Human Bone

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Introduction

Human remains were excavated from a total of 14 contexts at four sites along the length of the pipeline. A single, Middle Bronze Age cremation burial was recovered from Site 2. A group of three prehistoric inhumation graves were excavated from Site 3. Four of the five inhumation burials from Site 5 had been made within the fill of a ditch (6111) and may have been Late Iron Age/early Romano-British in date. Following completion of the excavations one other, possibly Iron Age, burial was found during machining on the southern margins of Site 5. Redeposited bone from one pit (6207) and the fills of two ditches (6152 and 6165) may be late prehistoric/early Romano-British. A medieval burial had been made in the upper fill of ditch 6011 at the west end of Site 5, adjacent to the road. The remains of a single prehistoric burial were found at the west end of Site 6.

Methods

Analysis of the cremated bone followed the writer's standard procedure (McKinley 1994a, 5-21; 2000a). Age (cremated and unburnt bone) was assessed from the stage of skeletal and tooth development (Beek 1983; McMinn and Hutchings 1985), and the patterns and degree of age-related changes to the bone (Brothwell 1972; Buikstra and Ubelaker 1994). Sex was ascertained from the sexually dimorphic traits of the skeleton (Bass 1987; Buikstra and Ubelaker 1994). Stature was estimated in accordance with Trotter and Gleser (1952 and 1958). Cranial index was calculated according with Brothwell (1972, 88). Platymeric (degree of anterior-posterior flattening of the proximal femur) and platycnemic (meso-lateral flattening of the tibia) indices were calculated according with Bass (1987). The degree of erosion to the bone was recorded using the writers system of grading (McKinley 2004, fig. 10).

Results

A summary of the results from analysis is presented in Table HB1. Full details are in the archive.

Disturbance and condition

The urned cremation burial had been disturbed in antiquity, the vessel being smashed and the contents distributed throughout the fill; since the grave survived to a depth of 0.20m this must have been by some action other than truncation due to ploughing alone. The inhumation graves survived to varying depths ranging from 0.15m to 0.55m, those on Site 3 generally being shallower than those on Site 5. The effects of extensive plough damage is illustrated by the low levels of skeletal recovery from the two shallowest graves on Site 3 (contexts 3117 and 3127; Table HB1). One of the inhumation burials – 6141 – was obviously substantially disturbed in antiquity leaving only part of the articulated right foot *in situ*; though it is also possible that the articulated foot was redeposited in the base of the ditch.

The cremated bone appears to be in good condition, and includes both trabecular and compact bone. Most of the unburnt bone was fairly heavily eroded as a result of root action

(3-4), with that from Site 3 showing consistently higher levels of erosion (4-5) than that from Sites 5 and 6 (0-5), probably reflecting variations in grave depth as discussed above. Three of the four Late Iron Age/early Romano-British deposits from the ditch 6111 on Site 5 were well preserved (0-1) and one moderately well preserved (2-3), suggesting a slight variation in the burial environment since the surviving depth does not appear to have been a factor. The difference between the burials in ditch 6111 and others is further reflected in the percentage skeletal recovery which was generally higher from the former undisturbed burials (96-98%; Table HB1) than from the other undisturbed inhumation burials (46-47%). All the inhumed bone showed varying degrees of dark brown patchy staining, possibly indicative of fungal activity.

Demographic data
Eleven individuals were identified from the remains of the burials including one cremated and ten unburnt. The remains of a minimum of two other individuals are represented amongst the disarticulated and redeposited bone. The assemblage contains no infants or juveniles, all except three of those identified being adults and including a minimum six females and four males (Table HB1).

The temporal range spans the prehistoric to the medieval and the dating of individual burials is frequently imprecise. The one cremation burial – apparently made in an area between two ring ditches on Site 2 – is dated to the Middle Bronze Age. Both here and at the other Sites, the nature of the excavation – a narrow, 8m strip crossing the landscape – will have influenced our view of the density of mortuary deposits. This fact, together with the questionable and broad span of much of the dating render any demographic discussion difficult and to a large extent inappropriate. The three prehistoric burials made in the area of Site 3 were all of adult females, including two young individuals and one mature, but other burials of males and females may exist beyond the confined limits of the excavation. Similarly at Site 5, where most of the burials appear to have been made in the late prehistoric or early Roman period, it is likely that the adult females were not as alone as they may appear, other burials probably lying in the ditch fill to the north and south. The single excavated medieval burial is noteworthy given its position; it may represent a genuine singleton having, as it does, the appearance of a clandestine grave.

