EXCAVATIONS AT ROCHESTER CATHEDRAL

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1. THE LAY CEMETERY

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At the invitation of the Dean and Chapter of Rochester Cathedral the Canterbury Archaeological Trust undertook an excavation within the Lay Cemetery of the Cathedral during April and May 1990 (Fig. 1, P1. I). This was undertaken prior to the underpinning of the foundations of a modern semi-basemented structure known as the 'Chair Store' which lies in the angle between the west side of the north transept and the north side of the nave. The excavation consisted of three small trenches each 3 m. × 1 m. and up to 4.50 m. deep (Fig. 1). When the Chair Store was constructed in the early 1970s large numbers of burials were removed and three medieval stone burial cists uncovered. Roman deposits were not reached at that time.[1]

The earliest features located (96 and 98, Fig. 1) were cut into natural brickearth, the latter, probably a gully or truncated ditch contained a dark grey silt/ash mix with patches of brickearth, but no finds. Feature 96 (a shallow pit) had a fill indistinguishable from the overlying topsoil of brown crumbly loam (92) and both produced Belgic pottery of the early first century A.D.

Within Trenches A and B redeposited brickearth (91, Fig. 2, section A–A) covered the early topsoil. This redeposited brickearth contained pottery possibly of the late second or third century A.D. A further layer of brown crumbly loam (89) lay above the redeposited brickearth and contained sherds dating up to *c*. A.D. 150. Although this layer may have been upcast from pit-digging, its

[1] Pers. comm. A.C. Harrison.

identification in Trench A and Trench B is perhaps suggestive of more widely dispersed topsoil; it contained only residual pottery. Pit 90 producing later fourth-century pottery cut Layer 91, but could not be seen to cut the brown loam (89) due to the pit-fill being indistinguishable in colour and texture.

A large pit (94) within Trench B cut Layer 89 and had been backfilled with loosely compacted daub and ash, and at a lower unexcavated level a grey/green silt, probably cess.[2] The occurrence of so much burnt daub might suggest the presence of a nearby wattle-and-daub structure. The few associated pottery sherds were of a late third- or fourth-century date. A further pit (100) (Fig. 1) found by the contractors beneath the chair store also seems to have cut from this level, but produced pottery only of the second century.

Within Trench C only one possible topsoil layer (76) (Fig. 3, sections C–C and C–c) of Roman date was identified probably being the same as Layer 92 encountered in Trench A. It overlay silt (77) infilling a natural hollow and the early gully (98) and was in turn overlaid by a very dark brown crumbly loam (71) containing the earliest burials (SK 54, SK 55). No grave cuts were visible either above or below the skeletons. This was true for almost all the burials encountered and stratigraphic relationships could only be determined when bone material had been cut through by later interments. Despite this it was possible to identify an approximate phased sequence of burials. The skeletal material is described separately below, with possible dates of deposition appended.

The north–south orientation of Trench C meant that no complete skeleton was excavated. Burials SK 54 and SK 55 are probably the earliest present, but a complete lack of medieval pottery makes close dating impossible. Burials SK 50, SK 51, SK 52 within the dark brown loams (71 and 60) and SK 48 and SK 49 above Layer 60 also belong to this earliest identifiable 'phase' of interments (Fig. 3), section C—C).

In both Trenches A and B the earliest burials lay within stone cists (Fig. 2). In Trench A Burial SK 60 within its stone cist (85) is in some ways the most interesting, not so much for its skeletal material, but for its method of interment. Around the feet of the skeleton the remains of the stone cist were well preserved, made out of irregular chalk and tufa blocks bonded by a buff-coloured mortar. The trunk and pelvis rested on two joining slabs of Jurassic limestone (perhaps Marquise stone from the Pas-de-Calais) roughly faced on both sides

[2] The pit underlay the north-west corner of the Chair Store and together with the shallow concrete foundation is probably the reason for the cracking of the Chair Store walls.

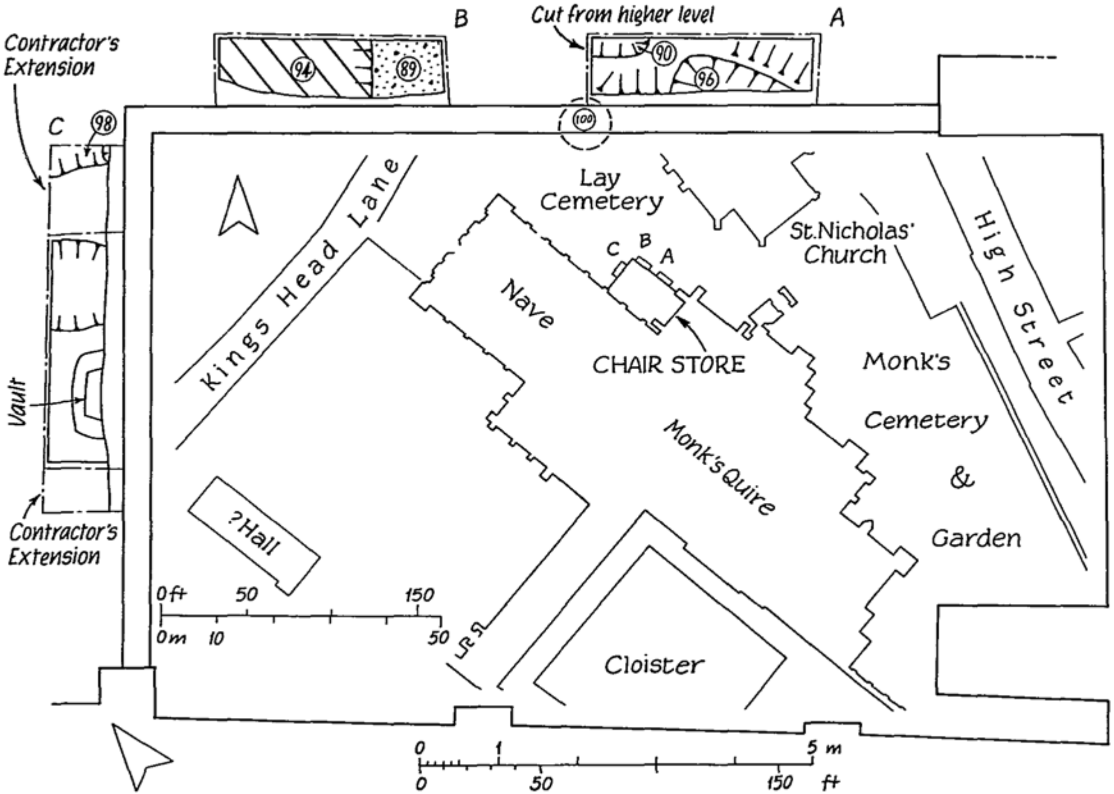

Fig. 1. Location plan (inset) with composite plan of trenches showing Belgic and Roman features.

and bearing signs of burning. The remnants of a 'ledge' survived on one side of both slabs. The slabs may have been of Roman origin.

The adjacent skeletons of two children (SK 56, SK 57) lay above the grave fill of SK 60. These may have been interred together. Iron nails associated with SK 57 suggested the presence of a coffin.

A similar sequence of burials was encountered in Trench B. The earliest skeleton (SK 62) lay within a well-preserved cist of mortared chalk and tufa block build (86), surviving to a height of 0.20 m. The eastern end of 86 was overlain by a smaller cist (93) containing the badly disturbed skeleton of a child (SK 63). The remains lay on a thin deposit of crushed chalk overlying mortar. The edges of the chalk bed were clearly visible and were presumably surrounded at one time by stonework. Two burials (SK 59 and 58) lay above burial SK 63 cutting burial SK 62. Another burial (SK 61) lay directly over the southern wall of the stone cist for burial SK 62.

Within all trenches a second phase of cist burials then occurred (Fig. 3). In Trench A the earliest of three cist burials (SK 45, SK 46 and SK53, Pl. II) was probably SK 45. The skull of burial SK 45 was missing, presumably cut away by burial SK 46. However, part of the cist wall (61) of burial SK 45 appeared to overlay the better-constructed wall (63) belonging to burial SK 46. This apparent contradiction of the stratigraphy might be explained by movement of the inferior construction of cist wall 61, which was bonded with a light brown clay and chalk mix (cob). The cist (70) surrounding the almost complete skeleton (SK 53) seemed to cut the stonework belonging to burial SK 46. More ragstone was used in the construction of cist 70 than any other; a large tile at the west end formed part of the head-recess. Above the few centimetres of soil covering SK 53 and entirely within the cist (perhaps suggesting a family relationship) a child's body (SK 44) had been deposited. A further burial (SK 42), that of an adult, lay 0.10 m. above that of the child, but above the level of the cist. The feet of another adult skeleton (SK 47) protruded from the western section.

In Trench B a further three burials (SK 30, SK 31, SK 33) of the second cist phase were located. The earliest of these cists (43) comprised only its chalk block head-recess containing a disarticulated skull (SK 31). The chalk blocks of this feature had been cut into or utilised by further cists to east and west (42 and 45 containing SK 30 and SK 33 respectively). The well-preserved curved foot surround of 45 contrasted with the rest of the cist of which only patches of mortar survived. The burial SK 33 extended beyond the excavation area so was only partially recovered, but as the section was straightened a pewter cup or chalice was revealed; this had probably been placed in the deceased's hands at burial (finger bones were found attached to

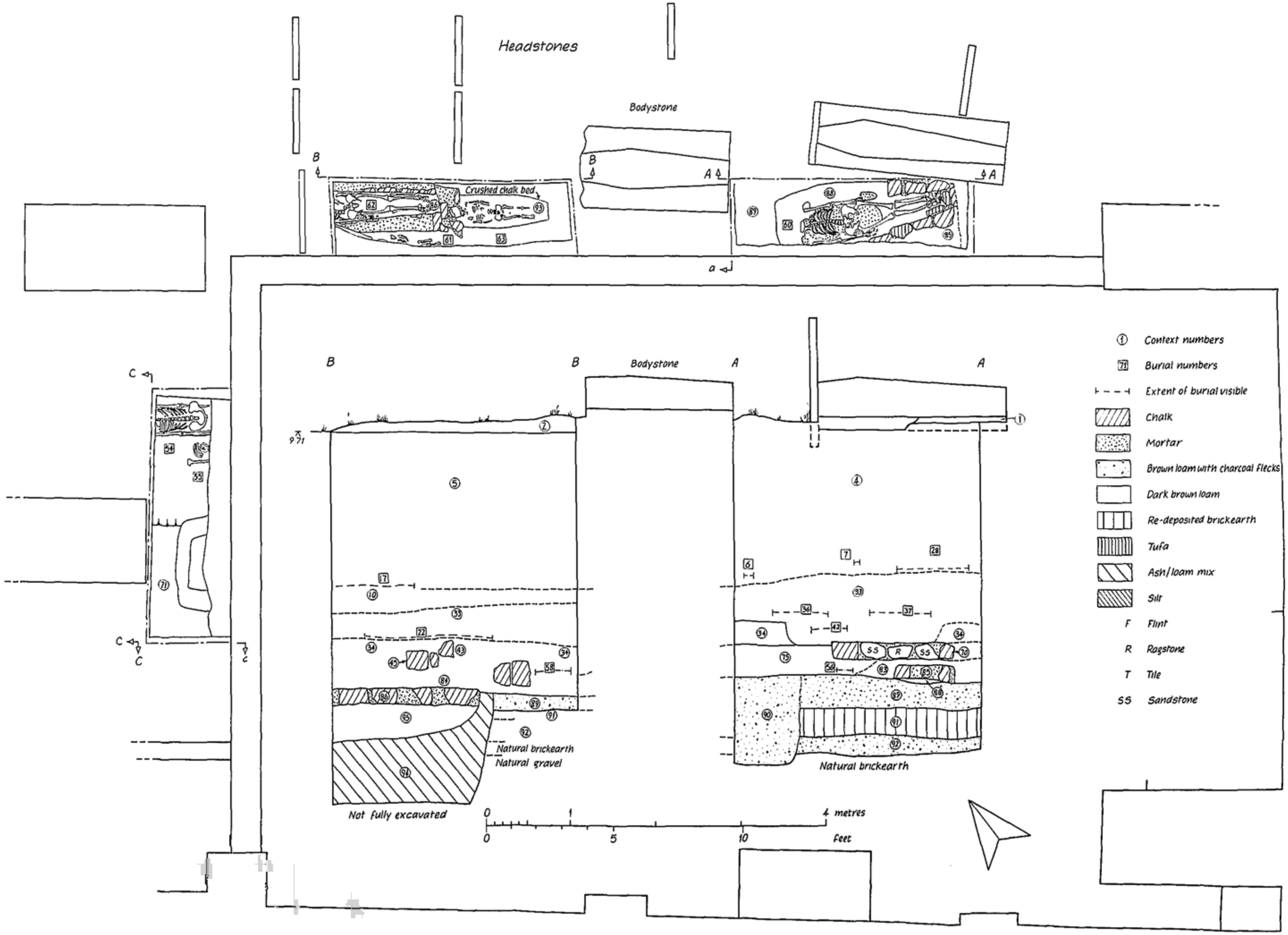

Fig. 2. Plan of the earlier cist burials with (inset) sections B—B and A—A.

