AML Rpt 4357

Rivenhall Church, Essex.

A report on the human remains.

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Report to the Ancient Monuments Laboratory September 1984

This report supercedes A.M. Laboratory Report no. 2202

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Introduction.

A total of 229 skeletons or partial skeletons were submitted for examination and report, from all parts of the cemetery. The burials have each been attributed to one of seven chronological groups. These groups, and their equivalent archaeological periods, are:

A - period 4C. Mid-late Saxon. 46 bodies.
B - period 5A-B. 10th-12th century. 28 bodies.
C - period 5C. 12th-14th century. 37 bodies.
B-C - period 5A-C. 10th-14th century. 4 bodies.
D - period 6. 14th-17th century. 39 bodies.
E - period 5-6. Pre-18th century. 31 bodies.
F - period 7. 18th-19th century. 44 bodies.

The state of preservation of the bones ranged from good to poor, the most well-preserved specimens not necessarily being the most recently buried. Some post-mortem damage and deformation had occurred, such as twisting or flattening of skull bones in poorly preserved skeletons. Fresh breaks were noted in an appreciable proportion of skull and limb bones, and this reduced the extent of any metrical analysis.

Methods.

The skeletons were recorded on duplicated forms which allowed standardised notation of dentition, measurements, and a number of discontinuous traits, and also gave scope for description or illustration of evidence for disease or injury, or unusual abnormalities. The original record forms are retained at the Ancient Monuments Laboratory, London. Examination and recording followed procedures described by Brothwell (1972). Sex was determined by examination of the pelvis and skull, sexing criteria on the pelvis being taken as the more reliable. In all uncertain cases, the skeleton was recorded as of indeterminate sex, and this was usually the case with immature skeletons. Age was estimated on the basis of tooth eruption and attrition, the state of fusion of appendicular epiphyses, and on the extent of obliteration of cranial sutures (Todd and Lyon, 1924). Where adult stature has been reconstructed, this was obtained from the regression equations given by Trotter and Gleser (1952; 1958), and should be regarded as an approximate estimate.

Results.

The information obtained for each burial is summarised in Table 1, and Table 2 gives a more condensed listing of information by chronological group.

Sex ratios.

The proportion of males to females varies considerably from group to group, although the high proportion of individuals of uncertain sex must be taken into account. The variation observed could have arisen randomly. Overall, 74 skeletons were identified as male, 76 as female, with 79 of uncertain attribution.

Mortality.

The number of cases in each of nine age-classes is given in Table 2, and in Table 3 these data are further subdivided by sex. Overall, the figures show an appreciable mortality in all age groups, including children and teenagers. The proportion of perinatal individuals may well have been higher than appears from Table 3, as preservation and recovery of infant bones would understandably be poor, and many small babies may not have been conventionally buried anyway. Most child skeletons could not be assigned to a sex. Exceptions were a total of ten cases in groups B, C, E and F which were clearly female, identified as such because of the form of the greater sciatic notch and the presence of a well-marked pre-auricular sulcus. Of the individuals assigned as children of indeterminate sex in Table 3, some could be females in which diagnostic pelvic features were not apparent and the remainder would be males. It would be quite wrong, therefore, to take the figures in Table 3 as evidence for a higher mortality of girl children than boys, as the indeterminate cases could all be males.

Individuals aged between puberty and mid-20s show a predominance of females overall, even if all indeterminate cases are assumed to be males. Although this can only be speculation, it seems likely that this greater mortality of young women was caused by childbirth complications. Two burials included the skeleton of a woman with that of a perinatal infant. In burial 227, the adult skeleton lacked head and feet, and an accurate estimate of age at death could not be made. The associated infant bones were those of a foetus in the 9th month in utero. Death could have been the result of complications in late pregnancy, or a difficult, slightly premature, birth. Burial 187 contained the body of a woman aged about 18-22 years, with the bones of a perinatal infant. Labour complications seem highly probable in this case: the woman was of very gracile build, with a reconstructed stature of only 148 cm (about 4'10"). Quite why she was so small is not clear, although hypoplastic disruptions of the enamel of the upper premolars may indicate periods of illness in chilhood.

Moving on to the older individuals, the modern pattern of women outliving men is not apparent. Most of the oldest individuals were male, although 'old' in this context only means 50 years or more. Individuals of over 40 years become increasingly difficult to assign to an age-class by conventional means, but taking into account sutural

obliteration and the rare incidence of senile osteoporosis, it seems likely that few, if any, of these individuals lived much beyond their 60th year. To calculate a precise life expectancy from such modest samples would be wrong. What can be said is that about half of the individuals in these groups died by their 25th year, and that there is no clear evidence for any change in this mortality pattern with time.

Estimated stature and biometry.

The mean values given for estimated stature in Table 2 show the mean for group A to be higher than for the other groups. This point is illustrated in Fig. 1, which shows group A to be characterised by the presence of several markedly tall individuals (6 feet is about 183 cm). The mean for this group is clearly higher than for groups B to F, but it may be an over-simplification to say that this shows the Saxon inhabitants to have been taller than their successors. Table 2 shows group A to include more males than females. If male skeletons were consistently giving higher stature estimates than females, then this sex imbalance in group A could account for the higher mean and larger range of this group. Table 4 gives mean estimated stature separately for males and females from groups A, D and F. The figures show the mean for males in group A to be significantly higher than for groups D and F, but little or no difference in the means for females. A better interpretation of Fig. 1, then, is to say that Saxon males were, on average taller than males in later periods, and that the high proportion of males in group A has produced a high sample mean. The decline in sexual dimorphism in height with time is difficult to explain in purely environmental terms, unless a fall in dietary standards suppressed the growth of potentially tall males, and there is no evidence to support such an interpretation.

A number of crania were sufficiently complete to be measured, and these measurements are listed in Table 5. The samples obtained were too small to be used on their own for any multivariate analysis, but may be of value for future research given the application of estimation techniques to compensate for missing values. The cephalic index (100 X cranial breadth/cranial length) was investigated to see if the Saxons of group A showed any clear difference in skull shape to the later inhabitants. Figure 2 plots the results, and shows mean cephalic index for group A to be markedly lower than for groups B and C. Given that the samples are rather small, it would be unwise to draw firm conclusions from this, but taking the apparent change in cephalic index with the change in stature described above, there is tentative evidence for some population change between periods 4 and 5.

A third metrical trait which was investigated was the robusticity of the humerus. For each complete adult humerus, the length (HuL1), and maximum and minimum shaft diameters (HuD1 and HuD2) were measured. Samples were drawn from groups A and C to determine whether there was any significant difference in upper arm robusticity between males and females, and whether this difference changed through time in parallel with the observed changes in stature dimorphism. As an index of robusticity, the product of the two shaft diameters (HuD1 X HuD2) was calculated. The results are given in full in Table 6. In brief, a

large and significant difference between males and females was noted in group A and a smaller difference in group C, males being the more robust. The mean obtained for the female humeri is almost the same for the two samples (381.5 in A, 381.6 in C), but that for male humeri differs considerably (513.4 in A, 431.8 in C). As with estimated stature, the results indicate a much greater degree of sexual dimorphism in the Saxon population than subsequently, the medieval males being generally shorter and more gracile than their forebears. To digress a little, a comparison of values obtained for pairs of humeri in Table 6 indicate a marked propensity for right-handedness, assuming a right-hand bias to lead to a greater robusticity in the right humerus.