Skeletal Indices
It was possible to estimate the stature for three individuals from the Site 5 ?Late Iron Age/early Romano-British group; two females at between 1.50-1.58m and one subadult (i.e. not fully grown) male at 1.73m. The cranial index of the same three individuals was calculated (Table HB1), the two females both being mesocranial and the male dolichocranial (long-headed). The platymeric index was calculated for eight individuals (range 69.7-93.8), most falling into the platymeric range with three in the eurymeric range. The platycnemic index was calculated for six individuals (range 62.3-66.9), most falling in the mesocnemic range and two in the platycnemic range. There were no evident distribution patterns within the various indices in relationship to location or apparent phase; there is no indication of a particular close homogeneity within or between groups of individuals. The lack of reliable dating evidence, potential broad temporal range and the fact that these small groups probably represent only a small part of the 'cemetery population' renders further discussion inappropriate.

One point of interest is that two of the ?Late Iron Age/early Romano-British females from Site 5 (6109 and 6145) had some pelvic traits (i.e. narrow hips) which would normally be associated with males; they also had very similar cranial indices and the same platymeric index. Taken together these observations suggest at least a broad genetic link between the two.

Where morphological evidence survived, most of the individuals (prehistoric, Iron Age/Roman and medieval) have strong muscle attachments in the upper limb bones (3039, 6109, 6119, 6143 especially deltoid and pectoral attachments), three have strong supinator attachments (3039, 6143 and 6145) and one strong pronator attachments (6109) in the forearm, and one with strong attachments for the muscles of the thumb (6145). Only the prehistoric 3039 has noticeably strong attachments for the hip and thigh muscles. The strength of the various muscle attachments reflect the everyday stresses to which the individuals were exposed; the activities in which the prehistoric individual 3039 engaged clearly involved all-round body strength with a highly mobile aspect. The other individuals appear likely to have been engaged in more static activities primarily involving upper body strength.

Pathology

Pathological lesions were observed in the unburnt remains of eight individuals and in the cremated remains (Table HB1).

Dental lesions were observed in all seven surviving dentitions including three male and five female. Due to the small size of the assemblage and insecurity of dating, the rates given are for the assemblage as a whole. Dental calculus (calcified plaque/tartar) harbours bacteria which predispose to periodontal disease and the development of dental caries. Slight-moderate (Brothwell 1972, fig. 58b) calculus deposits were noted in five dentitions, with moderate deposits in the single medieval dentition. Periodontal disease (gum infection) was observed in four of the same dentitions, being very slight in all except the medieval dentition where it was mild-medium in severity (Brothwell 1972, fig. 58a). Dental caries were recorded in four dentitions, including 6/160 (4%) of the fully erupted permanent teeth (6/70 female teeth, 9%). Lesions were moderate to severe, obscuring the origin of the lesion and were predominantly within the molar teeth though two premolars were affected. *Ante mortem* tooth loss had occurred in three dentitions, two female and one male, with an overall rate of 4% (6:148), 1% for the females and 3% for the male (medieval). Most loss was of molar teeth, probably as a result of dental disease, though the loss of two maxillary incisors from the medieval male 6143 may have been as a consequence of a blow (accidental or deliberate) to the face. A similar trauma is indicated by the chipped anterior tooth from 6145. Dental abscesses were see in two female dentitions, both with associated carious lesions, giving an overall rate 3% (7% for females). In both cases infection from the abscess had spread into the adjacent facial soft tissues leading to the formation of periosteal new bone on the underlying facial bones. The potential significance of variations between females and males (the usual higher caries rates in the former), different age groups and different phases (greater calculus and *ante mortem* tooth loss in the medieval dentition) is difficult to assess given the various factors outlined above.

Dental hypoplasia (a developmental defect in the tooth enamel formed in response to growth arrest in the immature individual) was observed in four dentitions (57%) including all three from the Site 5 ?Late Iron Age/early Romano-British group. Occurring in both female and male dentitions this may indicate nutritional stress amongst the group burying their dead in this place at this time (Hillson 1979). Slight porotic or cribotic *cribra orbitalia* (believed to result from a metabolic disorder connected with childhood iron deficiency anaemia; Robledo *et al* 1995) was observed in 3/6 orbits, including male and female, all individuals dated to the ?Late Iron Age/early Romano-British. This may lend support to the implied nutritional stress at this time.