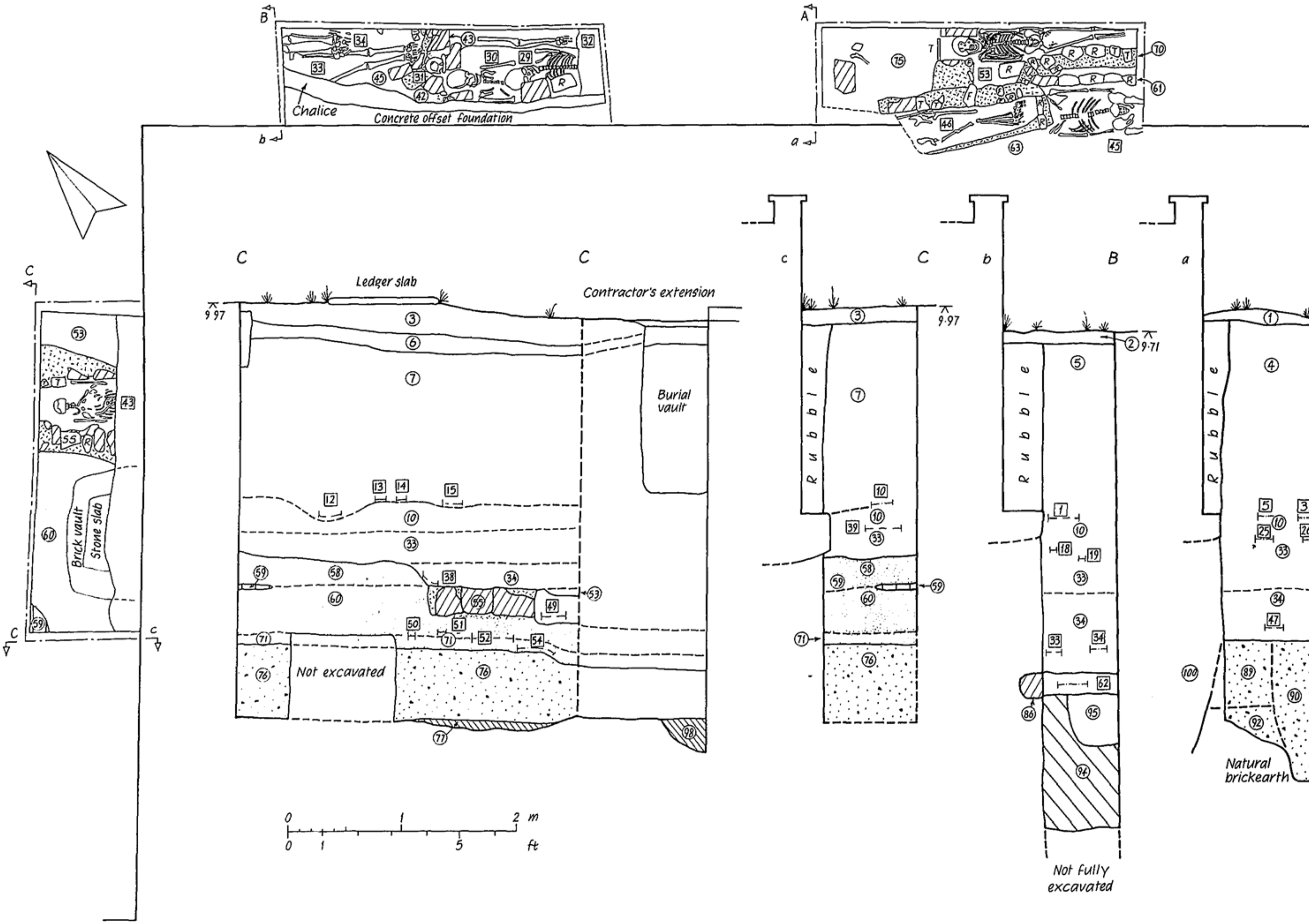

Fig. 3. Plan of the later cist burials with (inset) sections C—C, c—C, b—B and a—A.

the vessel, Pl. IX, Fig. 6).[3] A non-cist burial (SK 34) cut into SK 33 to the north.

The eastern cist (42) had a well-preserved head-recess, which had helped preserve the skull of SK 30, but the ribs had almost completely disappeared, presumably destroyed by burial SK 29 lying directly above. Burial SK 29 did not have a cist, but two large stone blocks appeared to have been deliberately placed on the south side of the grave.

Trench C only produced one cist (55) containing SK 43 associated with the second phase of interments, although later watching brief work did indicate a further two cists, one truncated by the other. Skeleton 43 was overlain by grave infill and a well-preserved skeleton (SK 40) some 0.10 m. above. The latter was probably more or less contemporary with a further burial (SK 41) located nearby to the north.

In all three trenches the remaining burials were of post-medieval date. In Trench A, SK 35, SK 36 and SK 37 were aligned on a slightly different angle to those above or below suggesting a separate phase of burial not present in the other trenches. Burials SK 24–28 were of seventeenth- or eighteenth-century date, the last laying on a bed of bitumen from the base of a coffin. The latest horizon of burials (SK 3–9) had for the most part intercut one another. These included the remains of a baby of between 2 and 4 months old (SK 4), lying on the left knee of an adult (SK 5). Burial SK 7 had a corroded name-plate lying across the pelvis.

In Trench B burials SK 22, SK 23 and SK 32 were probably of seventeenth-century date. Burials SK 20 and SK 21 found immediately overlying these may form a family grave. Burials SK 19, SK 18, SK 17, SK 2 and SK 1 were all of eighteenth- or nineteenth-century date. Burial SK 18 lay on a bitumen bed with coffin handles around the periphery and a badly corroded name-plate was found lying across the pelvis. The uppermost burial (SK 1) was associated with headstone No. 2, but unfortunately the text of this is illegible.[4]

The latest interments in Trench C were Burials SK 10–16, SK 38 and SK 39.

Conclusions

It has been known since the 1960s that Rochester was the site of a Belgic settlement. The present excavation produced two features

[3] See Appendix E for a short description of the chalice.

[4] A plan of the graveyard along with a report on the grave markers will appear as a separate report; see note 5 below.

(96, 98) and a possible deposit of topsoil (92) associated with pre-Conquest to mid first-century pottery.

The interpretation of the Roman deposits in such a small excavation area is difficult, but the occurrence of pits would tend to confirm that the area was open ground and perhaps peripheral to settlement. The large amounts of daub within Feature 94 might suggest the presence of a nearby timber building of the late Roman period. Overall the recovered pottery assemblage implies occupation to the end of the Roman period. A coin of the House of Theodosius (A.D. 388–395) was found redeposited in one of the medieval graves.

Very little archaeological evidence for the Anglo-Saxon period was recovered, this consisting of one residual sherd of seventh-century organic-tempered pottery found in a medieval grave.

The earliest reference to the Lay Cemetery seems to occur in 1418 although it was probably in use long before this and may even be of pre-1066 date. Its history is related to that of the parish of St. Nicholas, which appears to have been in existence before the Conquest. As the parish had no church of its own, it is possible that this area was used as the parish (or lay) cemetery. Although the parishioners had no church, from 1147, and possibly from 1077, they had a parochial altar within the nave of the cathedral (Hasted 1797, 155). In 1312, an agreement was reached whereby the parishioners would cease to use the altar, if the monks built them a church. However, there is no further documentary mention of the church until 1418 when a licence to 'continue and compel' the building of a church in the 'cemetery to the north' is issued by the bishop. The church of St. Nicholas was consecrated in 1423.

Two early nineteenth-century prints of 1806 and 1833 in Rochester Library show that the cemetery was walled at some time between those dates. Within the walled area the ground level seems to have been raised by *c.* 1 m., presumably so that more burials could take place. There is also a documentary reference for a churchyard wall and gate being contracted for in 1627 (Smith 1928, 316). The nineteenth-century wall had iron railings which survived into this century, when they were probably removed as part of the war effort.

Numerous late nineteenth-century photographs show many more gravestones than are present now.[5] Many of the markers that survive

[5] The recording of surviving grave markers formed an important part of the project and was carried out entirely by local volunteers who hope to compile and eventually publish a comprehensive record of all the memorials in the cathedral and cemetery. This record will include a comprehensive archive of all accessible nineteenth-century photographs of the cemetery area.

in front of the cathedral are now laid horizontally. Although one modern stone dating to 1970 is present, it seems that burials ceased in the mid nineteenth century, when a new cemetery was opened on the outskirts of the city.

Of the sixty-three burials uncovered, twenty-four were in Trench A, twenty in Trench B and nineteen in Trench C. If this volume of burials is considered likely for the walled cemetery area, then a conservative estimate for interment would be 3,500 individuals. The remaining parts of the cemetery to the west of the cathedral were filled to capacity in the nineteenth century and at least 500 victims of the plague of 1665 (Smith 1928, 165) may be buried beneath the Deanery Gate alleyway.[6] After the raising of the walled area by about a metre in the early half of the nineteenth century, accumulated evidence suggests that the cemetery went out of general use by about 1875.

II. THE HUMAN BONES

Trevor Anderson

INTRODUCTION

Archaeological investigation, in advance of consolidation to the Chair Store foundations at Rochester Cathedral, led to the discovery of sixty-three burials (see Appendix A) covering a wide date-range. The stratigraphic evidence and the dateable finds suggest that twenty-five graves are medieval (six of them possibly Anglo-Saxon); thirty-five are post-medieval and three could be either late medieval or early post-medieval.

The available bones are quite solid and are reasonably well-preserved. However, the nature of the excavation, three narrow trenches abutting the Chair Store, means that few burials could be recovered in their entirety. Only three skeletons, a juvenile (SK 44) and two children (SK 56, 57) are almost complete. Thirteen burials are well-represented, approximately three quarters present, a further nine are half complete. The remainder, just over 60 per cent, are represented by incomplete limbs, or by small miscellaneous bones.

The small size of the sample, the incomplete nature of the remains, as well as the wide time-span of the burials mean that they cannot be

[6] Pers. comm., K. Ashby.

used to draw conclusions concerning demographic patterns, morbidity, or the general health of the parent population. The following short report outlines the area of study undertaken.

DEMOGRAPHY

The skeletons are grouped by sex and age in Appendix B. A total of sixty-one burials were available for examination, of which fifty-two (85.2 per cent) reached adulthood. In both medieval and post-medieval periods there is a greater number of male burials; however, the sex ratio is not markedly different. In such a small sample, all that can be concluded is that this part of the burial ground was a lay cemetery, with men, women and children being buried from early medieval times up to its most recent usage in the mid nineteenth century. The incomplete nature of the remains, skeletons missing both skull and pelvis, has meant that many could not be aged, except to say that they were fully grown (see Appendix B). Consequently, no examination of overall age at death or study of sexual morbidity differences was attempted.

Only nine sub-adult skeletons were discovered (see Appendix C) ranging from a few months old (SK 4) to juvenile (SK 27, 47), the greatest number of deaths occurring between six and twelve years. This represents a child mortality of 14.8 per cent; which is lower than the normal 30–50 per cent from most medieval cemeteries. These findings may reflect a well-nourished community with a low infant mortality, but the poor standard of child oral health in the five available dentitions (see below) does not support this view.

However, there is no guarantee that this very limited excavation, which includes relatively recent burials, is representative of the community as a whole. It would not be meaningful to infer any demographic patterns for such a small sample of poorly-preserved burials ranging from early medieval (or even Anglo-Saxon) to the mid nineteenth century.

METRIC ANALYSIS

Stature Reconstruction

Stature was assessed from long-bone lengths, based on the formulae of Trotter and Gleser (1952; 1958). In two cases (SK 11, 14) no complete long-bones were available and stature was calculated from metacarpal (hand bone) length (Musgrave and Harneja 1978). The

TABLE 1: Stature Reconstruction.