Disease and trauma

The most frequent disease symptoms in all groups were those of degenerative joint disease ('arthritis'). In a valuable survey of joint disease, Zivanovic (1982, 142-55) describes some of the numerous causes of joint disease, and concludes that it is 'more than probable' that a definitive diagnosis of ancient arthritic symptoms will not be possible. So it is with Rivenhall, for which few firm diagnoses can be offered. Table 7 summarises the anatomical sites afflicted. There is an obvious concentration of cases in the lower back, hips and knees, group F showing a particularly high concentration of cases involving the hips. Rheumatoid and tubercular arthritis are two common causes of joint damage in the spine, the latter disease involving necrosis or collapse of vertebral centra. A few cases can possibly be attributed to tubercular arthritis, namely 293, 237, 208 and 252. For the remaining spinal cases, some showed patterns of ankylosis typical of rheumatoid arthritis, in particular 52. The small number of cases involving hands and feet can probably be attributed to rheumatoid arthritis, rather than gonococcal arthritis which will also attack the extremities. Burial 301 exhibited severe peripheral exostosis development and eburnation of the articular surfaces of both knees, to a probably crippling extent. In 218, only the right knee was thus afflicted, and this may indicate osteoarthritis following an injury to that knee. Overall, symptoms of joint disease were more frequent in older individuals, although individuals under 30 years of age were occasionally afflicted. Most probably rheumatoid arthritis was common at all times, and people accepted a bad back and aching hips as symptoms of growing old. In addition, a smaller number of individuals acquired damaged joints as a consequence of trauma or bacterial infection.

Oral disease was the next most frequent category. Table 8 lists the occurrence of four common oral conditions: caries, periapical abcesses, calculus accretion and periodontal disease. The results are summarised in Fig. 3. There is a general fall in the incidence of calculus and periodontal disease from group A to group F, matched by an increase in caries and periapical abcesses. It can be argued that this shows a shift from predominantly alkaline mouth conditions in the Saxon period to predominantly acid in late- and post-medieval times (Hillson 1979, 149-150). Such a change could have been a consequence of changing dietary habits or oral microflora, or, more probably, a combination of the two. Two individuals showed evidence of traumatic damage to the teeth. In 243, the crown of the upper left lateral incisor had broken

off during life, leading to some secondary dentine response in the tooth and an inflammatory reaction in the alveolar bone. In 198, the left upper canine was displaced lingually, with fracturing and a healing response in the alveolus. In both of these cases the damage could be attributed to the individual being struck in the mouth by something or someone.

Turning to post-cranial disease and injury, six individuals (299, 214, 103, 200, 202 and 8) showed deformations of the tibiae or femora indicative of childhood rickets or its adult form osteomalacia. Burials 106 and 218 each had a small compact osteoma, one in the centre of the frontal bone, the other high on the right parietal. This is a non-malignant form of neoplasm or tumour. Only one convincing example of senile osteoporosis was noted, around the feet and ankles of the elderly woman in burial 204.

Fractures were rare. Two examples were found (235, 273) of a healed spiral fracture of the left fibula, in each case about 90 mm above the distal articulation. The skulls from burials 283 and 137 showed injuries suggestive of blows to the head. In 283 a healed linear trauma ran from the left frontal bone across the coronal suture to the parietal bone, whilst in 137 the injury was located obliquely across the sagittal suture about 60 mm posterior to bregma. In both cases the injury appeared to have been caused by a long, sharp-edged implement such as a sword, scythe or large knife, and was not fatal. A left femur from burial 200 exhibited an area of superficial hyperostosis on the anterior aspect of the proximal end of the right femur, suggestive of a very severe bruise leading to sub-periosteal bleeding. Similar symptoms were noted on the medial aspect of the proximal end of the right tibia from burial 232.

It is important not to exaggerate the extent of disease and injury symptoms in these skeletons. Most cases were of uncomfortable but not excruciating arthritis, there were few signs of violent injury, and not a single case showed an obvious cause of death.

Non-metrical anomalies.

Wormian bones (supernumary sutural ossicles) were common in all groups. Table 9 summarises the frequency in different sutures for skulls in which the whole vault could be examined. The sagittal suture was less commonly affected than the coronal or lambdoidal sutures, and there is no simple change in frequency from group to group. Overall, the majority of skulls exhibited these additional bones. Epipteric and parietal notch bones were present in a small number of skulls, again with no concentration in one period. In seven skulls the mesofrontal or metopic suture had been retained into adulthood, a common anomaly recorded from most medieval assemblages. Wormian bones and metopic suture retention are developmental anomalies which, it has been argued, might be linked with low life expectancy and poor nutrition (Zivanovic 1982, 90, 94-5). If so, the high frequency of these sutural anomalies should perhaps be viewed together with the mortality data in Table 2 and the cases of rickets or osteomalacia referred to above.

Less commonly recorded is the presence of a perforation in the olecranon fossa of the humerus. This trait was recorded in 8 individuals. In seven cases the sacrum had six segments instead of the usual five. This was usually attributable to sacralisation of the lowest lumbar vertbra, although in one specimen (305) the extra segment was derived from the coccyx. At the other extreme, in two individuals the first sacral segment was not fully integrated with the rest of the sacrum. In one of these cases (241), this condition was associated with remodelling of the lumbar vertebrae so as to cause the spinal axis to deviate slightly to the left. Three specimens exhibited incomplete closure of the sacral canal.

Three dental anomalies were noted. In burial 280, crowding of the upper incisors had displaced the left upper medial incisor distally, pushing the left upper lateral incisor in a lingual direction. The condition observed in burial 245 may possibly have had a traumatic origin. The left upper medial incisor had been lost during life, the adjacent lateral incisor was displaced distally, and the left upper canine had 'leaned over' mesially such that the crown of the canine approximately occupied the resorbing alveolus of the medial incisor. No less bewildering was the palate of burial 152, for which no teeth remained in situ. Only one alveolus could be located for the right upper incisors. It was not clear whether this was for the medial or lateral incisor, nor what fate had befallen the other one. Of a total of 74 'mouths' examined, only one was found (175) in which the third molars were all apparently congenitally absent.

Conclusions

The conclusions which have been reached for the Rivenhall bodies hold little that is surprising or unusual. These skeletons represent the dead of a small community seen over a long period of time, and few changes are apparent over the period represented. Most notable, perhaps, is the evidence for a change in the morphotype of males between the Saxon and early medieval periods. This could have an environmental or demographic explanation, and, of the two, the latter seems the more probable. Other trends are shown in the changing frequencies of oral disorders. The rise in caries during the later part of the medieval period could reflect an increase in the proportion of carbohydrate in the diet. The low frequency of caries seen in the Saxon group A cetainly indicates a totally different oral environment to that typical of modern Essex.

Life expectancy was quite low in all periods, suggesting conditions to have been arduous. There is some evidence that the stresses of childbirth despatched some of the younger women, whilst the sparse evidence for serious injuries or lethal skeletal diseases suggests that soft-tissue disorders killed many people of both sexes. For those who survived to their fortieth year, the future held the promise of aching joints and, in later periods, bad teeth.

The possible association between sutural anomalies in the skull and extrinsic or intrinsic factors retarding growth remains unproven. If the sutural anomalies are an expression of epigenetic polymorphism, then a high frequency might be expected in a small, inbred community. On the other hand, if these anomalies are predisposed by poor nutrition and a high disease load, then the high frequencies in this community match other evidence for a low life expectancy and generally sub-optimal quality of life.

References.