Only one fracture was observed, a well-healed lesion in the distal half of the left ulna (1:13 ulnae) from 3039 (adult female). A fracture of this type is likely to have resulted from a direct blow and may represent a ‘parry’ fracture sustained whilst trying to ward-off a blow to the head.

Periosteal new bone (formed in response to infection of the periosteal membrane covering bone) was observed at nine sites in four individuals. The lesions in the hand and leg of 3039 may have formed in response to infection in the overlying soft tissues. Lesions in the dorsal surface of the scapula from 6145 probably had a similar cause. Lesions in the ventral surface of the ribs from 6143 may have been related to a pulmonary infection, but lesions were also observed in the dorsal surface of the same ribs and in the dorsal surface of the scapula which implies a more wide-spread involvement.

Smooth-margined destructive lesions in the right side of the C6 and T1 from 6145 are likely to have resulted from a tumour; given the position of the lesions it is likely that the lesions will have interfered with the *brachial plexus* (nerves to the upper limb) causing severe pain along the course of the nerves, and motor and sensory impairment (Adams 1986, 185). The cervical lesion is also likely to have put pressure on the arteries and veins within the transverse foramen.

Osteoarthritis is manifest by eburnation of the joint surface and/or pitting in association with osteophytes on joint surface margins; the aetiology is complicated including the effects of age, mechanical alteration through activity or injury and genetic predisposition (Rogers *et al* 1987; Rogers and Waldron 1995). Manifestations of the condition were noted in the remains of two adult females (3039 and 6145) with spinal lesions at five sites in each and extra-spinal lesions at one and three sites respectively. The highest rate was seen in the right temporo-mandibular joint (50% overall, 67% female), followed by the left shoulder (25%, 50% female), left temporo-mandibular (20%, 33% female), hip (12%, 25% female), cervical vertebrae (9%, 14% female), costo-vertebral (4.2%) and thoracic (2%, 3% female). Degenerative disc disease - a condition resulting from the breakdown of the intervertebral disc largely related to age and reflecting 'wear-and-tear' (Rogers and Waldron 1995) – was noted in two spines and 9% of vertebrae (16% of female); the highest rate was seen in the lumbar region (15%, 25% female), followed by the cervical (13%, 26% female) and thoracic (2%, 4% female). Schmorl’s nodes (destructive lesions resulting from a rupture in the intervertebral disc) were observed in three spines (7% vertebrae, 2% of female and 12% of male), with the highest rate in the first sacral (33%), followed by the lumbar (15%) and thoracic (6%). There were no lesions above T10.

Osteophytes (irregular growths of new bone along joint margins), pitting and other destructive lesions may develop in response to a number of conditions and it is not always possible to ascertain the specific cause of individual lesions (Rogers and Waldron 1995). The vast majority of these lesions were seen in joint surfaces and are most likely to represent the early stages of some form of joint disease. As with the aforementioned lesions it is not always possible to be conclusive with respect to the aetiology of exostoses, bony growths which may develop at tendon and ligament insertions on the bone. Causative factors include advancing age, traumatic stress, or various diseases.

Several miscellaneous pathological changes were observed in the remains of the adult female 6145. It is possible that the rarefied/porous appearance of the medial ends of the clavicles, both humeral heads and the superior portion of the ulnae olecranons may be related to the motor and sensory impairment to the upper limb resulting from the tumours suggested within the cervical/upper thoracic area of the spine. Fine or coarse-grained, granular new bone was observed in several areas of the axial skeleton (lateral sides of T8-12 vertebral bodies, anterior surfaces of the L1-3 and L5-S1 vertebral bodies, anterior surface of the manubrium and lateral/dorsal surface of one upper left rib) and upper limb (juxta-articular surfaces of the clavicles, humerus left lesser tubercle); the lesions had the appearance of a hyperostosis rather than a reaction to infection but a diagnosis is uncertain. The possible causes of the odd thin patches of smooth plaque-like new bone observed on the endocranial surface of the parietal and frontal vault are similarly inconclusive.

The various limiting factors regarding the size of the assemblage and dating make it difficult to draw any wide conclusions with respect to the health status and lifestyle of the individuals. The large number of pathological lesions observed in the adult female 6145 may in part reflect the advanced age of the individual or her predisposition to develop certain problems, seen in comparative isolation there are limits to the conclusions which can be drawn.

Variations in the skeletal morphology may, with other predisposing factors, indicate genetic relationships within a 'population', however there are problems with the uncertain heritability of traits (Berry and Berry 1967; Finnegan 1978.). Some traits have been attributed to developmental abnormalities, for instance, extra sutural ossicles or wormian bones (Brothwell 1972, 95-98), but the aetiology remains debatable.