	MEDIEVAL			POST-MEDIEVAL			ALL		
	Avg. stature	Range	No.	Avg. stature	Range	No.	Avg. stature	Range	No.
Male	1.73m. 5′ 8″	1.64–1.80 m. 5′ 4½″–5′ 11″	(7)	1.69 m 5′ 6½″	1.60–1.79 m. 5′ 3″–5′ 10½″	(13)	1.70 m. 5′ 7″	1.60–1.80 m. 5′ 3″-5′ 11″	(21)
Female	1.63 m. 5′ 4″	1.54–1.70 m. 5′ 0½ 5′ 7″	(5)	1.57 m. 5′ 2″	1.51–1.61 m. 4′ 11½″–5′ 3½″	(9)	1.59 m. 5′ 2½″	1.51–1.70 m. 4′ 11½″–5′ 7″	(15)
All	1.69 m. 5′ 6½″	1.54–1.80 m. 5′ 0½–5′ 11″	(12)	1.64 m. 5′ 4½″	1.51–1.79 m. 4′ 11½″–5′ 10½″	(21)	1.66 m. 5′ 5½″	1.51–1.80 m. 4′ 11½-5′ 11″	(36)

overall results, as well as the average male and female stature for medieval and post-medieval periods are presented (Table 1). The height of the individuals at Rochester is similar to larger samples of excavated material. At medieval York the average male stature was 1.693 m. (n240) and 1.574 m. (n268) for females (Dawes and Magilton 1980).

It is interesting that the medieval skeletons from Rochester, both male and female, are taller than those from post-medieval levels. This might suggest that the standard of nutrition and health was better in the medieval period and that diet subsequently deteriorated. Unfortunately, no valid conclusions can be drawn from a small sample. However, it would be extremely interesting to see if a similar pattern emerged, if a larger part of the cemetery was available for excavation.

Cranial Metrics

Forty-six different measurements were taken on each complete skull, when right and left sides are included fifty-six metrics were recorded in total. These included those traditionally employed in osteology (Bass 1987; Brothwell 1981) as well as others thought to display sexual dimorphism (Giles 1964; Giles and Elliot 1963; Hollander 1986). There is no agreement as to which cranial measurements are most suitable for separating population groups (Howells 1969). A major difficulty is identifying those which are largely genetic and thus hereditary, and those which are subject to greater external environmental influence, the so-called 'noisy' measurements (Crognier 1981; Heathcote 1986; Thomson and Buxton, 1923; Van Limborgh 1972). The problem is compounded since certain measurements apparently show significant increase with advancing age in males (Baer 1956; Thompson and Kendrick 1984) and possibly in females (Israel 1973).

Only thirteen skulls, eight male and five female were sufficiently intact for measurement. From these twelve indices were calculated, all of which fell within the normal range for British excavated material. From such a small sample, brief mention will be made only of the Cranial Index (the breadth/length ratio) of the skull. A lower figure, under 75, is classed as long-headed (*dolichocranic*); a higher index, over 80, is round- or broad-headed (*brachycranic*); a result between these ranges is *mesatocranic*.

Based on only eleven available crania the average index was 80.4, with a range of 74.6–86.4. The male index was 80.3 (n7) and female 80.6 (n4). These figures fall between the medium/long-headed seventeenth-century London skulls from Farringdon Street: male

75.5 (n73); female 74.8 (n167) (Hooke 1926); the mesatocranic Spitalfields material: male 79.4 (n274); female 79.8 (n89) (Morant and Hoadley, 1931) and the round-headed individuals from medieval Hythe: male 82.6 (n112); female 81.9 (n87) (Stoessiger and Morant 1932).

It is uncertain how valuable a single index can be in separating genetic sub-groups (Brothwell 1981, 87). Various environmental factors, including climatic (Beals 1972) and even differential mortality (Olivier and de Castro e Almeida 1975) may influence the cranial index for a given population. In conclusion, the small sample of crania from Rochester appears to be typically British and does not show any evidence of racial variations (Bass 1987, 83–9).

Post-Cranial Metrics

Forty-nine different measurements were taken on the post-cranial skeleton, when right and left sides are included eighty-seven metrics were recorded in total and thirteen indices were calculated. Many measurements and indices are of value in sexing the skeleton: these are listed as Appendix A. Other indices are presented as Appendix D and, on these, brief comment is made below.

Index 1a: Clavicle: *Robusticity*

This is a ratio of mid-shaft circumference to maximum length. This index need not be sexually dimorphic since a gracile, short female clavicle will be of equal robusticity to a thicker, but longer male bone. This index is not widely used, but the average robusticity at Rochester appears to be similar to a large sample from medieval Canterbury (author, unpublished).

Index 2a: Humerus: *Platybrachia*

This is a ratio of minimum (HuD_2) to maximum (HuD_1) mid-shaft diameters. The lower the index, the greater the mid-shaft flattening. Unlike platymeria and platycnemia (see below) the shape of the upper arm bone has received very little attention. In the Rochester sample the female index is slightly lower than the male (Appendix D). A similar result, greater flattening of female bones, was obtained from medieval Trondheim, Norway (author, unpublished). It is possible that the index is related to variation in the insertion of the deltoid muscle.

Index 2b: Humerus: *Robusticity*

Calculated by the sum of the two mid-shaft measurements divided by the maximum length (HuL_1). There is a tendency for male humeri to be more robust than female (Appendix D), but the difference is not marked. The available arms for Rochester are slightly more robust than a medieval Norwegian sample, in which the average robusticity was 12.0 (right) and 12.6 (left) (source, author). Interpretation is handicapped by the fact that that humeral shape may be influenced by age (Pfeiffer 1980), as well as by musculature.

Index 3a: Femur: *Meric Index*

This records the degree of antero-posterior (front-to-back) flattening of the upper femoral shaft. An index under 85 is platymeric (marked flattening). The aetiology is still poorly understood; it could be due to mineral or vitamin deficiencies (Buxton 1938) or it may be related to mechanical adaptation and to increased muscular stresses (Brothwell 1981, 89). There is no evidence to suggest that it is related to platycnemia, transverse flattening of the upper tibia. A good summary of current knowledge, including CT scans of both conditions, is presented by Cross and Bruce (1989).

Platymeria occurs more frequently in earlier, pre-industrial societies (Brothwell 1981, 89). There is a tendency for the flattening to be more marked in females and on the left side in both archaeological (source, author) and in more recent material (Holtby 1918). Only thirty-eight femora from Rochester were available for measurement; of these 44.7 per cent (n17) were platymeric. This is a lower frequency than that from medieval Aberdeen 64 per cent (n46) (Cross and Bruce 1989). No firm conclusions can be drawn from this finding.

Index 3b: Femur: *Pilasteric Index*

This records the degree of transverse flattening of the femoral mid-shaft. Compared to the meric index, the pilasteric has received scant attention. There is some evidence that the flattening is more marked on the right side (Holtby 1918; Hrdlicka 1934). The small sample from Rochester displays the same finding (Appendix D). If a large group of burials were available, it would be interesting to see if an inverse relationship exists between platymeria (antero-posterior flattening) and pilastery (transverse femoral flattening). The fact that platymeria is more frequent in left femora and pilastery in the right side tends to support such a view.

Index 3c: Femur: *Robusticity*

Calculated by the sum of mid shaft femoral diameters (FeD_3, FeD_4), divided by the oblique length (FeL_2). At Rochester the male bones are more robust than the female (Appendix D). In a much larger sample of medieval femora from Trondheim bones were less robust and did not display sexual dimorphism (male: 12.2; female 12.3). No firm conclusions can be reached since lower limbs may be influenced by standard of nutrition and age-related bone remodelling (Ruff and Hayes 1988).

Index 4a: Tibia: *Cnemic Index*

This records the degree of transverse flattening of the upper tibial shaft. An index under 63 is platycnemic (marked flattening). Its aetiology is not fully understood, but it is probably the result of antero-posterior bending strain (Lovejoy *et al.* 1976). It is a more frequent occurrence in pre-industrial and primitive societies (Schofield 1959) and may bear a direct relationship to habitual squatting (Brothwell 1981, 89). As seen above tibial flattening is not necessarily associated with platymeria. At Rochester 13.5 per cent of the available tibiae (n37) were platycnemic; 27 per cent mesocnemic and 59.5 per cent eurycnemic. A similar pattern of 10 per cent, 30 per cent and 60 per cent was recorded from medieval Aberdeen (Cross and Bruce 1989).

All post-cranial metrics and indices from Rochester fall within the expected range for British material. There is no evidence of any metric abnormalities in the sample. No further conclusions are possible on such a small number of bones.

NON-METRIC VARIATION

Non-metric variants, also known as discontinuous traits, refer to anatomical, non-pathological anomalies. They include additional bone ossicles, supernumerary or absent foramina. Many workers, assuming a genetic causation, have used an incidence of the traits in an attempt to separate different population groups (Anderson 1968; Berry 1974; Carpenter 1976; Corrucini 1974; Wood-Jones 1931). Unfortunately, their aetiology is still poorly understood (Rösing 1984). It is probable that many are inherited on a multifactorial basis i.e. environmental, external, influence modifying the genetic component (Bennett 1965; Dahinten and Pucciarelli 1983; Rosenberg *et al.* 1983; Trinkaus 1978). Consequently, the true value of non-metrics in assessing 'biological distance' remains uncertain.

Cranial Non-Metrics

Based largely on the definitions in Berry and Berry (1967), thirty-seven different cranial non-metrics were recorded as present, absent, or unscoreable (bone area unavailable for study). The small size of the Rochester sample, coupled with the uncertain mode of their inheritance, means that no definite conclusions can be reached. Only four cranial non-metrics were considered worthy of further study.

a. *Metopism*

The two halves of the frontal bone begin to unite during the second year (Williams and Warwick 1980, 334), but occasionally they may remain separate throughout life. This condition is known as metopism and it has an incidence of *c.* 9–11 per cent in British material (Hooke 1926; Parsons 1908). At Rochester only three male skulls displayed a persistent metopic suture; the overall incidence of the trait was 21.4 per cent ($^{3}/_{14}$).

Metopism is thought to be largely genetic (Torgersen 1951) and a higher than normal frequency may suggest a familial group. However, environmental factors, including malnutrition (quoted in Cross and Bruce 1989) and bone resorption (Manzanares 1988) may also influence the persistence of the suture. The frequency and sex bias from Rochester need not be of significance, based on such a small sample.

b. *Hypoglossal Canal Bipartite*

The hypoglossal canal, located on either side of the foramen magnum, transmits blood vessels and the twelfth cranial nerve (Williams and Warwick 1980, 308). Normally, it presents as a single canal, but not infrequently it is divided into two by a bony ridge. This may be related to the composite origin of the hypoglossal nerve (*ibid.*, 1083). The morphology of the canal is thought to be largely genetic (Hauser and de Stefano, 1985); thus it may be a useful genetic marker. In European material the incidence of bipartition was 11.4 per cent (Lille 1917). At Rochester the trait was slightly more frequent, 16.7 per cent ($^{2}/_{12}$) and was not found in females. However, no definite conclusions can be drawn from such a small sample.

c. *Palatine Torus*

A bony overgrowth on the mid-line of the palate, first described in man by Fox in 1806 (Lasker 1952). During the last century it was thought to be a stigma of syphilis and even in the early part of this century a pathological interpretation, including tuberculosis or rickets, was considered (quoted in Woo 1950). The torus is now known to be a non-metric variant. It does not appear to be related to the torus mandibularis (Axelsson and Hedegaard 1985).

Some workers have found evidence that the trait is familial (Gould 1964; Sawyer *et al.* 1979; Suzuki and Saki 1960). However, a study of modern Icelandic schoolchildren suggests a multifactorial inheritance with a large environmental component (Axelsson and Hedegaard 1985). Microscopic examination of tori suggests that they are not related to mastication (van den Broek 1943).

At Rochester only two examples were found, both in females (n6). The available skeletons need not be representative of the cemetery, but it is noteworthy that a female bias has been noted previously (Axelsson and Hedegaard 1985; van den Broek 1943). The overall frequency, 15.4 per cent, from our sample, is much higher than the 6 per cent reported from seventeenth-century Britain (Axelsson and Hedegaard, 1985). However, compared to medieval Oslo with 38 per cent and medieval Greenland with 85 per cent (*ibid.*), the Rochester finding appears unexceptional.

d. *Mylohyoid Bridge*

The mylohyoid groove is located on the medial aspect of the mandibular ascending ramus (Williams and Warwick 1980, Fig. 3. 81B). Occasionally, a bony bridge, of varying thickness, may span this groove (Kaul and Pathak 1984), it may represent an ossified remnant of Meckel's cartilage and is inherited on a genetic basis (Ossenberg 1974). The bridge has not been found on children under six years of age (Sawyer *et al.* 1978), but it does not appear to be age-dependent in adults (Ossenberg 1974). Lundy (1980) found no sexual dimorphism for the bridging, but other workers suggest a female bias (Sawyer *et al.* 1978).

At Rochester the overall incidence was 11.8 per cent ($^{2}/_{17}$) and was found in both sexes. This finding is very similar to the frequency of 11.15 per cent in a large sample (n278) of American Whites (Kaul and Pathak 1984). It is interesting that the bridging is so rare, 0.47 per cent ($^{4}/_{844}$) in French material (Ossenberg 1974). The reason for this variation is unknown.