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Key to Table 1

Categories:

SF = Special features
Sur = Survival of skeleton
St. = Stature.
1 = Dental caries rate
2 = Lambdoidal Wormian bones
3 = Parietal ditto
4 = Coronal ditto
5 = Parietal Notch bones
6 = Epipteric Bones
7 = Metopism
8 = Supra-orbital foramena
9 = Parietal foramena
10 = Appendicular arthritis
11 = Axial arthritis
12 = Six sacral vertabrae present
13 = Perforate olecranon fossa

Notes:

M = Male
F = Female
I = Indeterminate sex
A = Adult
J = Juvenile
In = Infant
eg 2/30 = 2 carious teeth out of 30 teeth present
N = Numerous
B = Both sides
L = Left
R = Right
/ = Present
s = slight
m = moderate
c = chronic

A numeral in categories 2, 3, or 4 indicates the number of ossicles present.

Special Features:

PH = Tile and stone packing round head
PF = Tile and stone packing round feet
TL = Tile lined
C = Coffin
HAR 2019 etc. Radio carbon determination

Survival of skeleton:

C = Complete
C- = Largely complete
UH = Upper body
LH = Lower body
RS = Right side
LS = Left side
-H = Head missing
-F = Feet missing
Fr = Fragmentary

Table 1. Catalogue of skeletons.

Group A: Period 4C

Grave	Area	SF	Sex	Age	Sur	St	1	2	3	4	5	6	7	8	9	10	11	12	13
280	C2	PH	I	A c. 30	UH		1/31	N	N	N									
281	C2	PH	I	In 4-5	C		0/20	N											
282	C2	with 293	M	A 15-18	C		0/25	N	N					R	R				
283	C2	PH	M	A 25-30	-F	155	0/32	N	N	N		B		L					
284	C2	PH HAR 2019	F	A 30-35	C-	173	0/10	N	N	N									
287	C2	PH	I	J 6-7	C		0/15												
288	C2	PH with 289	M	A c. 25	C	169	0/26	N	1	N							s		
289	C2	PH with 288	M	A 18-22															
			I	A 16-19			0/12	N	N	N				B					
290	C2		I	A 15-18	LH														
291	C2	PH	F	A 30-40+	C-	160	0/10	N	N	N			/		B		m		
292	C2	PH	M	A 30-35	C	173	0/25	N		N							s		
293	C2	with 282	M	A 25-30	C	179	0/32	N	N	N		R		B		s	m		
295	C2	PH	M	A 35-40	-F	177	5/30										m		
296	C2	PH	M	A 23-28	C	180	0/30	N	N	N						s	c		
297	C2	PHF	M	A 40+	C	185	2/30									s	m	L	
298	C2	HAR 2020	M	A	LH	160										s	s		
299	C2	PF	M	A	LH	178										s			
300	C2	PF	F	A	LH	159													
301	C2		F	A		171										c	m		
			F	A		153										m	m		
302			I	A															
303	C2		M	A	-H	176											m		
304	C2	PH (prone)	F	A 25-30	C	158	1/29	2						R					
305	C2		F	A	-H	165											m	/	
307	C2		M	A 30+	-H	171	0/1									m	m		
309	C2		M	A	-H	182										m	s		

Group A: Period 4C Continued..

Grave	Area	SF	Sex	Age	Sur	St	1	2	3	4	5	6	7	8	9	10	11	12	13
310	C2	PF	M	A	-H	177										s			
311	C2		M	A	-H	182										m			
312	C2	PH	M	A 20-25	UH		0/28	N											
313	C2		I	In ½-1	C		0/2												
314	C2		M	A Elderly	-H	180										s	c	/	
315	C2		M	A	-H	187													
316	C2	PHF HAR 2021	F	A c.35 + newborn In.	C		1/4	N	N	N									
317	C2	PHF	F	A 50+	C		1/14	N		N				L		m			
318	C2		F	A	LH	156	0/1	N							B				
319	C2		F	A 40-45	C	176	3/23									c			L
320	C2	PH	I	In c. 3	Fr		0/8												
321	C2		I	J ?4-7	Fr														
322	C2	PHF	M	A 35-40	C		3/3							R					
323	C2	PH	I	In. ½-1½	C														
325	C2		I	A	UH												m		
326	C2	PH HAR 2404	F	A 20-25	C	166	1/20							R					
329	C2		I	In. 3-4	C		0/13												
330	C2		I	J c. 5	-H														
331	C2		I	J 6-7	UH		0/6												

Group B: Period 5A-B

89	C1E	TL HAR 2016	M	A 40+	C-	174	3/10	N	N	N				m	m
107	C1E		I	A	LH										
135	C1E	HAR 2015	M	A 40+	UH	176	3/25					L		s	
137	C1E		F	A	-H	154		N							
139	C1E		I	A	LH										
145	C1E		I	In. 4-5	C-		0/7	N	N						
151	C1E		I	A	LH										
153	C1E		I	J 9-10	UH		0/16	N					B		
157	C1E		I	In. 2-3	-F		0/12								
165	C1E	HAR 2017	M	A 35+	C	172	3/19	N		N				s	/
175	C1E	TL	F	A 25-30	-F	159	6/24	N		N					
177	C1E		I	In. c. 4	-F		0/9								
181	C1E		F	J 5-7	LH										
183	C1E		M	A	LS-F	169									
199	C1E		I	J 4-6	LH										
209	C1E		F	J 8-10	C		0/17	5		N					
214	C4		F?	A	LH	171									
227	C1E		F	A + foetus	-H-F										
230	C4		F	A	LH	154									
231	C1E		F	A 20-25	-F	156	0/22			1		B			
237	C1E		F	A 30-35	UH	171	1/7	N	N	N					s /
239	C1E		I	J 7-8	RS		0/9								
251	C1E		F	In. 3-4			0/10						L		
			I	A Old	LH										m
255	C1E		I	A 30+	C		4/16								
259	C1E		F	J 9-10	C		0/20	N	3						
260	C4		F	A 40-45	C	163	2/15							c	s
261	C1E		I	In.			0/10								
263	C1E		M	A	-H	168									

Group C: Period 5C

Grave	Area	SF	Sex	Age	Sur	St	1	2	3	4	5	6	7	8	9	10	11	12	13
6	C1E		F	In. 3-4	C		0/15	1											
18	C1E		I	J															
66	C1E		I	In. 3-4	-F		0/10												
68	C1E		I	A	LH														
76	C1E		F	J 10-12	UH		0/11												
81	C1E		F	J c. 10	C		0/3												
85	C1E		M	A Old	-F	168	1/2	N	N	N						c	s		L
87	C1E		F	J 10-11	-F		1/8	N		N									
95	C1E		M	A	LS-H-F	175													
103	C1E		F	A	LH	170													
115	C1E		M	A 30+	-F	168	0/13	6		N		R							
116	C4		F	A	-H-F												s		
117	C1E		F	A 18-20	LS-H-F														
119	C1E		I	J 4-6	LH														
121	C1E		F	A 20-25	C	167	3/10									s	s		
125	C1E		M	A Elderly	C	175	11/13	N		N				B	B		m		
133	C1E		I	A	F														
147	C1E		M	A 45+	-F	179	5/14	N	N	N					B	m			
173	C1E		F	J 9-10	C-		0/17												
187	C1E		F	A 18-23	C	155	0/31	N	N	N									B
189	C1E		M	A	C	167	0/8	N	N	N		R	/	R					
193	C1E		I	J 6-7	C		0/10												
197	C1E		F	J c. 5	C														
205	C1E		I	In. c. 3	UH		0/14												

