Orbital breadth	x	x	x	x	38.8	38.2	x	x	x	x	x	x	x	x	x	x	X	x	x	x	x	x	x	x	x	x

Adult dental metrics:

skeleton	L max canine BL	L max canine MD	R max canine BL	R max canine MD	L mand canine BL	L mand canine MD	R mand canine BL	R mand canine MD
164	9.1	8.3	9.8	8.9	8.8	7.7	9	8.2
166	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	x	x
190	8.9	9.1	9.9	8.2	9.7	8.5	x	x
193	x	x	x	x	8.7	7	8.1	7.8
210	x	x	x	x	x	x	x	x
214	9.7	8.2	10	8	11.2	7.2	11	7.4
240	x	x	6.9	8	5.6	6.9	x	x
246	10.3	8.5	10	8.3	11.3	7.3	9.7	6
249	7.2	7.8	6.2	7	7.2	6.4	7.3	6.8
261	11.2	9.3	11	8.8	11.8	7.7	12	8.2
280	x	x	x	x	6.3	7.2	7	7.4
282	x	x	x	x	x	x	x	x
296	x	x	9.3	8.2	9.7	7.5	9.7	7.5
299	9.7	8.8	9.8	8.3	10.9	8.2	12	9.2
302	x	x	x	x	x	x	x	x
305	7.8	7.3	8	7	9.2	7.3	9.6	7.1
315	11.2	8.7	9.8	8.8	10.8	8	8.9	8
318	8.9	7.8	8	7.8	7.9	6.9	7.9	6.9
323	x	x	x	x	x	x	x	x
360	x	x	x	x	7.8	7	x	x
363	x	x	x	x	x	x	x	x
372	9.4	7.8	9.8	7.6	9.4	7.6	6.7	7.8
378	8.1	7.2	7.2	7.8	7.1	7	6.5	7.6

Adult Post – cranial metrics:

Sk	FeL1 R	FeL1 L	FeL2 R	FeL2 L	FeHD R	FeHD L	FeD1 R	FeD1 L	FeD2 R	FeD2 L	FeD3 R	FeD3 L	FeD4 R	FeD4 L	FeC R	FeC L	FeE R	FeE L
164	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
166	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	28	x	34.8	x	x	x	x	x	x	x	x	x
190	x	x	x	x	x	x	x	27	x	31.5	x	x	x	x	x	x	x	x
193	x	x	x	x	x	42.3	25.5	24.5	32.4	31.0	x	x	x	x	x	x	x	x
210	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
214	x	x	x	x	37.4	35.9	22.3	23.4	30.0	32.6	23.9	23.8	24	25.2	75.0	77.0	x	x
240	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
246	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
249	x	x	x	x	42.2	41.8	24.0	23.6	32.5	34.2	x	x	x	x	x	x	x	x
261	x	x	x	x	x	48.3	x	29.6	x	36.8	x	x	x	x	x	x	x	x
280	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
282	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
296	x	x	x	x	44.2	x	x	x	x	x	x	x	x	x	x	x	x	x
299	471	x	467	x	50.0	46.0	30.4	29.4	33.9	34.0	34.2	x	27.7	x	110	x	x	x
302	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
305	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
315	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
318	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
323	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
360	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
363	x	x	x	x	47.2	x	22.0	23.0	34.0	33.0	x	x	x	x	x	x	x	x
372	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
378	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Adult Post – cranial metrics (cont'd)

Skeleton	TiL1 R	TiL1 L	TiL2 R	TiL2 L	TiD1 R	TiD1 L	TiD2 R	TiD2 L	TiE R	TiE L	FiL1 R	FiL2 L
164	x	x	x	x	x	x	x	x	x	x	x	x
166	x	x	x	x	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	x	x	x	x	x	x
190	x	x	x	x	x	x	x	x	x	x	x	x
193	x	x	x	x	x	x	x	x	x	x	x	x
210	x	x	x	x	x	x	x	x	x	x	x	x
214	x	x	x	x	x	x	x	x	x	x	x	x
240	x	x	x	x	x	x	x	x	x	x	x	x
246	x	x	x	x	x	x	x	x	x	x	x	x
249	x	x	x	x	x	x	x	x	x	x	x	x
261	x	x	x	x	x	x	x	x	x	x	x	x
280	x	x	x	x	x	x	x	x	x	x	x	x
282	x	x	x	x	x	x	x	x	x	x	x	x
296	x	x	x	x	x	x	x	x	x	x	x	x
299	374	375	370	368	35.5	31.5	25.3	25.3	x	x	x	x
302	x	x	x	x	x	x	x	x	x	x	x	x
305	x	x	x	x	x	x	x	x	x	x	x	x
315	x	x	x	x	x	x	x	x	x	x	x	x
318	x	x	x	x	x	x	x	x	x	x	x	x
323	x	x	x	x	x	x	x	x	x	x	x	x
360	x	x	x	x	x	x	x	x	x	x	x	x
363	x	x	x	x	x	x	x	x	x	x	x	x
372	x	x	x	x	x	x	x	x	x	72.0	x	x
378	x	x	x	x	x	x	x	x	x	x	x	x

Adult Post – cranial metrics (cont'd)