Post-Cranial Non-Metrics

Based on the definitions in Finnegan (1978) and in Anderson (1987), twenty-nine different post-cranial non-metrics were recorded as present, absent, or unscoreable (area unavailable for study). The aetiology of many of these traits is still poorly understood. Recent work suggests that most are inherited on a multifactorial basis, some, such as septal aperture (Anderson 1987) and those of the femoral neck region (Angel 1964) contain a very high environmental component. The post-cranial non-metrics available from Rochester appear to fall within the expected limits of both archaeological and modern samples (Anderson 1987). The sample is too small and chronologically divergent to be representative of the parent population. Thus, no meaningful conclusions can be obtained and no further examination of the post-cranial non-metrics was attempted.

PALAEOPATHOLOGY

The term was coined by Sir Marc Armand Ruffer at the turn of the century. It is generally defined as the study of disease in earlier human populations, based on skeletal or mummified remains. Various diseases lead to visible alteration in dry bone: degenerative joint disease ('arthritis') and trauma, including fractures and wounds, are the most frequently encountered. Congenital anomalies, chronic infection, metabolic bone disease and neoplastic growths have also been documented from excavated bone material (Manchester 1983a; Ortner and Putschar 1985; Steinbock 1976). Many diseases involve only soft tissue or may resolve without bone involvement; such conditions will not normally be available to the palaeopathologist.

In view of the size of the sample and its poor state of preservation, it is not possible to infer the health status of the general population from Rochester. However, a discussion of the various pathological conditions is presented below.

Congenital

In two skeletons (SK9, 36) the twelfth thoracic ribs were congenitally absent. Unlike presence of cervical ribs, costal aplasia is sub-clinical. Its inheritance is probably genetic, but influenced by environmental factors. There was no evidence of any other congenital anomalies in the sixty-one skeletons from Rochester.

'Arthritic' conditions

a. *Primary degenerative joint disease* (DJD)

Formerly known as osteo-arthritis, primary DJD is an extremely common finding in both modern and archaeological populations (Meisel and Bullough 1984; Ortner and Putschar 1985, 419–33). The causation is not fully understood but its incidence does increase with advancing age (Sharp 1964). Excessive usage and repeated stress, so called 'wear and tear' will predispose a joint to DJD (Gunn 1974; Jurmain 1977). Consequently, the pattern of joint involvement may give clues to life-styles and occupations (Anderson 1971; y'Edynak 1976).

At Rochester, the clavicle is the site of predilection. there are three cases of acromio-clavicular joint involvement (SK 43, 53, 58), an incidence of 13.6 per cent. The sterno-clavicular joint also exhibits degenerative alteration (SK 53, 54, 60) which represents 12.5 per cent of available sternal articulations. There is a distinct male bias, out of the five skeletons with clavicular degeneration only one (SK 54) is female. Other sites include shoulder (SK 30: male 35–40); elbow (SK 9: female 40–50); hand (SK 1: female 35–40; SK 53: male 40–55); knee and foot (both SK 1).

It is interesting that the hip is not involved; in both modern practice (Meisel and Bullough 1984, chapter 4) and in archaeological remains (Ortner and Putschar 1985, 419; Steinbock 1976, 279), it is a favourite site. Today the shoulder and the sterno-clavicular region is not a normal location for DJD, except in the elderly (Sharp 1964). In earlier populations upper limb joint disease appears to be more frequent and earlier in onset (Jurmain 1980).

The advanced bone changes in both feet of SK 1, with bilateral metatarso-cuneiform II–III involvement, is interesting. The appearance of the dry bones (Pl. III), as well as X-ray evidence are typical of DJD, but the tarsal location is somewhat unusual; the site of preference being the first metatarso-phalangeal joint (Meisel and Bullough 1984, Chapter 6). It is possible that repeated occupation stress (such as operating a treadle?) may have lead to an early onset of DJD. In modern patients, advanced joint disease at this site would only be found in the very elderly (Dr Carter, *pers. comm.*).

b. *Vertebral degeneration*

Each vertebral joint was examined (there are 142 articular surfaces in a complete spine) for signs of DJD. Other evidence of spinal degeneration, including osteophytic development and Schmorl's node formation were also investigated. Only 22 spines (13 male: 9 female), most incomplete, were available for examination.

Degeneration of the articular surfaces was recorded in 46 per cent of male and 67 per cent of female spines, with the earliest onset being 22–27 years (SK 20). Osteophytic outgrowths, a sign of disc space narrowing, were found in 31 per cent of male and 44 per cent of female spines. Schmorl's nodes, circular crescent-shaped depressions on the superior or inferior vertebral body, were found in 46 per cent of males and in only 11 per cent of females.

Osteophytic outgrowths tend to be more frequent in areas of greatest curvature: lower cervical, lower-mid thoracic and mid lumbar (Meisel and Bullough 1984, Fig. 7.1). A statistically significant male predilection has been reported (Nathan 1962). The outgrowths are thought to be a response to excessive pressure on the spine and thus are indicators of mechanical stress. Florid osteophytic development can also occur as a component of a specific disease entity, such as D.I.S.H. (Forestier and Lagier 1971) or Reiter's syndrome (Rogers *et al.* 1987).

Schmorl's modes occur due to the herniation of the soft tissue intervertebral disc into the vertebral body (Saluja *et al.* 1986). The defects develop more frequently on the inferior aspect of the lower thoracic and the superior surface of the upper lumbar vertebrae (Knowles 1983); they are related to mechanical, compressional forces (*ibid.*). Most workers have found them to be more frequent in males (*ibid.*; Saluja *et al.* 1986), but in a large sample (n1126) of modern Poles there was no sexual preference (Swedborg 1975).

In the Rochester sample over half the spines, including the quite elderly, do not display any degenerative changes. Other workers have found vertebral DJD to be almost universal in their sample (Cross and Bruce 1989). It is interesting that DJD is more frequent than osteophytes since it is generally agreed that osteophytic development occurs earlier than articular facet degeneration (Roche 1957). The incidence of Schmorl's nodes is much lower than that found in a small sample from medieval Aberdeen: males 72 per cent, females 67 per cent (Saluja *et al.* 1986).

It is uncertain how representative the Rochester sample is of the general population. The available material suggests that spinal pathology was relatively infrequent, with degeneration favouring the shoulder and clavicular joints, but sparing the hip. This might suggest occupations and activities involving repeated stress of the upper arms, but with little weight lifting or back bending.

c. *Secondary DJD*

Secondary DJD refers to joint degeneration which occurs as the result of an existing disease (often infection such as tuberculosis) or it may be secondary to a developmental defect (Perthes disease) or else the sequelae of trauma. It is never as frequent as primary DJD and unlike the former it can occur at any age and will display a different pattern of joint involvement (Ortner and Putschar 1985, Fig. 218; Meisel and Bullough 1984).

There were no definite examples of secondary DJD in the Rochester sample. The left hand of SK 53 (male, 40–55) displays eburnation and porosity of the metacarpal II-trapezium articulation. The base of the thumb is the normal location for wrist degeneration (Meisel and Bullough 1984). Involvement of metacarpal II may signify previous injury. However, there is no evidence of trauma, and it is more likely to be an occupationally linked primary DJD.

The morphology and distribution of the degenerative lesions suggest that the population suffered from primary DJD. There was no evidence for rheumatoid arthritis or any of the other skeletal arthropathies such as ankylosing spondylitis or gout.

Trauma

After degenerative joint disease, evidence of trauma is the most commonly encountered pathology in archaeological material. The term trauma includes broken bones, caused by accident, as well as direct violence and inflicted weapon injuries. Surgical operations, including trephination (Bennike 1985; Parker *et al.* 1986) and amputation (Ladegaard-Jakobsen 1975; Stloukal and Vyhánek 1989) have also been discovered in excavated material.

In the Rochester sample there were three cases of trauma, two of which clearly display weapon injuries.

SK 54, an older female 45–60 years, was suffering from an un-united upper mid-shaft fracture of the left ulna (lower arm bone). The radius was not broken. This is highly suggestive of a Monteggia fracture-dislocation: fracture of the upper shaft of the ulna and dislocation of the radial head (Watson-Jones 1982, 675). The head of the radius appears normal; however, in dry bone material a reduced dislocation need not display bony alteration. If the ulna had been fractured, without affecting the radio-ulnar joint the break would normally be at the lower-mid or mid shaft (Watson-Jones 1982, 672).

The mechanism of the Monteggia fracture is not perfectly clear. In most cases, it is due to indirect violence, a fall with forced pronation of the lower arm (Watson-Jones 1982, 676). However a blow to the back of the arm could cause a similar injury (*ibid.*); thus, direct violence cannot be completely ruled out.

Monteggia fractures are prone to complications in modern clinical practice. Watson-Jones (1982, 675) reports that prior to 1940 over 94 per cent ($^{32}/_{34}$) of patients treated had permanent disabilities. Consequently non-union due to inadequate treatment is not surprising in the medieval period. Examination of the dry bone shows that healing has taken place. Thus, the injury probably occurred several years before death. The formation of a pseudarthrosis (a false joint) implies that the bone would never re-unite.

SK 31, adult male, *c.* 30–40 years old, exhibits healed trauma to the skull. The lesion is situated on the middle of the right frontal bone (Pl. IV). It consists of a well-defined elliptical cut *c.* 23 mm. long. The right side of the lesion exhibits a smooth overgrowth of dense bone; the left edge is bounded by a narrow collar of porous bone. The appearance is typical of an old well-healed weapon injury (Pl. V). The wound did not penetrate the inner table of the skull. There is no sign of secondary infection.

The blow appears to have been inflicted across the forehead, from left to right. The appearance does not suggest a fracture due to the proverbial blunt instrument, yet it is not typical of a cutting injury, since the edge is not so sharply defined. A full-bodied sword cut would probably penetrate the skull. The reparative process has obliterated the original sharp edge of the lesion. On balance the most likely interpretation is a cutting injury, either from a heavy sword or perhaps an axe. The blow failed to penetrate perhaps due to the protection of a helmet.

SK 53, an adult male, *c.* 40–55 years old, displays evidence of healed trauma to the skull, situated in the centre of the left parietal bone. A circular lesion (*c.* 30 mm. in diameter), with exposure of the diploë, is clearly visible (Pl. VI). This wound is typical of a glancing blow from a sharp-edged weapon, quite possibly a sword. The lesion has not penetrated the skull and there is no evidence of infection. A similar example was found in the Anglo-Saxon cemetery at Eccles (Manchester 1983a, Pl. 30).

It is interesting that two cases of weapon injury should be found in such a small sample. Only thirteen skulls were available for examination; this means a 13.3 per cent of adult cranial injury. This appears to be a high figure since no weapon injuries have as yet been found on a large series of skulls from medieval Canterbury. Also, work on a large sample of material from Spitalfields suggests that head wounds were rare: eighteen examples from 986 crania, 1.8 per cent (Morant and Hoadley 1931).

Infection

Various infectious diseases including tuberculosis, leprosy and syphilis can exhbit bone alteration in their more advanced stages (Ortner and Putschar 1985, 141–218), but there was no evidence for these diseases in the Rochester material. The only sign of infection was three cases of lower leg bone reaction (SK 1: female 35–40; SK 33: male age unknown; SK 53: male 40–55). This so-called tibial osteitis is a common finding in archaeological contexts (Birkett 1983; Ortner and Putschar 1985, 129–38; Steinbock 1976, 60–85). It is evidence of an infection, but the underlying causation is uncertain, therefore it is classed as non-specific. Thirty-seven tibiae were available for examination; therefore, the incidence of non-specific infection is 7.5 per cent. This is a similar incidence to the 10 per cent from later medieval Winchester (Price 1975), but much less than at York where 26.2 per cent of the sample displayed osteitic reaction (Grauer 1989).

Nutritional

Chronic malnutrition as well as scurvy (vitamin C deficiency) and rickets (vitamin D deficiency) can be recognised from skeletal remains (Ortner and Putschar 1985, 270–80). Cranial porosis, caused by expansion of the diploë, is possible evidence for anaemia (Stuart-Macadam 1989). A similar finding in the eye sockets, cribra orbitalia, could have the same causation or else it may be evidence of scurvy (Holck 1987).

In the Rochester material there is little definite evidence of malnutrition. The tibiae of SK 1 display a slight medio-lateral bowing, which is suggestive of healed rickets, childhood deficiency of vitamin D (Ortner and Putschar 1985, Fig. 440). There are two cases of slight cranial porosity (SK 11: female 20–25; SK 30: male 35–40). This represents 10.5 per cent of available crania. The cranial porosis is very mild and is not diagnostic of anaemia. There was no evidence of cribra orbitalia in the seven skeletons with eye sockets complete enough for examination.

In SK 62 (female 30–40) the bones are extremely gracile and very light; the sacrum exhibits marked curvature. The latter is a common finding in adult vitamin D deficiency, osteomalacia (Ortner and Putschar 1985, fig. 441). Although a firm diagnosis is not possible, it does appear that this adult female was suffering from some form of chronic malnutrition, leading to bone deformity. The only other evidence of possible metabolic bone disease is a compression fracture of the fourth thoracic vertebra in SK 53 (male, 40–55). This could be the result of osteoporosis, rarefaction of the bone, but the available evidence is not diagnostic.