211	C1E		I	In. c. 2	-F		0/9										
213	C1E		F	A 25-30	-F	158	0/1	N		N	B					m	
223	C1E		M	A 30-40	-F	168	7/21	N		N	R					m	
225	C1E		I	In. 2-3	C-		0/8										
226	C4		M	A Elderly	F										s	c	
228	C4		F	A 35-45	C-	161	2/4					/			s	s	
235	C1E		M	A 40-45	C	167	6/22	N	N	N					s	m	
241	C1E		M	A	C	176		N	4	N			B				
243	C1E		F	A 35+	C	156	4/21	N	N	N							
245	C1E		F	A 18-20	C	168	3/8										
249	C1E		M	A	C	178		N		4						m	/
256	C4		M	A 18-22	-F	165	3/16					/					
257	C1E	HAR 2018	M	A 45+	C	180	3/14	N	N	N	B		B		s	m	
265	C1E		I	In. 3-4	C		0/13										

Group D: Period 6

Grave	Area	SF	Sex	Age	Sup	St	1	2	3	4	5	6	7	8	9	10	11	12	13
73	C1E		M	A 17-23	LS	172		N	N	N	L				L				L
79	C1E		I	In. 4-5	C		0/9	N											
124	C4		M	A 18-23	C-	177	3/12												
141	C1E		I	A	UH			N	N	N	L	L		B					
146	C4		M	A	C-		0/16												
152	C4		F	A	C	153	1/2	N	N	N				L					
154	C4		F	A 18-20	C	168	3/12	N	N	N				B					
158	C4		F	A Elderly	C-	165													
161	C1E		F	A 50+	-F	156	0/1	N		N				B					
163	C1E		I	J 3-6	UH														
164	C4		M	A	-H	177										m	/		
169	C1E		I	In 1-1½	C		0/7												
170	C4		F	A Elderly	-H	166										m	s	/	
171	C1E		I	J 7-10	LH														
174	C4		F	A ?Old	-F												m		
176	C4		F	A	-H	156											s		
178	C4		M	A Elderly	C	168	7/10									c	m		
179	C1E		I	A	LH-F											m			
180	C4		M	A 40+	F	177										m			
182	C4		F	A	C												s		
185	C1E		I	In 3-4	C		0/9	3											
188	C4		M	A	-F	160		N	N	N	L	L		B					
198	C4		F	A 16-18	C		9/21	N	N										

200	C4	F	A	C	170		N	N								
203	C1E	M	A 40-45	-F	165	3/13	N	N	N			R	m	m		
204	C4	F	A Elderly	C	150	3/4										
207	C1E	I	J 5-6	C		2/10										
208	C4	M	A	C	165											
210	C4	M	A 23-27	C	175	0/26								s		
212	C4	I		F												
215	C1E	M	A Old	C	169	1/8	N					B		m		
218	C4	M	A ?Old	-F	163	3/4							c			L
219	C1E	I	J 5-6	C		0/6	N									
220	C4	M	A 30-35	C		0/21							m	m		
221	C1E	I	In 3-4	C		0/3										
224	C4	F	A 35+?	F	168	3/10										
229	C1E	I	J 6-8?	UH												
233	C1E	F	A 20-25	C	162	1/27										
253	C1E	M	A 45+	C	177	2/12	N	N	N		L		c	s		

Group F: Period 7

Grave	Area	SF	Sex	Age	Sur	St	1	2	3	4	5	6	7	8	9	10	11	12	13
1	C1E	C	F	In. 3-4	C-		0/9												
2	C1E	C	I	In. 4-6	LS														
3	C1E	C	I	A 30+	UH								/						
4	C1E	C	I	A	LS														
5	C1E	C	I	J	C			N											
51	C3	C	F	A 40+	UH	166		N		N	B								
52	C3	C	I	A Old?															
64	C1W	C	M	A 51	F	169		N		N									
		1781 James Hatsill & Son	I	J 6-9															
67	C1E	C	F	A 18-22	C	163	14/30												
70	C3		I	J 14-17	UH														
74	C3		I	J 7-9	C-														
78	C3		I	In 2-4	-H-F														
80	C1W	C	F	A	LH	148													
99	C1E	C	F	A 20-25	C	175	10/31	N	N	N		R				s			
105	C1E	C	M	A 25-35	C	167	17/21	N	N	N				B	L				
108	C4		I	In 3-4															
			I	A 12-18															
			M	A 18-25			0/6	1		1									
109	C1E	C	F	A 30-35	C	165	1/18									s	s		
111	C1E	C	I	In c. 4	UH		3/12												
114	C4	C	F	A	C	171		1											
118	C4	C	F	A	C-	164													

120	C4	C	F	A	C													
126	C4	C	F	A	C-	158												R
128	C4	C	M	A Old											s			
130	C4	C	F	A 15-20														
132	C4	C	M	A ?Old											c			
134	C4	C	I	In 4-5			0/11											
136	C4	C	F	A 20-25?	RS	159	2/22	N	N	N		R		R	s	s		
140	C4	C	M	A Old	F	176									c			
156	C4	C	F	A 30+	RS		2/12	N	N	N				R	s			
160	C4	C	F	A	-H	173												
162	C4	C	F	A	C-	158												
206	C1W		I	In 0-¼														
236	C1W		I	In 0±														
242	C1W	C	I	In ½-1	C													
244	C1W	C	I	In 4-8 mths	C													
248	C1W	C	I	A	RS													
250	C1W	C	M	A	LS	178												
252	C1W	C	M	A V. Old	C	167		N		N		R	/	B	m	c		R
254	C1W	C	I	In c.2	C		0/10		2									
269	C1E	C	I	A	LH	173												
271	C1E	C	M	A	F	162									s	s		

Grave	Area	SF	Sex	Age	Sur	St	1	2	3	4	5	6	7	8	9	10	11	12	13
Group B-C:																			
143	C1E		F	A 35+	-F		3/13	N	N	N		R		L					
148	C4		I	A Old	-F-H														
191	C1E		M	A 40+	C	172	0/6												
247	C1E		I	J 7-8	UH		0/17		2										
Group E:																			
93	C1E		I	J 7-12															
97	C1E		M	A	UH		10/26									s	m		
98	C1W		M	A	RS	167													
101	C1E		I	In c. 4	UH		0/16												
106	C1W		I	A 30-40	UH		3/5	N	N	N	R						m		
112	C4		F	A 40+	UH		2/16		N						B		s		
113	C1E		F	A 20-25	LS	158	4/22												
127	C1E		M	A 30+	C	171	5/7		N					R					B
129	C1E		F	A 25-30	C	163	0/24	1	N					B					
144	C4		M	A 15-17	UH		1/21	N	2	1				B		c			
149	C1E		I	In 2-3	UH		0/9												
150	C4		M	A	UH	172				N					R	s	m		
155	C1E		I	In ½-½	UH														
166	C4		M	A 35-40	-F	165	4/6										s		
167	C1E		I	J 5-6	C		0/6												
168	C4		I	A	F														
172	C1W		I	A 30+	UH														
184	C4		M	A Old	C														
186	C4		F	A 20-25	UH	153	1/11												
192	C4		F	J 3-5															
			F	J 4-6															