Skeleton	HuL1 R	HuL1 L	HuHD R	HuHD L	HuD1 R	HuD1 L	HuD2 R	HuD2 L	HuC R	HuC L	HuE1 R	HuE1 L	RaL R	RaL L	ULL1 R	ULL1 L
164	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
166	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
190	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
193	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
210	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
214	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
240	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
246	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
249	312.0	x	x	x	23.0	x	19.0	x	64.0	x	x	x	253.0	x	x	x
261	x	x	x	x	x	x	x	x	x	x	70.0	57.4	x	266.0	x	x
280	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
282	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
296	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
299	343.0	336.0	50.0	46.0	25.4	22.8	20.2	21.4	77.0	69.0	69.2	x	249.0	x	267.0	x
302	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
305	x	x	x	x	x	x	x	x	x	x	x	x	233.0	x	x	x
315	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
318	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
323	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
360	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
363	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
372	x	x	x	x	x	x	x	x	x	x	x	x	254.0	x	x	x
378	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Adult Post – cranial metrics (cont'd)

Skeleton	CLL1 R	CLL1 L	CID1 R	CID1 L	CIC R	CIC L	GLL R	GLL L	GLB R	GLB L
164	x	x	x	x	x	x	x	x	x	x
166	x	x	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	x	x	x	x
190	x	x	x	x	x	x	x	x	x	x
193	x	x	x	x	x	x	41.8	x	25.8	x
210	x	x	x	x	x	x	x	x	x	x
214	x	x	13.2	11.5	36.0	36.0	x	35.4	x	22.2
240	x	x	x	x	x	x	x	x	x	x
246	x	x	x	x	x	x	x	x	x	x
249	x	x	10.2	x	35.0	x	39.3	x	25.5	x
261	161.0	162.0	14.5	13.5	44.0	42.0	44.5	x	31.5	31.3
280	x	x	x	x	x	x	x	x	x	x
282	x	x	x	x	x	x	x	x	x	x
296	x	x	12.2	x	33.0	x	x	x	x	x
299	158.0	165.0	12.2	11.1	44.0	41.0	42.8	42.5	34.0	29.7
302	x	x	x	x	x	x	x	x	x	x
305	x	x	x	x	x	x	x	x	x	x
315	x	x	x	x	x	x	x	x	x	x
318	x	x	x	x	x	x	x	x	x	x
323	x	x	x	x	x	x	x	x	x	x
360	x	x	x	x	x	x	x	x	x	x
363	x	x	x	x	x	x	x	x	x	x
372	x	x	x	x	x	x	x	x	x	x
378	x	x	x	x	x	x	x	x	x	x

Adult Post – cranial metrics (cont'd)

Skeleton	SaL	SaB	BW
164	x	x	x
166	x	x	x
178	x	x	x
190	x	x	x
193	x	x	x
210	x	x	x
214	x	x	x
240	x	x	x
246	x	x	x
249	x	x	x
261	118.1	130	x
280	x	x	x
282	x	x	x
296	x	118.2	x
299	x	x	x
302	x	x	x
305	x	x	x
315	x	x	x
318	x	x	x
323	x	x	x
360	x	x	x
363	x	x	x
372	x	x	x
378	x	x	x

Skeleton	CaL R	CaL L	TaL R	TaL L	Pal R	Pal L	PaB R	PaB L
164	x	x	x	x	x	x	x	x
166	x	x	x	x	x	x	x	x
178	x	x	x	x	x	x	x	x
190	x	x	x	x	x	x	x	x
193	72.8	74.4	52.0	50.5	x	x	x	x
210	x	x	x	x	x	x	x	x
214	x	x	x	x	x	x	x	x
240	x	x	x	x	x	x	x	x
246	x	x	x	x	x	x	x	x
249	x	x	x	x	x	x	x	x
261	89.5	85.9	55.0	55.8	x	39.8	x	x
280	x	x	x	x	x	x	x	x
282	x	x	x	x	x	x	x	x
296	x	x	x	x	40.8	x	x	x
299	85.3	90.0	60.3	59.0	43.2	44.0	44.4	44.8
302	x	x	x	x	x	x	x	x
305	x	x	49.2	48.8	x	x	x	x
315	x	x	x	x	x	x	x	x
318	x	x	x	x	x	x	x	x
323	x	x	x	x	x	x	x	x
360	x	x	x	x	x	x	x	x
363	x	x	x	x	x	x	38.8	x
372	x	x	x	x	x	x	x	x
378	x	x	x	x	x	x	40.8	x

Indices:

Skeleton	190	193	214	249	280	299	305
Frontal curve index	89.03	89.66	85.6	88.2	x	89.3	92.5
Parietal curve index	x	85.87	90.83	x	x	90.24	x
Occipital curve inmdex	x	x	x	x	x	88.29	x
Cranial index	x	x	78.9	x	x	x	x
Fronto parietal index	x	x	69.56	x	x	x	x
Nasal index	x	x	48.52	x	x	x	x
Orbital index	x	x	82.2	x	x	x	x
Maxillo-alveolar index	x	x	131.47	x	x	x	x
Palatal index	x	x	92.69	x	96.34	x	x
Upper facial index	x	x	x	x	x	69.89	x
Foramen magnum index	x	x	x	x	x	74.06	x

Skeleton	249	296	261
Humeral robusiticy	13.46	x	x
Bravcial index	82.61	x	x
Manubrio corpus index	x	50.45	40.54
Clavicel robusticity	x	x	25.93
Sacral index	x	x	110.08