Neoplasms

Neoplasms, also known as tumours, are not a common finding in archaeological remains. Those involving the skeleton can be divided into two types: (a) primary and (b) secondary bone tumours.

Primary bone tumours develop initially in bone. They may either be benign, such as ivory osteoma of the skull or else malignant and life threatening, such as osteosarcoma. Secondary bone tumours develop in soft tissue and then spread (metastasise) to bone. Depending on the sex of the skeleton and the distribution and type of the lesion it may be possible to infer the original site of the tumour (Grupe 1988; Manchester 1983b; Tkocz and Bierring 1984).

Primary bone neoplasms predominantly affect a younger age group and are rare after the age of thirty (Steinbock 1976). They are much less common in modern clinical practice than are secondary bone tumours, which develop in later life. In archaeological material both types of neoplasm are uncommon. It is possible that metastatic lesions are rarely encountered since life expectancy was shorter in earlier societies.

There was one example of a tumour-like condition. This involved the skull of SK 46 (female, 35–50). The bony overgrowth is truly spectacular (Pls. VII and VIII). The greater wing of the right sphenoid; the lateral aspect of the right frontal bone; most of the eye socket and the infra orbital process of the zygoma are all involved. The striking appearance is caused by a massive ovoid overgrowth (hyperostosis) of spongy bone, 70 mm. in circumference. It extends from the spheno-temporal articulation to the supero-lateral aspect of the right orbit. The hyperostotic bone is regular and well-demarcated. Thickened spongy bone with a clearly defined margin has extended supero-medially and has involved the supra orbital aspect of the frontal bone. The spongy hyperostosis has spread into the zygoma causing marked swelling and porosity. Comparison of the normal left orbit with the diseased right, shows quite clearly bony overgrowth in all but the medial aspect of the eye socket. In the sphenoid, just inferior to the spongy hyperostosis, there is a ragged-edged circular (*c.* 10 mm. diameter) defect, penetrating to the inner table.

The massive hyperostosis would have been extremely disfiguring. The overgrowth would be visible as a massive hard tissue swelling on the side of the skull. The right cheek would be enlarged and irregular. The right eye would be bulging out of its socket. Probably vision was destroyed due to compression of the optic nerve.

The most plausible diagnosis is a meningiomatous hyperostosis or possibly a haemangioma. The former originates on the outer surface of the brain (the meninges). The bony overgrowth is a pathological response to the initial soft tissue tumour (Steinböck 1976, 353). The chronicity of the hyperostosis, with its smooth, well-defined edges, rules out a primary malignancy such as osteosarcoma. Also the location of the lesion and the age of the skeleton would negate such a diagnosis. Osteosarcoma rarely occurs over the age of twenty-five and is not normally present on the cranium (Steinböck 1976, 363).

A differential diagnosis of haemangioma must be considered. The latter is an overgrowth of vascular channels. In dry bone its appearance may be indistinguishable from a meningiomatous hyperostosis. The X-ray evidence is suggestive of meningioma, since the peripheral lytic margin, common in haemangiomas is absent (Ortner and Putschar 1985, Fig. 606). Recently obtained CT scans show obvious destruction of the inner table, which is characteristic of a meningioma.

In conclusion the preferred diagnosis is one of meningiomatous hyperostosis. This is an extremely rare finding; Steinböck (1976, 354) reports only twelve palaeopathological examples in the world literature. Only one example, originally reported as an osteosarcoma, is known from Britain. This is from a Romano-British site at Radley (Brothwell 1967, Fig. 6c).

ORAL HEALTH

The adult oral health standard is based on sixteen upper and eighteen lower jaws in which 508 teeth were available for examination.

Tooth loss

In dry bone material it is possible to distinguish between tooth loss during life (*ante mortem*) and that which occurred after death (*post mortem*). In the latter, the socket for the tooth root is present and will be sharply defined. In cases of *ante mortem* loss the socket is remodelled and eventually the bone will show a smooth contour and all trace of the socket will have disappeared. It was possible to ascertain an overall *ante mortem* tooth loss of 22.2 per cent. This is a high figure compared with other sites. In a large sample of skeletons from medieval Denmark, the overall loss was only 3.2 per cent (Bennike 1985, table 35).

There is evidence that the females suffered a more serious loss: 25.3 per cent compared with 18.6 per cent. A similar bias is well known in modern societies and has also been reported from other archaeological sites (Bennike 1985, fig. 90). The sample is very small, thus the tendency for the lower jaw to show greater loss (36.6 per cent) than the upper (11.6 per cent) may not be representative of the community in general.

Caries

Examination of the teeth for carious cavities revealed an overall incidence of 5.5 per cent; 7.6 per cent ($^{14}/_{284}$) of male teeth were involved, but only 2.4 per cent ($^{3}/_{125}$) of female. This is unusual, since females usually display a higher carious experience than men in both archaeological (Burns 1979) and modern populations (Jenkins 1978). In our small sample the high percentage of female tooth loss has probably biased the result. If we assumed that *ante mortem* tooth loss was due to caries, the figures would be: male 22.4 per cent; female 40.2 per cent.

The overall incidence of caries is virtually identical to the 5.6 per cent from medieval Cuddington (James and Miller 1970). However, it is much lower than reported from eighteenth-century England: male 19.7 per cent; female 31.7 per cent (Krogman 1938) or from eighteenth- and nineteenth-century Norwich, 33.8 per cent ($^{534}/_{1578}$) (Wells 1968). As mentioned above, the high percentage of *ante mortem* tooth loss, especially in the female mandible (46.2 per cent) has artificially lowered the caries prevalence at Rochester.

Abscesses

Abscess cavities affected 1.8 per cent of erupted tooth positions. The term erupted positions is preferred since teeth loss during life can still be scored as having an abscess, if the cavity is visible in the jaw bone. There appeared to be a direct relationship between crown destruction by caries and abscess development. This is due to exposure of the pulp cavity and subsequent danger of infection.

It is noteworthy that abscesses were confined to males (3.3 per cent). Out of 207 erupted positions no abscesses were found in females. Compared to other sites, the overall incidence is low. Abscess cavities were found in 9.2 per cent of sockets at medieval Clopton (Tattersall 1968). Even the inhabitants of Iona, with healthy teeth, had a higher abscess prevalence (2.3 per cent, Wells 1981).

Calculus

There was some evidence of calculus, calcified plaque, on all the available dentitions. Many of the deposits were minimal (62 per cent). There is a tendency for calculus to have a greater frequency in the mandible: 71.2 per cent of teeth affected as to 60.8 per cent in the maxilla. Buckley (1980) in a sample (n300) of present day juveniles found a similar lower jaw predilection. The slight female bias (72.4 per cent, as opposed to 62.7 per cent of males with calculus), is not a significant difference. The overall incidence of teeth with some calculus deposition is 66.6 per cent. This equates very well with the 67 per cent from medieval Jewbury (Dobney and Brothwell 1986). Chemical and microscopical examination of calculus may provide clues to ancient diets (Dobney and Brothwell 1986; Piattelli *et al.* 1987).

Hypoplasia

Hypoplastic lines represent defects in the enamel formation during the growth of the tooth. They occur in response to some form of childhood stress. If widespread, they probably signify a period of malnutrition or systemic illness during the growth period, rather than trauma (Hillson 1979). Once formed they remain visible throughout life. By measuring their position it is possible to calculate how old the child was when the defect occurred.

Only fifteen adult dentitions were sufficiently complete for examination. The overall incidence of hypoplasia was 20 per cent. The sample is too small to be meaningful, but it is worth noting that the three cases of hypoplasia all occurred in males. Possibly there is a relationship between childhood hypoplasia, small stature and shorter life expectancy. However, a larger sample would be required to test this hypothesis.

Sub-adult oral pathology

There are only five sub-adult dentitions available for study, ranging in age from 5–7 years (SK 44) to 12–14 years (SK 27). Only one child, SK 56, 6–7 years old, suffered from caries. The maxillary milk molars (e, d) displayed a large, contact point cavity. Based on 77 available teeth, the sub-adult caries rate was 3.9 per cent. This is much lower than the medieval sites of Cuddington, 12.2 per cent ($^{27}/_{222}$; James and Miller 1970) and the Hirsel, 9.2 per cent (Williams and Curzon 1985). Childhood caries experience is even more prevalent in modern societies; approximately one third of children display cavities (James and Miller 1970).

There was no evidence of marked periodontal disease or of abscesses in the sub-adult dentitions. Calculus was present in

20.8 per cent ($^{16}/_{77}$) of the available teeth. The deposits were all minimal, but in SK 56 they were widespread, involving 9 out of the 18 available teeth. Clearly the standard of oral health was extremely low since the child suffered from advanced caries and widespread calculus at such a young age.

Study of sixteen measurable hypoplastic lines show that the defect occurred between $2^1/_2$–$5^1/_2$ years, with an average of $3^1/_2$ years. Its presence in three dentitions, 60 per cent of the total, is interesting. This is three times the adult incidence, which suggests that children who suffered from episodes of illness in early infancy were less likely to survive into adulthood.

CONCLUSION

The examination of a small number of skeletons (n61) from medieval and post-medieval levels from Rochester Cathedral has revealed the following information. The burial ground contained men and women as well as children (14.8 per cent) and was clearly a lay cemetery. Only three small trenches were excavated; thus the bones although solid, are very fragmentary and incomplete. The poor preservation has meant that only a small number of skeletons could be aged with any accuracy.

Metric analysis has shown the average stature to be 1.70 m. for males and 1.59 m. for females. It is very interesting that the medieval skeletons were taller than the post-medieval (see Table 1). This suggests a deterioration in diet during the post-medieval period. Detailed examination of cranial and non-cranial metrics suggest that most measurements fall within the bounds of normality. Unfortunately, the small sample means that no firm conclusions can be drawn from either stature variation or from metric analysis.

Study of non-metric variation was unable to show any clear familial relationship. Four cranial variants: metopism; bipartite hypoglossal canal; palatine torus and mylohyoid bridge were discussed in greater detail. The sample was not large enough for a clear pattern to emerge.

Examination of the pathology suggests that DJD conditions were more common in the upper limbs and of earlier onset than in modern populations. It is probable that certain 'arthritic' conditions, such as the deformed feet (SK 1) are occupationally linked. In comparison with other archaeological populations, spinal degeneration was not too severe. There was little evidence for malnutrition or for vitamin deficiency. Infection was only visible in two skeletons (SK 1, 53); an incidence of 7.5 per cent which is not high by medieval standards.

The only evidence of accidental injuries, such as broken arms or legs due to a fall, was an un-united fracture of the left ulna (SK 54: female 45–60 years). There were two examples of weapon injury, involving the skull (SK 31: male, 30–40; SK 53: male, 40–55). In both cases healing had taken place without any signs of infection.

The most spectacular lesion (Pls. VII and VIII) is the meningiomatous hyperostosis (SK 46: female, 35–50). This is a very rare finding in archaeological material, only one other case is known from British material (Brothwell 1967).

The small sample of skulls with intact dentition suggests calculus was frequent, affecting about two thirds of the available teeth, but in most cases (62 per cent) deposits were minimal. The caries experience is fairly low, certainly in comparison to post-medieval samples. This may be related to a high percentage of *ante mortem* tooth loss many of which may have been the result of carious destruction. Abscess cavities are much less frequent at Rochester than at most other sites. This, as well as the apparent sex link (no females affected) may be an anomaly due to the sample size. The few sub-adults available display rather unhealthy dentition especially SK 56 (6–7 years old) with carious lesions of the upper milk molars and widespread calculus deposits.

The small sample of excavated skeletons suggests a community suffering from 'arthritis'; trauma; infection; possible vitamin deficiency as well as neoplasm and various oral problems. Examination of SK 53 would suggest an extremely unhappy existence; 'arthritis' of both shoulders and collar bones; spinal degeneration with vertebral collapse and subsequent scoliosis; chronic infection of the lower leg and also a sword cut to the skull. However, viewing the sample as a whole the standard of health appears no worse than that of other excavated samples. Indeed, spinal degeneration, chronic infection and dental problems are, in general, more serious in other British samples.

In conclusion, these dry bones give us a fascinating glimpse into the way in which a small section of an earlier community lived and died. If possible, it would be worthwhile examining a larger number of burials from the same site in order to ascertain how representative this small sample is of the community in general. The knowledge we have already gained from this group of skeletons bears out the motto of the Palaopathological Society: *Mortui viventes docent*.

APPENDIX A

For notes on the criteria used for sexing and ageing see Notes 1 and 2 at the end of this appendix.