194	C4	I	J 10-12			0/16						/				
196	C4	M	A Elderly	F	180											m
202	C4	M	A	LH	179										m	c
222	C4	F	A 40+	RS	155	3/10		N								m
232	C4	F	A Elderly	RS	166	4/14	N	N	N	L	B		L		m	s
238	C1W	I	In 0-½	C												
240	C1W	M	A	RS	168											m
246	C1W	M	A 16-18	C-		3/14										
258	C1W	M	A 35-40	C	166	0/23										s
273	C1E	M	A	LH	170											

	A	B	C	B-C	D	E	F
no. male	20	5	12	1	14	13	9
no. female	12	12	15	1	13	8	15
no. indet.	14	11	10	2	12	10	20
AGE							
0-1 yrs	2	1	1	0	0	2	3
1-5 yrs	4	4	6	0	4	3	6
5-10 yrs	4	6	4	1	5	3	3
10-18 yrs	3	0	3	0	1	3	3
18-25 yrs	3	1	5	0	4	2	4
25-30 yrs	5	1	1	0	1	1	0
30-35 yrs	5	2	1	0	1	2	4
35-40 yrs	3	1	2	1	1	3	0
40+ yrs	4	4	7	2	9	5	5
STATURE ESTIMATES							
mean	171.1	165.6	168.1	(172)	166.3	166.6	166.2
std. dev.	10.0	8.0	8.3	-	7.9	7.9	7.6
no. cases	26	12	19	1	22	14	18

Table 2. Summary of sex, mortality and stature estimation data.

	A			B			C			B-C			D			E			F		
	M	F	I	M	F	I	M	F	I	M	F	I	M	F	I	M	F	I	M	F	I
0-1 yr	0	0	2	0	0	1	0	0	1	0	0	0	0	0	0	0	0	2	0	0	3
1-5	0	0	4	0	1	3	0	1	5	0	0	0	0	0	4	0	1	2	0	1	5
5-10	0	0	4	0	3	3	0	2	2	0	0	1	0	0	5	0	1	2	0	0	3
10-18	1	0	2	0	0	0	0	3	0	0	0	0	0	1	0	2	0	1	0	1	2
18-25	2	1	0	0	1	0	1	4	0	0	0	0	2	2	0	0	2	0	1	3	0
25-30	4	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0
30-35	2	2	1	0	1	1	1	0	0	0	0	0	1	0	0	1	0	1	1	2	1
35-40	2	1	0	1	0	0	1	1	0	0	1	0	0	1	0	2	0	1	0	0	0
40-50	2	1	0	2	1	1	2	1	0	1	0	1	4	3	0	2	3	0	1	1	1
50+	0	1	0	0	0	0	4	0	0	0	0	0	1	1	0	0	0	0	2	0	0

Table 3. Proportions of males and females in different age classes.

	A	D	F
MALES			
mean	175.7	170.4	169.8
standard deviation	8.6	6.2	6.0
no. cases	16	12	6
FEMALES			
mean	163.7	161.4	163.6
standard deviation	7.7	7.1	7.8
no. cases	10	10	11

Table 4. Comparison of stature estimates for male and female skeletons, showing greater sexual dimorphism of group A individuals.

Table 5. List of skull and mandible measurements in ascending burial number order.

Burial	L	B	B'	H'	LB	S1	S2	S3	S'1	S'2	S'3	BiB	G'H	GL	GB	G2	G'I	J	O1	O2	FL	FB	NB	NH'	SC	DC	W1	ZZ	RB	H1	M2H	CH	CyL	ML	M<	RL	sex
051	195	134	101	138	108	137	142	120	117.3	128	97	109	72.2	103.6	92	0	0	125.5	41.7	32.9	32.6	28.7	25	51	10.7	24	0	0	0	0	0	0	0	0	0	0	F
085	193	149	98	0	0	131	140	0	113	124	0	112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	M
089	195	148	102	0	0	129	134	129	111	121	98	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	M
097	172	136	90	0	0	122	118	0	103	103	0	116	0	0	90.4	38.5	46.3	0	38.4	34	0	0	27	50.4	0	0	0	38.4	29.5	25	21	0	0	0	0	0	M
099	190	142	95	133	98	137	130	120	116	119	98	110	73.8	94	83	37.2	44.3	126	38.4	35.2	39.3	32.1	22.2	52.9	8.9	20.4	0	0	0	0	0	0	0	0	0	0	F
105	208	141	101	135	105	140	150	132	121	129	105	102	72	97	90	35.3	49.5	0	40	37.2	34.4	27.3	23.3	48.9	8.6	22	0	0	0	0	0	0	0	0	0	0	M
106	184	157	91	0	0	130	127	129	114	114	104	116	0	0	0	0	0	0	0	0	0	0	0	0	0	42.9	28.8	29.6	0	66.3	0	0	0	0	I		
112	187	148	99	119	96	127	126	117	111	112	92	119	0	0	0	0	0	0	0	0	38.5	30.5	0	0	0	0	0	46.4	31.8	31.6	24.0	55	0	102	48	56	F
115	182	158	104	0	0	130	144	116	110	119	94	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	M
124	191	144	0	118	0	130	127	125	113	112	96	115	75.4	86.9	0	36.9	46.8	0	0	0	37.9	29.0	23.0	57.5	7	17.5	0	0	0	0	0	0	0	0	0	0	M
125	0	160	106	0	0	145	132	0	122	119	0	0	0	0	0	42.1	44.6	0	0	0	0	0	25.9	49.8	8.6	21.8	0	46	30.9	0	0	71	22.8	106	65	71	M
135	180	137	89	0	0	124	116	0	109	106	0	115	0	0	0	0	59.4	0	0	0	0	0	0	0	8.5	0	0	50.3	29.8	32.1	27.5	0	0	130	57	65	M
136	180	136	94	131	95	120	150	120	108	126	99	116	0	0	0	0	0	0	0	0	0	34.4	0	0	0	0	0	0	43.6	30.8	31	24.9	61	17.4	66	43	54	F
143	179	149	95	0	0	140	121	115	118.9	107.8	93.8	116	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F
146	195	0	0	0	0	0	130	132	0	116	104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	137	50	27.3	35.2	32.7	75.5	20.8	101	62	70	M
147	0	155	0	0	0	0	136	116	0	121	96	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	M
152	186	138	94	0	0	120	120	116	105	110	92	107	0	0	0	0	0	0	0	0	0	0	0	0	9	21.6	0	0	0	0	0	0	0	0	0	0	F
154	193	135	92	135	107	133	134	116	117	117	97	105	70.2	107	0	0	48.1	0	40.4	34.3	37.2	30.4	0	52.4	9.3	19.2	0	0	0	0	0	0	0	0	0	0	F
156	183	141	102	133	96	134	124	119	112	113	99	113	61	83	0	0	0	0	41.2	35.3	41.4	0	0	45.3	6.9	0	0	0	0	0	0	0	0	0	0	0	F
165	193	155	99	111	78	144	126	123	121	109	96	132	0	0	0	0	0	0	0	0	36.1	31.4	0	0	0	0	0	51.4	35.2	29.7	30.2	69.4	0	130	62	66	M
175	181	144	91	125	97	118	124	113	104	110	92	113	66.3	92	83	37.2	47.9	0	39.8	36.5	37	33.7	22.6	48.1	9.1	19.2	0	40.5	27.4	23.8	24.4	61.3	0	100	57	61	F
187	173	0	99	0	0	116	126	110	104	109	93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	32.6	26	24.2	55.7	19.4	102	56	55	F		
188	180	142	96	127	96	121	120	124	107	106	100	112	0	0	0	0	0	0	38.7	37.5	35.4	30.3	0	0	10.5	20.3	0	0	0	0	0	0	0	0	0	0	M
189	173	145	0	135	103	120	130	115	102	115	95	115	66.2	92	0	0	0	0	36.3	32.2	38	30	0	48.5	0	0	0	0	0	0	0	0	0	0	0	0	M
198	0	0	100.8	0	0	0	130	124	0	114	102	109	0	0	0	33.6	42.5	0	0	0	32.7	31.6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F
203	186	142	98	133	102	128	125	120	112	113	99	114	0	0	0	0	0	0	0	0	34.4	27.8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	M
204	0	142	101	0	0	130	130	106	111.6	115.4	88.4	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	F

