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FULL ANALYSIS OF HUMAN REMAINS FROM FIELD 163E OF THE A1 WIDENING SCHEME

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Introduction

During excavations in September 2016 in Field 163E of the A1 Leeming to Barton Joint Venture for widening of the A1, a single inhumation was identified. Previous investigations within a different area of the same field had identified an extensive Roman/post-Roman cemetery, with which this inhumation is likely associated. Additional fragments of burnt and unburnt animal bone were also recovered from the grave fill, as well as an additional developing human tooth (see below). This document presents the objectives, methods and results of the analysis of the articulated skeletal remains.

Objectives

The skeletal assessment aimed to determine age and sex, as well as any manifestations of disease from which the individual may have suffered.

Methodology

The skeleton was analysed in detail, assessing the preservation and completeness, as well as determining the age, sex and stature of the individual. All pathological lesions were recorded and described. A summary of the osteological and palaeopathological data for the inhumation burial is given in Table 1.

Osteological Analysis

Skeletal preservation depends upon a number of factors, including the age and sex of the individual as well as the size, shape and robusticity of the bone. Burial environment, post-depositional disturbance and treatment following excavation can also have a considerable impact on bone condition. Preservation of human remains is assessed subjectively, depending on the severity of bone surface erosion and post-mortem breaks, but disregarding completeness.

Preservation was assessed using a grading system of five categories: very poor, poor, moderate, good and excellent. Excellent preservation implied no bone erosion and very few or no post-depositional breaks, whereas very poor preservation indicated complete or almost complete loss of the bone surface due to erosion and severe fragmentation.

Skeleton 13592 was moderately fragmented, but the surface preservation was very poor, with complete loss of detail on the surviving long bones. Only 30% of the skeleton had been preserved, with only the cranium, dentition, and long bones, and a few small bones of the feet present.

A count of the 'minimum number of individuals' (MNI) recovered from a cemetery is carried out as standard procedure during osteological assessments of inhumations in order to establish how many individuals were represented by the articulated and disarticulated human bones (without taking the archaeologically defined graves into account). The MNI is calculated by counting all long bone ends, as well as other larger skeletal elements, such as the hip joints and cranial elements.

A minimum of two individuals were present within Field 163E, based on the presence of two left upper third molars. One of these teeth was *in situ* within the left maxilla of Skeleton 13592, and the other tooth was a loose developing crown recovered from the grave fill. As the crown had not yet completed development, it was unlikely to have belonged to Skeleton 13592, so may have just been residual within the soil, as no other additional human bone fragments were identified.

Age was determined using standard ageing techniques, as specified in Scheuer and Black (2000a; 2000b) and Cox (2000). Age estimation relies on the presence of the pelvis and uses different stages of bone development and degeneration in order to calculate the age of an individual (Lovejoy et al 1985; Meindl and Lovejoy 1989). Age is split into a number of categories, from foetus (up to 40 weeks in *utero*), neonate (around the time of birth), infant (newborn to one year), juvenile (1-12 years), adolescent (13-17 years), young adult (ya; 18-25 years), young middle adult (yma; 26-35 years), old middle adult (oma; 36-45 years), mature adult (ma; 46+) to adult (an individual whose age could not be determined more accurately as over the age of seventeen).

The poor preservation of Skeleton 13592 meant that the pelvis was not present for analysis; therefore age estimation was based solely on dental wear, which is a much less reliable indicator of age. While dental wear was suggestive of this individual being aged between 26 to 35 years of age (young middle adult), it may be more appropriate to refer to them as "Adult" (18+ years of age).

Sex determination is usually carried out using standard osteological techniques, such as those described by Mays and Cox (2000). Assessment of sex in both males and females relies on the preservation of the skull and the pelvis and can only be carried out once sexual characteristics have developed, during late puberty and early adulthood.Based on cranial morphology, it was determined that Skeleton 13592 was possibly female. However, this is tentative, as due to poor preservation only a small number of cranial criteria were present for observation.

Stature depends on two main factors, heredity and environment; it can also fluctuate between chronological periods. Stature can only be established in skeletons if at least one complete and fully fused long bone is present, but preferably using the combined femur and tibia. Knowing the sex of the individual is also necessary, which is an issue with disarticulated long bones where sex cannot be determined. The bone is measured on an osteometric board, and stature is then calculated using a regression formula developed upon individuals of known stature (Trotter 1970). Where possible, bones from the legs were used in preference to those of the upper limb as these carry the lowest error margin (*ibid*). Stature could not be estimated for Skeleton 13592 (young middle adult possible female?), as all of the long bones present were fragmented.