Skeleton No. 1
Sex: Female
M 4b; 5a.
F 2a, b, c?, d-f; 9b, c; 11a?; 12a, b?
? 2g; 3c; 4a; 6a; 7a.
Age: 35–40
II 23–39
III 35–39
V 33–46
Comments: *c.* 75 per cent complete; missing skull and right arm.
Date: Post-medieval (1800–1825).

Skeleton No. 2
Comments: Unavailable for study.
Date: Post-medieval (1800–1825).

Skeleton No. 3
Sex: ?
Age: Grown
No ageing criteria. Radial epiphyses fused.
Comments: Less than 5 per cent. Left lower arm only.
Date: Post-medieval (1800–1825/50).

Skeleton No. 4
Sex: ?
Age: 2–4 months
iii 2–4 months
Comments: Less than 5 per cent. Right lower arm and collar bone.
Date: Post-medieval (1800–1825/50).

Skeleton No. 5
Sex: Female?
M
F
? 4a?, b?; 5a; 6a; 7a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 30 per cent. Legs and feet.
Date: Post-medieval (late eighteenth/early nineteenth century).

Skeleton No. 6
Sex: Male

M 4b.
F
?
Age: 22–27
V 19–27
Comments: *c.* 10 per cent. Left: rib fragments, lower arm, hand and upper leg.
Date: Post-medieval (late eighteenth/early nineteenth century).

Skeleton No. 7
Sex: Male?
M 5a.
F
? 6a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 5 per cent. Right lower leg and foot.
Date: Post- medieval (late eighteenth century).

Skeleton No. 8
Sex: Male?
M 7a?.
F
? 6a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: Less than 5 per cent. Right lower leg (fibula) and foot.
Date: Post-medieval (late eighteenth century).

Skeleton No. 9
Sex: Female
M
F 1d; 2a, b; 3a, c.
?
Age: 40–50
I ?
III 40–50
IV ?
Comments: *c.* 40 per cent complete. Skull and vertebrae fragments. Left arm, hand, pelvis and upper leg.
Date: Post-medieval (late eighteenth/early nineteenth).

Skeleton No. 10
Sex: Male
M 2a, g; 4a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 10 per cent. Left lower arm fragments. Left pelvis, upper leg.
Date: Post-medieval (1825–50/75).

Skeleton No. 11
Sex: Female?
M 4b.
F 1c, e?
? 1a, b, d, g.
Age: 20–25
I 20–25
Comments: Less than 5 per cent. Skull and cervical spine fragments.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 12
Sex: ?
M 5a.
F
? 6a; 7a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 15 per cent. Lower legs and feet.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 13
Sex: Male?
M 2a?
F
?
Age: 17–24
iii 17–24
Comments: Less than 5 per cent. Vertebral fragments. Left pelvic fragment. Left lower leg (tibia) fragment.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 14
Sex: Male
M 4a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: Less than 5 per cent. Left lower arm fragments and hand. Right upper leg fragment.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 15
Sex: Male?
M 3c?
F
?
Age: 21–28
V 17–28
iii over 20

Comments: Less than 5 per cent. Rib and vertebral fragments. Right elbow.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 16
Sex: Female
M
F 1a-f.
?
Age: 30–40
I ?elderly
IV *c.* 30
Comments: 5 per cent. Skull only.
Date: Post-medieval (late eighteenth to mid nineteenth century).

Skeleton No. 17
Comments: Skeleton in section.
Date: Post-medieval (1800–1825).

Skeleton No. 18
Sex: Female
M
F 2a: 3a; 5a; 12b.
? 4a, b; 6a; 7a.
Age: (25–40)
III ?40–45
V ?
iii ?20–25
Comments: *c.* 75 per cent. Missing: skull, neck, right arm.
Date: Post-medieval (late eighteenth/early nineteenth century).

Skeleton No. 19
Sex: Male
M 4b; 6a; 7a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 10 per cent. Right leg and foot.
Date: Post-medieval (late eighteenth/early nineteenth century).

Skeleton No. 20
Sex: Female
M
F 1a-d, e?, f-g; 2a, e?, f?, g?; 3a, c; 4a, b; 11a; 12a, b.
? 2b, c; 9a.
Age: 22–27
I 23–28
III 25–29
IV under 30?
V under 20

Comments: 75 per cent. Missing lower legs and feet.
Date: Post-medieval (seventeenth to eighteenth century).

Skeleton No. 21
Sex: ?
Age: 8–10
i 8–9 years
ii HuL_1, 10–12 years
RaL_1, 8–10 years
FeL_1, 10–12 years
Comments: *c.* 80 per cent complete. Missing most of lower legs, feet.
Date: Post-medieval (mid to late eighteenth century).

Skeleton No. 22
Sex: Male?
M 1a, b, c?, d?, g?; 2a?; 4a; 5a.
F 6a; 7a; 12a.
? 3a; 12b.
Age: 25–35
I 22–27
III 30–39
Comments: *c.* 75 per cent. Skull fragmentary. Missing left arm.
Date: Post-medieval (seventeenth century?).

Skeleton No. 23
Sex: Female
M
F 4b; 5a; 6a; 7a.
?
Age: Grown
No ageing criteria available. Epiphyses fused.
Comments: *c.* 15 per cent. Right leg and foot.
Date: Post-medieval (seventeenth century?).

Skeleton No. 24
Sex: Male
M 2a; 3a; 11a?
F 1a.
?
Age: 28–35
I 25–30
III 40–44
IV ?
Comments: *c.* 10 per cent. Skull fragments, vertebrae and rib fragments, left collar bone and arm, left pelvis.
Date: Post-medieval (seventeenth century?).

Skeleton No. 25
Sex: Male
M 4b; 5a; 6a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.

Comments: *c.* 15 per cent. Lower legs (including distal femora) and feet.
Date: Post-medieval (seventeenth/eighteenth century).

Skeleton No. 26
Sex: Male
M 2a; 4b; 5a.
F
?
Age: Grown
No available criteria. Epiphyses fused.
Comments: *c.* 10 per cent. Left hip and upper leg.
Date: Post-medieval (seventeenth/eighteenth century).

Skeleton No. 27
Sex: ?
Age: 12–14
i *c.* 12 years
ii HuL_1, 14–16
Ral_1, 13–15
Comments: *c.* 15 per cent. Lower jaw fragment. Cervical vertebrae and left arm.
Date: Post-medieval (seventeenth/eighteenth century).

Skeleton No. 28
Sex: Female
M
F Very gracile bones.
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 5 per cent. Right: rib fragments; collar bone; lower arm.
Date: Post-medieval (eighteenth century).

Skeleton No. 29
Sex: Female
M 1b.
F 1a?, d, e; 3c.
? 1c, g; 3a.
Age: 27–32
I 25–30
IV *c.* 30
Comments: *c.* 40 per cent. Upper torso present. Missing lower arms, hands, pelvis, legs and feet.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 30
Sex: Male
M 1a-e, g; 2a, d-g; 3a, c; 4a; 12a, b.
F
?
Age: 35–40
I 35–40
II 23–29
III 35–39
IV 30–40

Comments: *c*. 50 per cent. Incomplete skull and spine. Rather fragmentary lower legs, feet missing.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 31
Sex: Male
M 1a, b, c?, d?, e.
F
?
Age: 30–40
IV 30–40
Comments: Less than 5 per cent. Skull vault only.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 32
Sex: Female
M
F 5a; 6a; 7a.
?
Age: Grown
No ageing criteria available. Epiphyses fused.
Comments: *c*. 15 per cent. Left leg and feet.
Date: Post-medieval (sixteenth to seventeenth century).

Skeleton No. 33
Sex: Male
M 4b.
F
? 6a; 7a.
Age: Grown
No available ageing criteria. Epiphyses fused.
Comments: *c*. 20 per cent. Lower legs and distal right femur.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 34
Sex: Male
M 4a; 5a; 6a?
F
? 7a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c*. 20 per cent. Left hand and leg. Right lower leg and feet.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 35
Sex: Male
M 4b; 5a.
F
? 7a.
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c*. 10 per cent. Incomplete left leg and foot.
Date: Post-medieval.

Skeleton No. 36
Sex: Male
M 1a?, b, c?, d, e, g; 2a, g?; 4a; 5a; 10a?; 12b.
F 6a; 10b?; 12a.
? 3a, c; 7a; 11a.
Age: 30–40
I 30–35
III 40–44
IV 30–40
V 23–28
Comments: *c.* 80 per cent. Missing upper left arm, hand, sacrum and left upper leg.
Date: Post-medieval.

Skeleton No. 37
Sex: Male
M 2d??; 3a??; 4a, b; 5a; 9a; 11a; 12b.
F 9b.
? 2a; 9c; 12a.
Age: 22–27
III 25–29
V 19–27
iii *c.* 23–27
Comments: *c.* 60 per cent. Missing skull, upper spine, left upper torso, feet and lower legs.
Date: Post-medieval.

Skeleton No. 38
Sex: Male
M 4b.
F
? 2a.
Age: Grown
No ageing criteria available. Epiphyses fused.
Comments: *c.* 5 per cent. Lower arm and hand, fragment of sacrum and incomplete left upper leg.
Date: Post-medieval (eighteenth century).

Skeleton No. 39
Sex: Female
M 2a.
F 2b?; 3a, c; 4a; 10b; 12a, b.
? 10a; 11a.
Age: 30–35
III 30–34
V under 16
Comments: *c.* 50 per cent. Missing skull and upper spine, lower left arm, legs and feet.
Post-medieval (eighteenth century).

Skeleton No. 40
Sex: Male
M 1a–e, g; 3a?, c; 8a; 11a; 12b.
F
? 12a.

Age: 30–40
I 35–40
IV 30–35?
Comments: *c*. 30 per cent. Skull, upper spine and upper arms.
Date: Late medieval/Post-medieval.

Skeleton No. 41
Sex: Male
M 1c?, d, e; 3a, c; 8a; 11a; 12a-b.
F 1a?, b.
?
Age: 40–50
I 40
IV 40–50
Comments: *c*. 15 per cent. Skull, upper spine, right upper arm present.
Date: Post-medieval.

Skeleton No. 42
Sex: Female
M 1c?, e?; 4a?, b?
F 1a?, b, d, g; 3a, c?; 5a; 11a; 12a.
? 2a?, f?, g?; 6a?; 7a?
Age: 30–40
I 30–40
III 30–40?
IV about 30
Comments: *c*. 75 per cent. Missing ribs, upper left arm and right foot.
Date: Late medieval/Post-medieval.

Skeleton No. 43
Sex: Male
M 1d, g?; 3c; 11a?; 12b.
F 12a.
? 1e; 3a.
Age: 30–40
I *c*. 35
IV 30–40
Comments: *c*. 30 per cent. Fragmentary skull, incomplete spine, ribs and upper arms.
Date: Medieval (late thirteenth century to fifteenth century).

Skeleton No. 44
Sex: ?
Age: 5–7
i *c*. 5–6 years
ii RaL_1, 5–7 years
FeL_1, 5–7 years
T_1L_1, 6–8 years
Comments: *c*. 95 per cent. Skull fragmentary, spine incomplete, missing left foot.
Date: Late medieval/Post medieval.

Skeleton No. 45
Sex: Male
M 2a, d-g; 3a, c; 4a; 10a; 12a, b.
F

? 11a.
Age: 30–40
II 22–40
III 40–44
V 23–31
Comments: *c*. 60 per cent. Missing skull, cervical spine and most of legs.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 46
Sex: Female
M 1e?, f?
F 1a, b, d, g; 2a; 6a; 7a.
? 1c?
Age: 35–50
I *c*. 40
III 50–60?
IV under 35?
Comments: *c*. 50 per cent. Missing most of spine and ribs. Long bones present but fragmentary.
Date: Medieval (late fourteenth to fifteenth century).

Skeleton No. 47
Sex: ?
Age: 13–17
iii under 19 (by size of calcaneus and talus, 13–17 years).
Comments: Less than 5 per cent. Feet only.
Date: Medieval (late fourteenth to fifteenth century).

Skeleton No. 48
Sex: ?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: Less than 5 per cent. Left ulna and incomplete hand only.

Skeleton No. 49
Sex: Female
M
F 5a.
? 4a.
Age: Grown
No available ageing criteria. Epiphyses fused.
Comments: *c*. 10 per cent. Right leg and left upper leg.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 50
Sex: Male
M 4b; 5a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c*. 10 per cent. Right leg and lower left leg.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 51
Sex: Female?
M
F 2a?; 3c??
?
Age: Grown
No ageing criteria available. Epiphyses fused.
Comments: *c.* 10 per cent. Right arm and pelvis present.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 52
Sex: Male
M 5a.
F
?
Age: Grown
No ageing criteria. Epiphyses fused.
Comments: *c.* 10 per cent. Incomplete lower legs present.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 53
Sex: Male
M 1a, c-e, g; 2a, e?, f, g; 3a, c; 4a, b; 8a.
F
?
Age: 40–55
IV Elderly?
II Elderly
III 40–45
I 40–50
V 38–59
Comments: *c.* 90 per cent. Missing lower legs and feet.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 54
Sex: Female
M
F 2a, c, e, f, g?; 4a.
? 3c.
Age: 45–60
II 52–55
III 45–49
Comments: *c.* 50 per cent. Missing skull, cervical vertebrae, legs and feet.
Date: Medieval (late thirteenth to fifteenth century).