209 180 140 0 0 0 125 126 115 106 112 92 0 0 0 0 0 0 0 0 0 0 0 0 0 0 00 0 0 0 0 0 0 0 0 0 0 0 F

213 176 142 97 126 99 122 114 116 109 103 96 114 0 0 0 0 0 0 0 0 35.5 30.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F

223 189 148 90 146 100 139 134 121 121 120 95 112 0 0 0 0 0 0 0 0 32.2 28.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 M

231 176 0 91 0 0 126 110 0 107 102 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F

233 185 137 102 139 103 120 138 114 102 114 93 113 67.4 99 0 40.8 50 0 37.5 31.5 33.8 31.9 22.7 48.8 13.3 26.9 0 0 0 0 0 0 0 0 0 0 F

235 0 147 0 128 0 0 124 114 0 111 94 113 0 0 0 0 0 0 0 0 34.6 31.6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 M

237 192 145 100 126 101 133 120 130 114 107 100 114 0 0 0 0 0 0 0 0 33.6 30.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F

241 189 154 103 140 103 130 135 120 112 114 97 117 0 0 0 0 0 0 0 0 38.9 36 0 0 0 0 0 0 0 0 0 0 0 0 0 0 M

243 0 141 0 125 0 0 125 126 0 107 99 110 0 0 0 0 0 0 0 0 30.2 28.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F

245 180 140 94 137 98 130 130 0 112 116 0 107 64.5 85 84 0 43.5 0 36.5 33.9 0 0 24 47.5 0 19.6 0 0 0 0 0 0 0 0 0 0 F

252 196 150 105 126 101 146 106 140 120 99 103 116 0 0 0 0 0 0 0 0 39.6 33.1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 M

253 198 155 101 140 108 144 135 140 119 119 104 124 71.4 101 97 41.9 53.5 139 42.3 32.8 34.2 29.7 25.2 56.9 11.3 20.9 0 49 31 0 0 63 24.5 117 50 71 M

255 180 148 107 0 0 130 130 115 115 115 95 112 0 0 0 0 46.9 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 I

257 198 154 101 0 0 140 130 0 123 117 0 0 71.5 0 96 43.2 53.6 0 42.9 30.5 0 0 26.6 51.8 6.7 23 130 44.8 35.3 30.1 30.2 68 0 111 57 75 M

280 184 142 94 0 0 118 126 0 103 114 0 117 71.5 0 90 37.6 0 125 39.5 36.1 0 0 22 53.9 7.7 24.8 0 40 28.7 28.1 24 58.1 0 101 55 57 I

283 194 146 100 128 103 121 130 129 116 109 102 115 78 98 89 40.2 54.8 136 39.8 36.6 34.7 29 22.3 54.8 8.1 20.7 0 48.9 31.2 31.5 29 66 23.4 67 54 66 M

284 171 143 0 0 0 132 117 0 104 107 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 0 0 F

288 188 140 91 0 0 0 130 121 0 116 97 99 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 115 38 22.2 0 19 53 0 93 56 61.5 M

289 200 0 95 0 0 0 130 0 0 118 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 0 0 0 0 M

291 0 139.5 0 0 0 0 0 117 126 0 108.4 97.8 114.5 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 F

292 0 140 92 127 0 0 128 110 0 114 90 113 0 0 0 0 0 0 0 0 40.6 0 0 0 0 0 0 42.7 33.2 30.2 0 0 0 0 0 0 M

293 197 144 100 135 109 135 125 120 121 115 100 114 0 0 0 42.2 53 0 0 0 33.0 29.9 0 0 0 0 122.5 43.8 35.8 32 29.7 70 22 115 50 72 M

295 195 148 101 132 102 127 140 125 112 127 100 118 0 0 0 0 0 0 0 0 35.8 32.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 M

296 195 144 94 136 99 132 132 124 116 118 100 109 71.4 98 97 39 51.8 131 38.5 30.6 40.2 30.3 22.9 52.4 6.7 24.5 0 47.6 34.3 35.3 30.5 67.5 0 116 52 67 M

297 191 145 100 132 104 131 120 130 115 110 102 114 73.8 100 86 40.9 51.8 135 41.2 35.8 36.9 29.3 25.2 53.7 8.9 20.8 121 45.3 30.2 22.9 25.3 72.2 21.2 106 58 70 M

316 183 136 93 0 0 0 130 0 0 119 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 F

317 188 141 99 0 98 0 0 127 0 0 100 111 0 0 0 0 0 0 0 0 35.1 29 0 0 0 0 0 0 0 0 0 0 0 0 0 0 F

326 207 140 104 0 0 145 137 130 117 124 106 107 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 46.8 29.9 28.1 26 59.5 0 101 62 60 F

Table 5. List of skull and mandible measurements in ascending burial number order.

		R			L			R	L
		HuL1	HuD1	HuD2	HuL1	HuD1	HuD2	HuD1 XHuD2	HuD1 XHuD2
group A									
282	M	-	-	-	-	21.6	18.0	-	388.8
283	M	338	24.3	19.6	-	-	-	476.3	-
284	F	-	-	-	-	21.7	16.5	-	358.1
288	M	-	-	-	327	20.8	17.7	-	368.2
292	M	325	25.4	19.5	328	24.3	19.5	495.3	473.9
293	M	350	31.0	26.6	345	28.6	22.8	824.6	652.1
295	M	342	25.0	19.0	-	-	-	475.0	-
296	M	343	26.4	20.2	-	25.5	19.7	533.3	502.4
297	M	-	26.5	18.8	371	24.3	19.0	498.2	461.7
301	F	-	-	-	336	25.0	20.5	-	512.5
304	F	309	21.3	15.7	304	20.6	15.3	334.4	315.2
307	M	336	23.8	13.5	-	-	-	321.3	-
311	M	-	-	-	-	26.0	18.0	-	468.0
314	M	342	27.4	23.0	-	-	-	630.2	-
315	M	379	30.0	21.5	-	-	-	645.0	-
319	F	349	23.8	18.7	-	-	-	445.1	-
326	F	-	21.6	16.7	-	20.5	16.8	360.7	344.4
group C									
187	F	309	22.5	16.2	303	21.8	15.5	364.5	337.9
85	M	312	23.6	16.5	308	22.7	18.0	389.4	408.6
108	F	332	21.8	18.4	335	22.0	17.6	401.1	387.2
115	M	311	22.4	16.7	304	22.0	16.0	374.1	352.0
125	M	-	25.4	19.1	330	25.0	18.6	485.1	465.0
147	M	-	-	-	350	25.4	18.6	-	472.4
189	M	304	18.3	15.2	308	18.4	16.1	278.2	296.2
213	F	297	24.0	17.5	-	-	-	420.0	-
223	M	320	26.2	20.8	313	24.0	19.4	545.0	465.6
235	M	333	27.0	18.4	327	26.4	17.5	496.8	462.0
241	M	335	26.0	18.4	-	-	-	478.4	-
243	F	294	21.4	17.6	290	21.2	18.0	376.6	381.6
245	F	-	-	-	326	21.8	17.6	-	383.7
249	M	328	23.0	18.3	-	-	-	420.9	-
257	M	357	24.7	19.3	352	24.4	19.4	476.7	473.4

HuD1 X HuD2	mean	std.dev.	n.
group A males	513.4	124.0	16
group A females	381.5	70.9	7
group C males	431.8	72.8	17
group C females	381.6	24.3	8

Table 6. Measurements of humeri.