Aspects of pyre technology and ritual

Although most of the cremated bone from the burial was white in colour indicative of full oxidation of the bone (Holden *et al.* 1995a and b), a substantial proportion of fragments from all skeletal areas showed variations from black (charred), through hues of blue and grey (incompletely oxidised). There is no discernible pattern of involvement dependant on side or skeletal element suggesting there was a general shortfall in the efficiency of cremation rather than some specific problem. This is likely to reflect a shortage in time and temperature, possibly related to insufficient fuel being used to construct the pyre, or to cremation being curtailed possibly due to adverse weather (i.e. rain). The levels of variability observed in this instance are in keeping with contemporaneous deposits elsewhere, for example at Simons Ground, Dorset (Hazzledine 1982), Shrewton, Wiltshire (Wells 1984) and Twyford Down, Hampshire (McKinley 2000b).

The quantity of bone recovered from the burial – 1023.2g – represents 64% of the average weight of bone from an adult cremation (McKinley 1993). The weight is within the upper range recovered from Bronze Age burials in general, and falls within the consistently high range of weights recovered from 'primary' Early-Middle Bronze Age burials (902-2747g, average 1525.7g; McKinley 1997). It has been suggested that the time and effort taken in collecting and burying such a substantial proportion of the bone in these deposits is reflective of the 'high regard' in which the individuals were held by their community.

The majority of the bone (52%) was recovered from the 10mm sieve fraction and the maximum fragment size is 68mm. There are a number of factors which may affect the size of cremated bone fragments (McKinley 1994b), in this instance, although the fragment sizes are within the average range, there is likely to have been increased fragmentation due to the disturbance clearly suffered by the buried remains. There is no evidence to suggest deliberate fragmentation of bone occurred prior to burial.

The burial included bone fragments from each of the four skeletal areas (skull, axial, upper limb and lower limb) and there is no suggestion of selection of specific elements for burial. The relatively common inclusion of small bone fragments – tooth roots, hand and foot bones – may be indicative of the mode of recovery of bone from the pyre site for burial; mass collection either via raking-off bone fragments or by winnowing would be more likely to lead to the easy recovery of such small bones than recovery of individual fragments by hand. It cannot, however, be conclusively stated that these specific elements were within the burial or from amongst the pyre debris. The grave fill contained fuel ash probably representative of redeposited pyre debris. Unfortunately, due to the disturbed nature of the deposit, the original position of this material in relationship to the burial itself could not be deduced. The inclusion of pyre debris in the fill of Bronze Age cremation graves is frequently observed (McKinley 1997), such depositions may be made before and/or subsequent to the burial. The presence of pyre debris indicates the close proximity of the pyre site to the place of burial.

Although the inclusion of small quantities of cremated animal bone, representing the remains of pyre goods, is relatively common in this period (McKinley 1997) in this instance the 0.3g of animal rib may be fortuitous.

Human skeletal material of various dates – prehistoric to medieval but mostly Iron Age or Romano-British – has been observed/recovered from lone graves or small groups of graves in the vicinity of Old Sarum and to either side of the adjacent south-western ridge Without more secure dating of both the remains from these investigations and the earlier ones, comparisons between the skeletal material would be of limited value since homogeneity or lack of it between contemporary groups and the potential for temporal variation could not be made with any confidence.

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Table HB1 Summary of results from analysis human bone