Skeleton No. 55
Sex: Female
M
F 3a.
?
Age: Grown
No available ageing criteria. Epiphyses fused.
Comments: *c.* 5 per cent. Right upper arm and rib fragments present.
Date: Early medieval (possibly Anglo-Saxon).

Skeleton No. 56
Sex: ?
Age: 6–7
i 6–7
ii HuL_1, 7–9 years
RaL_1, 6–8 years
FeL_1, 8–10 years
TiL_1, 7–9 years
Comments: *c.* 100 per cent. Spine not complete.
Date: Medieval.

Skeleton No. 57
Sex: ?
Age: 10–12
i 10–11 years
ii 11–14 years
Comments: *c.* 90 per cent. Missing right arm. Right upper leg fragmentary.
Date: Medieval.

Skeleton No. 58
Sex: Male
M 1a-g; 11a; 12b.
F
?
Age: 40–50
i *c.* 50
iv under 30
Comments: *c.* 15 per cent. Skull, most of spine, right upper arm present.
Date: Medieval.

Skeleton No. 59
Sex: Male?
M 1g; 12b.
F 12a.
? 11a.
Age: 30–40
I 30–40
Comments: *c.* 15 per cent. Mandible, upper spine, upper arms present.
Date: Medieval.

Skeleton No. 60
Sex: Male
M 2a, e-g; 3a; 4a, b; 5a; 6a; 7a; 9b; 12b.
F
? 2d; 3c; 9a, c; 12a.
Age: 20–30
II 22–40
III 20–24
Comments: *c.* 80 per cent. Missing skull and upper spine.
Date: Medieval (*c.* 1250).

Skeleton No. 61
Sex:

Age: 4–5
ii FeL$_1$, 4–5 years
TiL$_1$, 4–5 years
Comments: *c.* 30 per cent. Left: shoulder blade, ribs, pelvis, leg. Right: lower leg.
Date: Medieval.

Skeleton No. 62
Sex: Female
M
F
2a, c-f, g; 4b; 5a; 6a; 9a.
? 2b; 4a; 7a; 9b, c.
Age: 30–40
II 30–47
III 35–39
V under 20
Comments:
[*c.* 60 per cent. Missing skull, most of spine, shoulders and upper arms.]
Date: Medieval (*c.* 1250).

Skeleton No. 63
Sex: ?
Age: 18–24 months
i 18–24 months
ii FeL$_1$, 18–24 months
TiL$_1$, 18–24 months
Comments: *c.* 60 per cent. Missing skull, spine, hands, feet. Long bones all represented but incomplete.
Date: Medieval (late thirteenth to fifteenth century).

Note 1: Sexing

1. Cranium
   a. Arcus superciliaris
   b. Glabella
   c. Inclinatio frontale
   d. Processus mastiodeus
   e. Relief of the planum nuchale
   f. Ossae orbitae
   g. Os mandibula
   h. Discriminant function

2. Os coxae
   a. Incisura ischiadicum major
   b. Sulcus preauricularis
   c. Ventral arc
   d. Ischio pubic index
   e. Foramen obturatum
   f. Sub pubic angle
   g. Acetabulum diameter

3. Humerus
   - a. Vertical diameter of cuput ($HuHD_1$)
   - b. Transverse diameter of cuput ($HuHD_2$)
   - c. Epicondylar width (HuE_1)

4. Femur
   - a. Vertical diameter of caput ($FeHD_1$)
   - b. Bicondylar width (FeE_1)

5. Tibia
   - a. Proximal bicondylar width

6. Calcaneus
   - a. Maximum length (CaL_1)

7. Talus
   - a. Maximum length (TaL_1)

8. Atlas
   - a. Maximum length

9. Sacrum
   - a. Length/Breadth index
   - b. Corpus/Alae index

10. Sternum
    - a. Corpus length
    - b. Manubrium/Corpus index

11. Clavicle
    - a. Maximum length (ClL_1)

12. Scapula
    - a. Glenoid fossa height (ScLg)
    - b. Glenoid fossa width (ScBg)

The sources

1. a-g. Ferembach *et al.* 1980.
   h. Giles 1964; Giles and Elliot 1963.

2. a, e. Ferembach *et al.* 1980.
   b-c, f. Phenice 1969.
   d. Bass 1987, 193; M under 90, F over 95.
   g. Dutra 1944; M 52 mm. (av.), F 46 mm. (av.).

3. a, b. Dwight 1905;
   a. M 48.76 mm. (av.), F 42.67 mm. (av.).
   b. M 44.66 mm. (av.), F 36.98 mm. (av.).
   c. Thieme and Schull 1957; M 63.89 mm. (av.), F 56.76 mm. (av.).
4. a, b. Pearson and Bell 1919;
   a. M 45.5 mm. (av.), F 41.5 mm. (av.).
   b. M 78 mm. (av.), F 72 mm. (av.).

5. a. Dutra 1944; M over 71 mm., F under 71 mm.

6. a. Steele 1976; M over 81.1 mm., F under 75.5 mm.

7. a. Steele 1976; M over 55.3 mm., F under 49.7 mm.

8. a. Martin 1928, 1083; M 74–90 mm., F 65–76 mm.

9. a. Bass 1987, 107; M under 102.9, F over 112.4.
   b. Flander 1978; M 40.78–50.06, F 36.49–42.79.
   c. Fawcett 1938; M 37.606–54.910, F 33.770–49.506.

10. a. Jit *el al.* 1980; M over 95 mm., F under 74 mm.
    b. Martin 1928, 1090; M 46.2, F 54.3.

11. a. Parsons 1916; M 152 mm. dex av. (range 130–180 mm.), F 137 mm. dex av. (range 125–165 mm.).

12. a, b. Bainbridge and Tarazaga 1956;
    a. M 43.7 mm. (av.), F 42.6 mm. (av.).
    b. M 27.5 mm. (av.), F 26.0 mm. (av.).

Note 2: Ageing

Adult

I. Teeth: Dental attrition (Brothwell 1981, Fig. 3.9).
II. Pelvis: Pubic symphysis (Ubeleker 1978, 55–59).
III. Pelvis: Sacro-iliac auricular surface (Lovejoy *et al.* 1985).
IV. Skull: Suture closure (Cornwall 1974, Fig. 55).
V. Ribs: Sternal end morphology (Isçan *et al.* 1984; 1985).

Sub-adult

i. Dental development (Ubeleker 1978, Fig. 62).
ii. Long bone length (Ferembach *et al.* 1980).
iii. Epiphyseal fusion (Ferembach *et al.* 1980).

APPENDIX B

Adult skeletons by sex and age

Skeleton No.	Age	Stature	Palaeopathology
Male: Young Adult			
6	22–27	1.69	
13	17–24	–	Schmorl's nodes.
15	21–28	–	
37	22–27	1.71	R ulna marked sulcus for insertion of pronator quadratus.
60	20–30	1.78	

Male: Adult

22	25–35	1.62	Spinal DJD and osteophytes.
24	28–35	–	Spinal DJD, osteophytes and Schmorl's nodes.
30	35–40	1.75	Osteophytic outgrowths: both shoulders. Slight cranial porosis.
31	30–40	–	Healed weapon injury to R frontal bone.
36	30–40	1.60	Schmorl's nodes.
40	30–40	1.73	Spinal osteophytes, Schmorl's nodes.
43*	30–40	1.68	DJD R acromio-clavicular joint. Schmorl's nodes.
45*	30–40	1.76	Spinal DJD (minor).
59	30–40	–	Spinal DJD.

Male: Mature

41	40–50	1.79	
53	40–55	1.80	DJD. Both clavicles and L hand. Advanced spinal DJD. Infection of R tibia and fibula. Collapsed TV4 (fracture). Trauma-healed sword cut to L parietal.
58	40–50	–	DJD R acromio-clavicular joint. Spinal DJD and osteophytes.

Male: Grown

7	?	1.68	L calcaneo-cuboid, osteophyte on lateral aspect.
8	?	1.68	
10	?	–	
14	?	1.64+	
19	?	1.75	
25	?	1.65	
26	?	1.72	
33	?	1.64	Infection R and L tibiae.
34	?	1.71	
35	?	1.70	
38	?	1.72	
50	?	–	
52	?	–	Marked roughening of L linea aspera.

Female: Young adult

11	20–25	1.61+	Very slight cranial porosis.
20	22–27	1.62	Spinal DJD.

Female: Adult

1	35–40	1.55	Spine: DJD and osteophytes. DJD: L clavicle (proximal and distal); L shoulder; both knees; feet (cuneiform II/III). Infection of R tibia and fibula.
16	30–40	–	Spinal osteophytes.
18	30–40	1.61	
29*	27–32	1.67	
39	30–35	1.56	Spinal DJD and osteophytes.
42	30–40	1.61	
62	30–40	–	Very gracile, lightweight bones. Marked curvature of sacrum.

Female: Mature

9	40–50	1.53	Spinal DJD, advanced osteophytes. DJD of L elbow.
46	35–50	1.54	Spinal DJD. Neoplasm: Meningiomatous hyperostosis.
54*	45–60	1.65	Marked spinal DJD. DJD of L sterno-clavicular joint. Trauma: L ulna un-united fracture.

Female: Grown

5	?	1.63
23	?	1.51
28	?	–
32	?	1.51
49	?	1.57
51	?	1.70
55	?	–

Sex unknown

3	?	–
12	?	–
48	?	–

* = cist burial
\+ = stature calculated from metacarpal length.

APPENDIX C

Sub-adult skeletons by sex and age

Skeleton No.	Age
Infans I	
4	2–4 months
Infans II	
61	4–5 years
63	18 months–2 years
Infans III	
21	8–10 years
44	5–7 years
56	6–7 years
57	10–12 years
Juvenile	
27	12–14 years
47	13–17 years

APPENDIX D

Post-cranial indices

1a	R			L		
	Avg.	Range	No.	Avg.	Range	No.
Male	27.7	23.9–31.6	(8)	26.6	24.2–28.9	(4)
Female	24.8	24.8–28.1	(3)	25.3	24.6–26.4	(3)
All	27.3		(11)	26.1		(7)

1 Clavicle

a Robusticity: $\frac{\text{mid-shaft circumference} \times 100}{\text{max. length}}$

2a	R			L		
	Avg.	Range	No.	Avg.	Range	No.
Male	31.7	68.2–87.7	(12)	79.1	71.4–89.9	(8)
Female	75.6	66.7–80.3	(6)	77.5	66.2–83.3	(8)
All	78.6		(18)	78.3		(16)
2b						
Male	13.4	11.8–15.4	(10)	13.0	12.9–13.8	(5)
Female	12.2	11.8–13.0	(4)	12.6	11.3–14.0	(6)
All	13.1		(14)	12.8		(11)

2 Humerus

a Platybrachia: $\frac{\text{minimum mid-shaft } (HuD_2) \times 100}{\text{maximum mid-shaft diameters } (HuD_1)}$

b Robusticity: $\frac{(HuD_1 + HuD_2) \times 100}{\text{maximum length } (HuL_1)}$

3a	R			L		
	Avg.	Range	No.	Avg.	Range	No.
Male	87.1	69.3–95.7	(9)	84.7	74.1–90.8	(10)
Female	86.9	78.4–107.0	(9)	87.4	77.4–107.0	(10)
All	87.0		(18)			
3b						
Male	106.2	89.9–120.0	(10)	102.0	89.1–113.1	(10)
Female	109.4	95.3–120.0	(8)	106.9	83.0–133.2	(10)
All	107.6		(18)	104.5		(20)
3c						
Male	13.6	12.7–14.8	(4)	13.5	12.6–15.3	(5)
Female	13.1	11.6–15.1	(6)	12.7	11.8–13.7	(3)
All	13.3		(10)	13.1		(8)

3 Femur

a Meric: $\frac{\text{sub-trochanteric antero-posterior diameter } (FeD_1) \times 100}{\text{sub-trochanteric transverse diameter } (FeD_2)}$

Platymeric : under 85
Eurymeric : over 85 under 100
Stenomeric : over 100

b Pilasteric: $\frac{\text{mid shaft antero-posterior diameter } (FeD_3) \times 100}{\text{mid shaft transverse diameter } (FeD_4)}$

c Robusticity: $\frac{(FeD_3 + FeD_4) \times 100}{\text{oblique length } (FeL_2)}$

4a	R			L		
	Avg.	Range	No.	Avg.	Range	No.
Male	73.2	66.6–84.4	(12)	68.4	52.1–82.6	(9)
Female	73.6	60.8–81.3	(8)	72.0	57.4–79.2	(8)
All	73.4		(20)	70.1		(17)

4 Tibia

a Cnemic: $\frac{\text{nutrient foramen transverse diameter } (TiD_2) \times 100}{\text{nutrient foramen antero-posterior diameter } (TiD_1)}$

Platycnemic : under 63
Mesocnemic : over 63 under 70
Eurycnemic : over 70

APPENDIX E

The Rochester Cathedral Chalice

Julie Lovett

The Rochester chalice (Fig. 4, Pl. IX) was found placed in the left hand of SK 33, a burial only partially excavated since it extended beyond the excavation area into the section. The chalice was unfortunately in very poor condition; being distorted and fragmented it has proved difficult to visualize in its complete form and, therefore, comparison with other known examples is limited. At the time of writing parallels are still being sought, and I am grateful to John Cherry (British Museum) and Marion Campbell (Victoria and Albert Museum) for their comments and for drawing my attention to several helpful articles. Research is continuing, and for this reason it is considered wise to publish only a summary description at this time and leave full discussion for future publication.