	TOT.	C	T	L	S	A	K	F	G	E	H
A	20	1	6	14	0	8	6	2	3	1	1
B	6	0	1	4	0	1	2	0	0	2	1
C	13	4	8	8	0	5	1	1	1	1	2
D	18	2	8	10	0	6	6	0	1	3	0
E	11	3	7	8	3	2	3	0	1	0	1
F	11	1	2	4	1	8	0	1	3	1	0

Table 7. Incidence of degenerative joint disease.

Key.
TOT. = total number of individuals displaying arthritic symptoms
C = symptoms in the cervical vertebrae
T = symptoms in the thoracic vertebrae
L = symptoms in the lumbar vertebrae
S = symptoms at the sacro-iliac joint
A = symptoms at the hip joint
K = symptoms at the knee joint
F = symptoms in the joints of the feet
G = symptoms at the shoulder joint
E = symptoms at the elbow joint
H = symptoms in the joints of the hands

	A	B	C	B-C	D	E	F
Age 0-18 yrs.							
no. teeth examined	101	110	118	17	65	82	42
no. teeth with caries	0	0	1	0	11	4	3
Age 18+ yrs.							
no. teeth examined	379	138	198	19	178	164	140
no. teeth with caries	18	22	48	3	30	36	46
Age 12+ yrs.							
no. mouths examined	19	7	13	1	15	12	7
no. with calculus	13	5	4	1	8	6	3
no. with periodontal disease	10	2	3	0	4	2	2
no. with periapical abcesses	2	1	1	0	3	0	2

Table 8. Incidence of dental diseases.

	no. skls	no. lam.	no. sag.	no. cor.	no. all 3
A	14	11	9	11	9
B	8	6	2	6	2
C	13	12	8	12	8
D	10	5	5	4	4
E	3	1	2	1	1
F	6	5	5	5	4

Table 9. Incidence of Wormian bones.

Key.
No. skls. = number of skulls in which sutures could be examined.
No. lam. = number of skulls with Wormian bones in lambdoidal suture.
No. sag. = number of skulls with Wormian bones in sagittal suture.
No. cor. = number of skulls with Wormian bones in coronal suture.
No. all 3 = number of skulls with Wormian bones in lambdoidal, sagittal and coronal sutures.

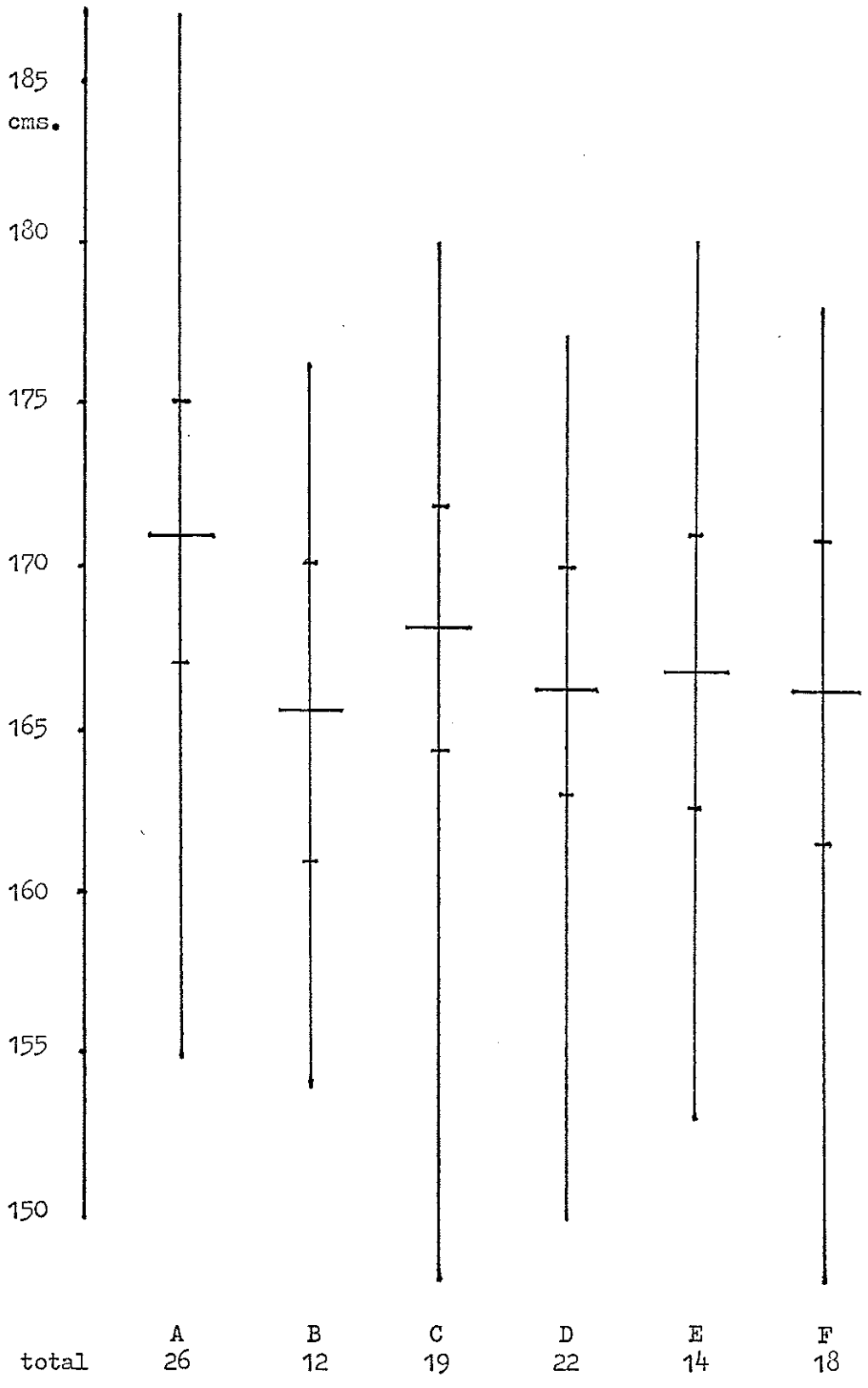
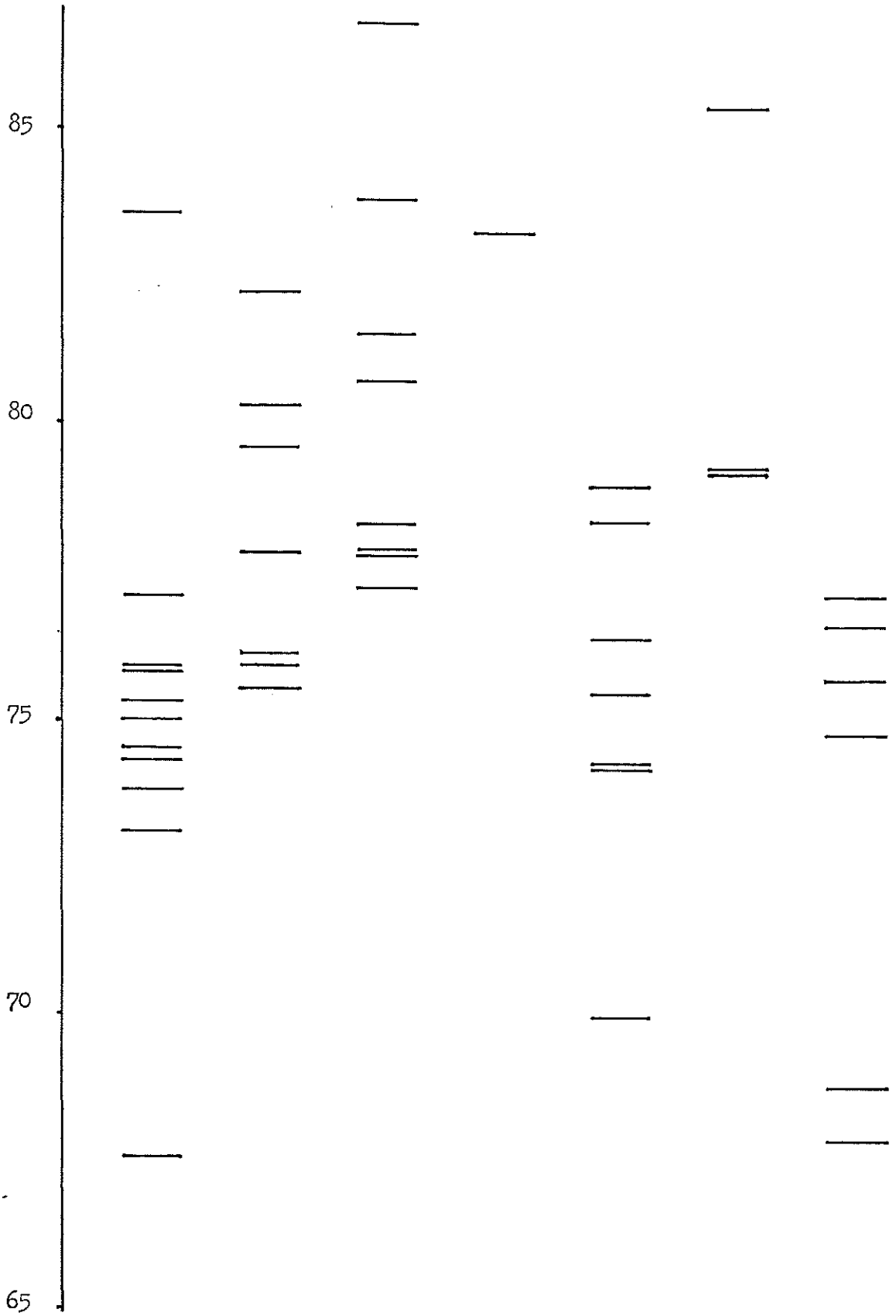