Context	*Phase*	*Deposit type*	*Quantification*		*Skeletal indices*	*Age (approx.)/sex*	*Pathology summary*
			weight (crem.)	*% skel. rec./ skel. elem.*			
Site 2							
2120	MBA	urned cremation burial	1023.2 g	-	-	adult 35-50 yr. male	osteophytes – axis; pitting – medial clavicle; exostoses - patella
Site 3							
3039	preh.	inh. burial	-	68%	platymeric (69.7) mesocnemic (67.2)	adult 35-50 yr. female	*am*tl; caries; abscess; calculus; pnb – left maxilla, right ?4th metacarpal shaft, left tibia and fibula; cyst – right distal ulna; solitary bone cysts – left lunate, left capitate; healed fracture – left distal ulna; osteophytes – C1-2, right 1st Metacarpal-P; osteoarthritis - 2C, right temporo-mandibular, right hip; ddd – 4Cmv – wormian bones
3117	preh.	inh. burial	-	20% (a.u.l.)	platymeric (76.4)	adult 20-30 yr. female	
3127	preh.	inh. burial	-	5% (a.u.l.)	-	adult 20-35 yr. female	caries; exostoses – left proximal humerus
Site 5							
6109	?LIA/ERB	inh. burial	-	96%	1.50m (4ft 11in) mesocrany (76.4) eurymeric (86.4) platycnemic (60.4)	adult 20-25yr. ??female	calculus; hypoplasia; periodontal disease; infection – mandible, maxilla; pnb - left scapula; mv – impacted maxillary canine, bunning, extra sutural ossicles, L6 semi-sacralised, maxillary R I2 skewed & shovelled; accessory transverse foramen C4, C6-7
6119	?LIA/ERB	inh. burial	-	98%	1.73m (5ft 8in) dolichocrany (69.1) platymeric (75.6) mesocnemic (64.9)	subadult 16-18 yr. male	hypoplasia; calculus; periodontal disease; *cribra orbitalia*; Schmorl's node – L4-5, S1; infection – tali (calcaneal surfaces), 1st metatarsals proximal surfaces, 1st proximal foot phalanges proximal metaphyses & epiphyses; *spina bifida occulta*; mv - impacted right mandibular M3 left absent, maxillary right M3 pegged, nasal bone skewed to right, occipital bunning, atlas double superior facets
6124	?LIA/ERB	redep.	-	1 frag. (u.)		adult >18 yr. ??male	-
6141	?LIA/ERB	?inh. burial	-	1% (l.)	-	adult >18 yr. ?female	-

Context	*Phase*	*Deposit type*	*Quantification* *weight (crem.)*	*% skel. rec./ skel. elem.*	*Skeletal indices*	*Age (approx.)/sex*	*Pathology summary*
6143	medieval	inh. burial	-	46%	eurymeric (85.7)	adult >40 yr. male	calculus; *am*tl; caries; periodontal disease; pnb – min. 1 right & 1 left rib, right scapula; slight collapse cervical bodies; osteophytes – C1, C2; Schmorl's node – T10, 1T; exostoses – left distal radius; pitting – C2, 1T; mv – maxillary enamel pearl, mandibular M3 5-cusp, overcrowding anterior mandibular teeth with slight rotation and overlapping
6145	?LIA/ERB	inh. burial	-	97%	1.58m (5ft 2in) mesocrany (75.7) eurymeric (93.8) mesocnemic (64.6)	adult >35 yr. ?female	*am*tl; caries; abscesses; hypoplasia; calculus; trauma – chipped left maxillary I1; *cribra orbitalia*; osteoma; pnb – right mandible, dorsal surface right scapula; granular new bone – T8-12 lateral bodies, L1-3, L5 & S1 anterior surfaces, manubrium anterior surfaces, 1 left rib, clavicles, left lesser tubercle; rarefied/porous bone – clavicles, humeral heads, proximal ulnae; plaque-like new bone – endocranial parietal and frontal; pitting – right proximal humerus; destructive lesion – C6 & T1 (tumour), right distal humerus; exostoses – proximal ulnae, palmar margins phalanges, patellae; osteoarthritis – C1-2, T2, 11-12th costo-vertebral , bi-lateral temporo-mandibular, left shoulder; Schmorl's node – L2; ddd – L1; pitting – C3, T5-6 & L3-4 articular processes, T1 rib facets, min. 4 left & 4 right ribs; osteophytes – left hip, right knee, min. 4 left & 4 right ribs, T3 articular process, T3-9 & L1, L3-5 body surface margins; mv – congenital absence maxillary & left mandibular M3, occipital bunning
6166	?IA/RB	redep.	-	2 frags. (s.)	-	subadult 12-18 yr.	-
6167	?	redep.	-	1 frag. (l.)	-	adult >18 yr.	exostoses – tibia shaft
6320	??IA	inh. burial	-	10%	platymeric (80) mesocnemic (65.9)	adult 30-40 yr. ?	*cribra orbitalia*; osteophytes – right distal IP joint (foot)
Site 6							
8166	preh.	inh. burial	-	47%	platymeric (71.3) platycnemic (59.2)	subadult 13-16 yr. ??male	calculus; hypoplasia; periodontal disease; mv – maxillary left M3 pegged, rest M3 absent

KEY: amtl = *ante mortem* tooth loss; pnb = periosteal new bone; mv = morphological variation; ddd = degenerative disc disease