The base of the chalice is circular and hollow, rising to a hollow stem. Around the shoulder there is a shallow moulding surmounted by a slight groove. The base and bowl were discovered detached from the stem, and there is a shallow moulding below and above the slightly rounded knop which is directly under the base of the bowl. There is some doubt as to the actual shape of the bowl, due to distortion, but it is thought likely (Marion Campbell, pers. comm.) to be of the wide shallow type (with everted rim) such as those examples from graves 3 and 4 of the vestibule graves at Lincoln (Bruce-Mitford 1976, 132–3).

The thickness of the metal indicates that the chalice was originally cast, but due to its poor condition it is impossible to say in how many pieces.

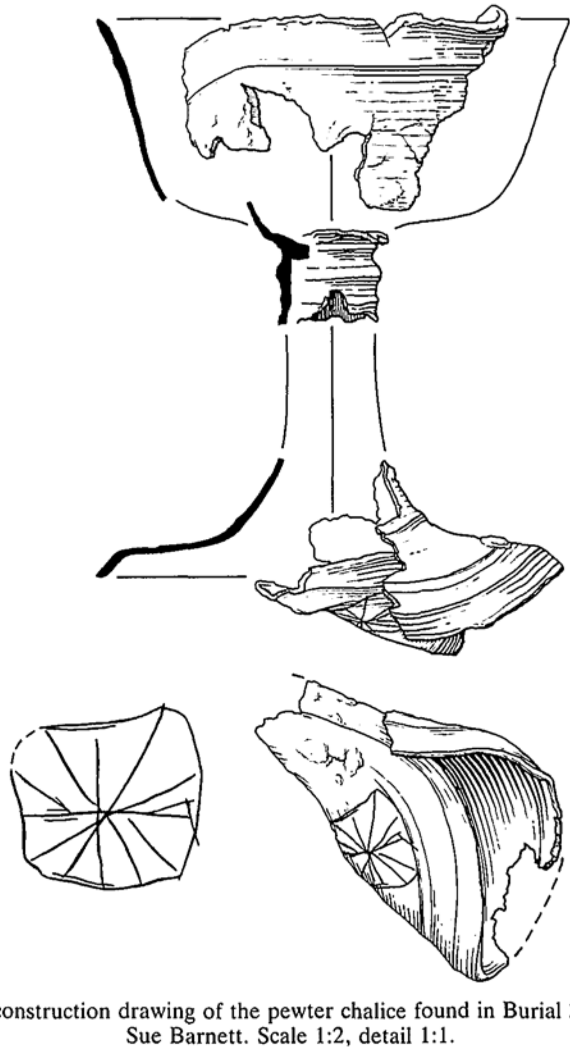

Fig. 4. Reconstruction drawing of the pewter chalice found in Burial 33. Drawn by Sue Barnett. Scale 1:2, detail 1:1.

Radial crossed lines within a possible square have been roughly scratched onto the foot of the chalice. This is not a maker's mark, which tends to be stamped, nor does it appear to be a cross which would have indicated the side the priest should use (Webb 1986, 352–62). Perhaps it is most feasible to explain this 'engraving' as the owner's mark.

The context of the find is not closely dated. At present it is only possible to suggest a lower date of the thirteenth century (based on the similarity of knop and possibly the bowl form to the previously cited examples) and an upper date of the mid sixteenth century. It is known that (in England) the placement of chalices in graves took place up to and no later than this date.

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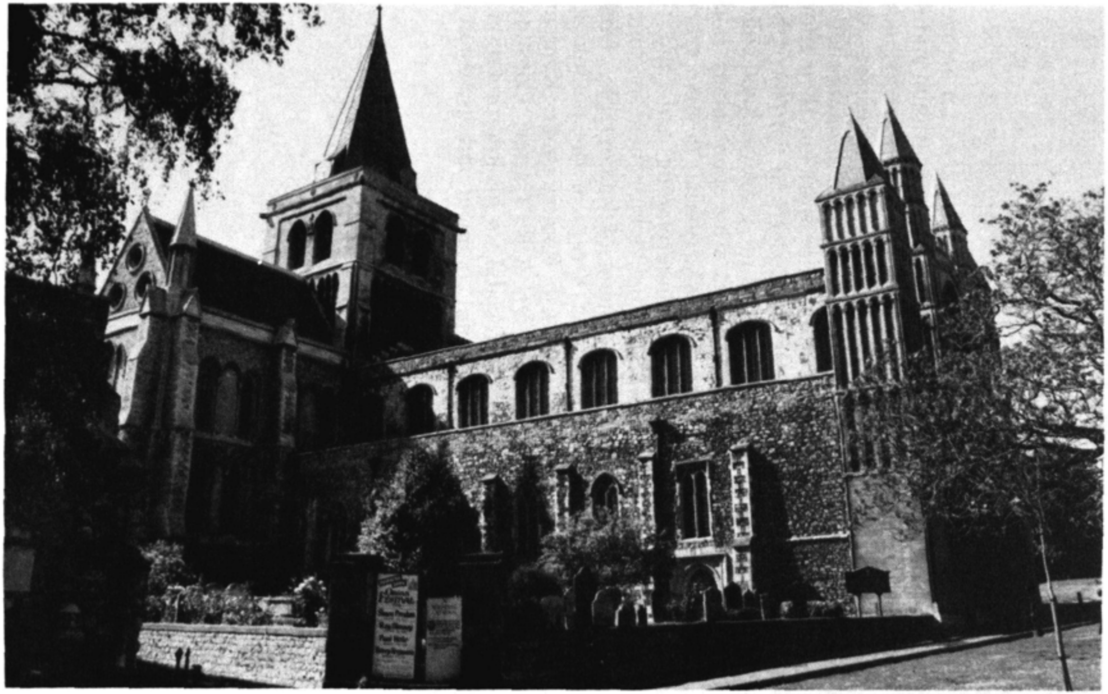
PLATE I



General view of the cemetery, looking south.

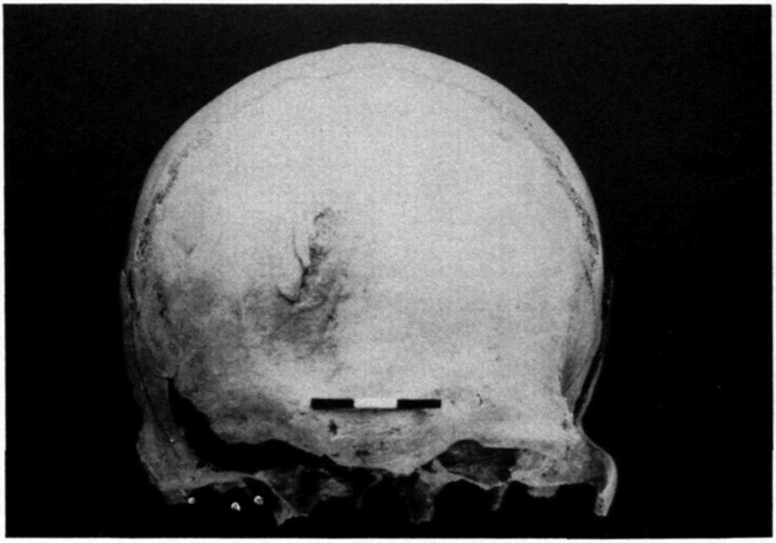
PLATE II

Cist burials 46, 53. Scale 1 m.

PLATE III

SK 1 left foot: proximal articulation of the metatarsals (note the degenerative changes of metatarsal III). Scale in centimetres.

PLATE IV



SK 31 skull: healed weapon injury to right frontal bone. Scale in centimetres.

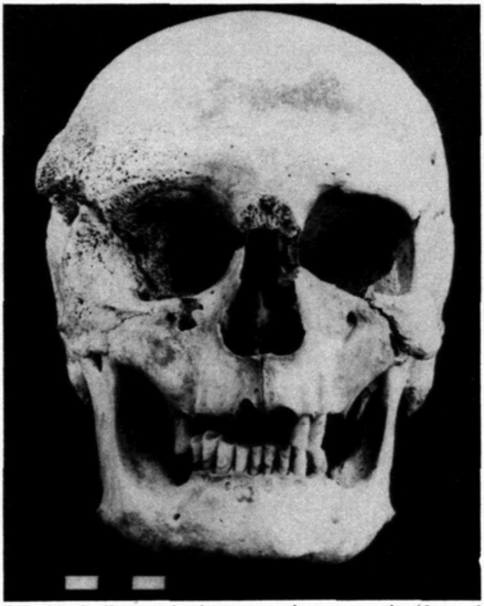
PLATE V

SK 31 skull: detail of Plate IV. Scale in centimetres.

PLATE VI

SK 53 skull: healed sword(?) injury to left parietal bone.

PLATE VII

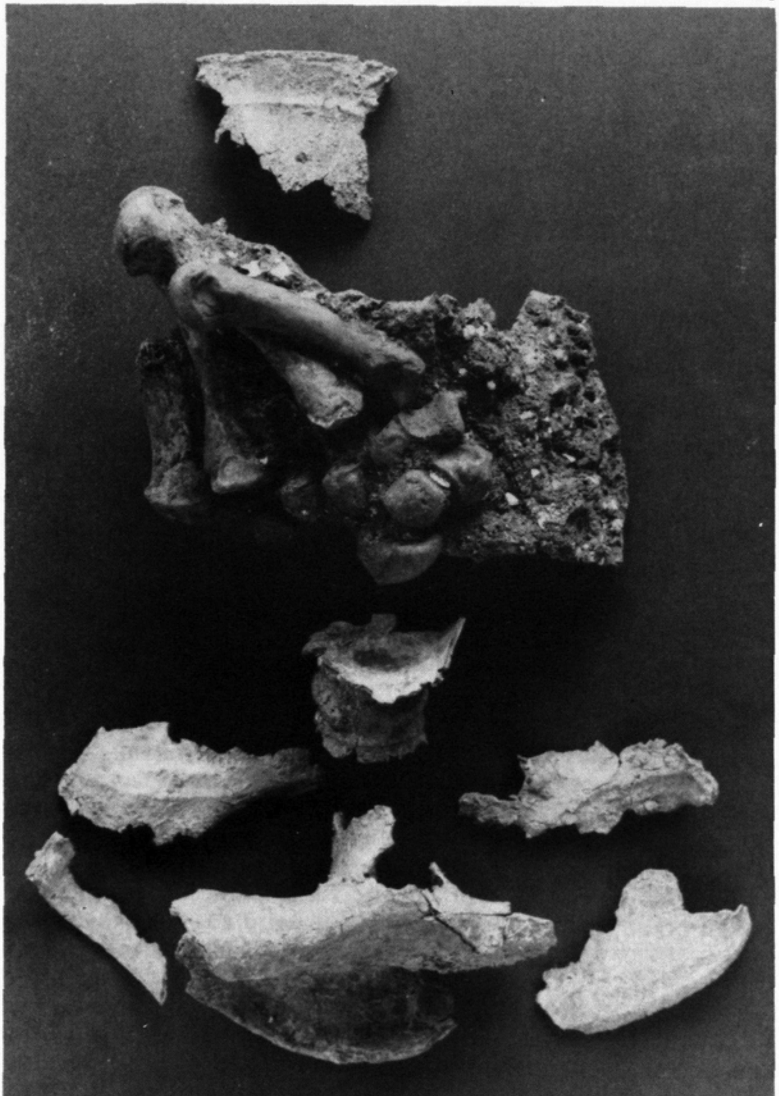


SK 46 skull: meningiomatous hyperostosis (frontal view). Scale in centimetres.

PLATE VIII

SK 46 skull: detail of Pl. VII.

PLATE IX



Fragmented pewter chalice with attached finger bones.