Figure 1. Estimated stature.
The graph shows mean, .95 confidence limits, and range



	A	B	C	B-C	D	E	F
mean	75.1	78.2	80.5		75.3		73.4
std. dev.	3.75	2.56	3.43		3.00		4.07
n.	11	7	8		7		6

Fig. 2. Values obtained for cephalic index (100 X skull breadth/length)

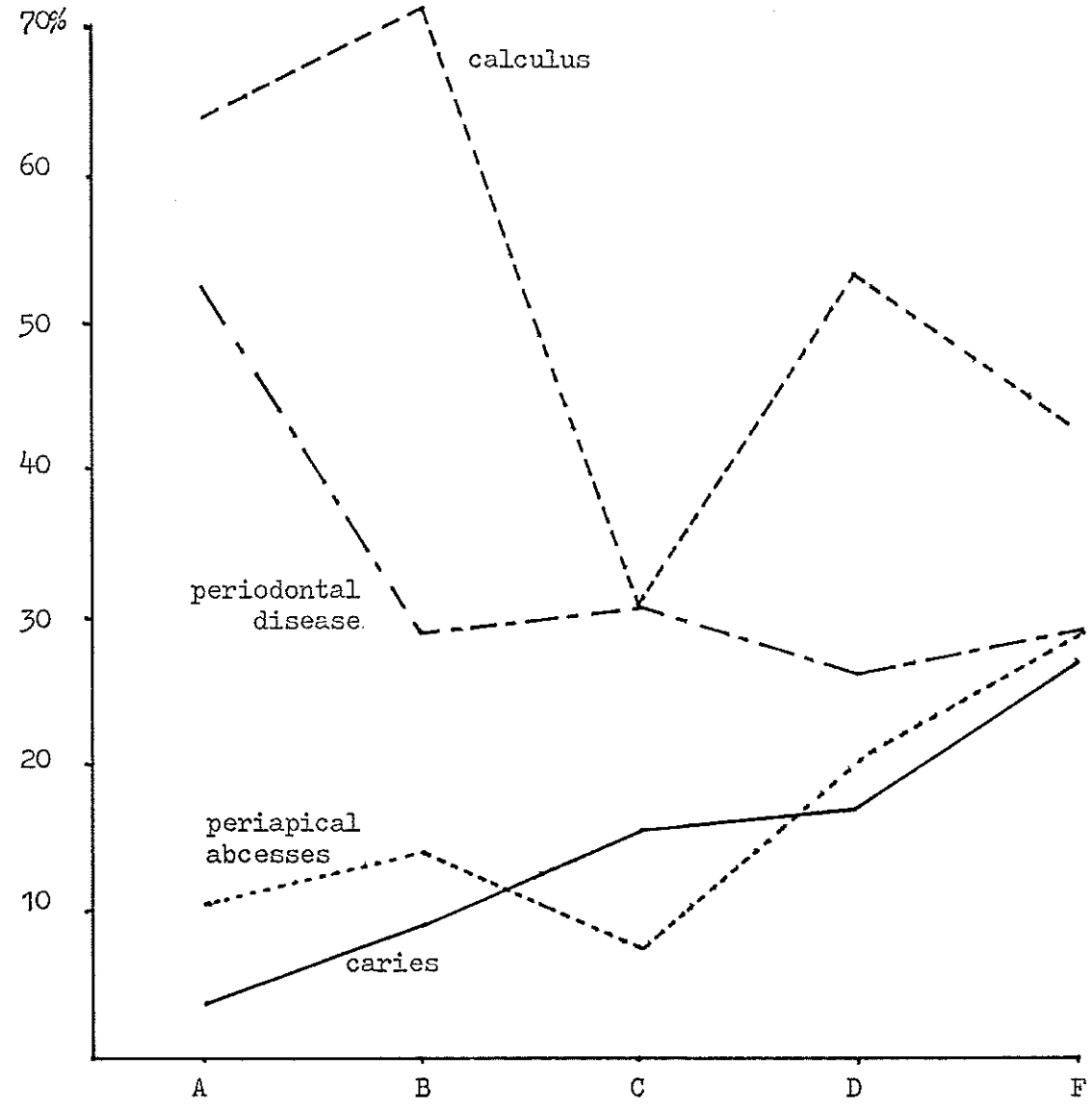


Fig. 3. Incidence of dental diseases. Data drawn from Table 8.