Non-metric traits are additional sutures, facets, bony processes, canals and foramina, which occur in a minority of skeletons and are believed to suggest hereditary affiliation between skeletons (Saunders 1989). The origins of non-metric traits have been extensively discussed in the osteological literature and it is now thought that while most non-metric traits have genetic origins, some can be produced by factors such as mechanical stress (Kennedy 1989) or environment (Trinkhaus 1978). Skeleton 13592 (young middle adult possible female?) had bilateral bridging of the supraorbital notch, and an accessory supraorbital foramen above the right orbit.

Pathological Analysis

The analysis of skeletal and dental manifestations of disease can provide a vital insight into the health and diet of past populations, as well as their living conditions and occupations. A small number of pathological changes were seenSkeleton 13592 (young middle adult possible female?).

Cribra orbitalia, or fine pitting of the orbital roof, tends to develop during childhood, and often recedes during adolescence or early adulthood. Until recently, it was thought to be related to iron deficiency anaemia, a condition with complex causes linked to the environment, hygiene and diet (Stuart-Macadam 1992). However, a recent study has suggested that other forms of anaemia are more likely causes (Walker *et al* 2009). These include megaloblastic anaemia, which results following a diet deficient in Vitamin B_{12} (found in animal products) and/ or folic acid, and haemolytic anaemia (e.g. sickle cell anaemia and thalassemia, found in areas of the Old World prone to malaria). It was also suggested that chronic infections and scurvy (Vitamin C deficiency) may have led to the development of *cribra orbitalia* in Europe (*ibid*). While the exact aetiology of this condition remains contentious (Oxenham and Cavill 2010), it is generally accepted that this pitting relates to unhygienic environments and/or dietary deficiency. *Cribra orbitalia* is commonly observed in archaeological populations, particularly associated with agricultural economies (Roberts and Cox 2003), and is often used as an indicator of general stress (Lewis 2000, Roberts and Manchester 2005). *Cribra orbitalia* was seen in the right orbit of Skeleton 13592 (young middle adult possible female?).

Sinusitis is characterised by the inflammation of the mucous membrane of the sinuses (cavities in the cheek bones). Acute sinusitis lasts between seven days and one month, but the condition is classed as chronic if it persists for more than three months (Merrett and Pfeiffer 2000, 304). If untreated, chronic sinusitis can persist for years and skeletal changes occur after a number of weeks. In modern groups, around 60% of patients with chronic sinusitis develop bone changes that are radiographically visible (Boocock *et al* 1995:484). Most commonly, the skeletal manifestations take the form of pitting or spicular bone formation on the floors of the sinuses. Symptoms include pain in the forehead, cheeks and eyes, together with fever and a general unwell feeling (Youngson 1992, 551). The quality of life and productivity can be greatly reduced for those suffering from sinusitis. Infection of the maxillary sinuses can result from upper respiratory tract infections, pollution, smoke, dust, allergies, or a dental abscess that has penetrated the floor of the sinus cavity (Roberts and Manchester 2005, 174-176). The left maxillary sinus of Skeleton 13592 (young middle adult possible female?) had nodules of lamellar bone formation, suggestive of sinusitis. The right maxilla was not present for observation.

Dental Health

Dental pathology was also noted on the dentition of Skeleton 13592 (young middle adult possible female?).They had eight tooth positions, and 31 teeth present for analysis.

If plaque is not removed from the teeth effectively (or on a regular basis) then it can mineralise and form concretions of calculus on the tooth crowns or roots (if these are exposed), along the line of the gums (Hillson 1996, 255-257). Mineralisation of plaque can also be common when the diet is high in protein (Roberts and Manchester 2005, 71). Calculus is commonly observed in archaeological populations of all periods, although poor preservation or damage caused during cleaning can result in the loss of these deposits from the teeth (*ibid*, 64). Calculus deposits were seen on eighteen teeth from Skeleton 13592 (young middle adult possible female?), ranging from flecks to moderate deposits.

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Appendix

Table 1 Summary of osteological and palaeopathological results

Sk No	Fragmentation	SP	Completeness (%)	Age	Age Group	Sex	Dental Pathology	Skeletal Pathology
13592	Mod	5	30	26-35 years?	YMA?	F??	Calculus	Cribra orbitalia; sinusitis

Key: SP = Surface preservation: grades 0 (excellent), 1 (very good), 2 (good), 3 (moderate), 4 (poor), 5 (very poor), 5+ (extremely poor) after McKinley (2004); C = Completeness; F = Fragmentation: min (minimal), sli (slight), mod (moderate), sev (severe), ext (extreme)

Non-adult age categories: f (foetus, <38 weeks *in utero*), p (perinate, c. birth), n (neonate, 0-1m), i (infant, 1-12m), j (juvenile, 1-12y), ad (adolescent 13-17y)

Adult age categories: ya (young adult, 18-25y), yma (young middle adult, 26-35y), oma (old middle adult, 36-45y), ma (mature adult, 46+y), a (adult, 18+y)

R – right; L – left; OA = Osteoarthritis; DJC = Degenerative Joint Changes; DEH – dental enamel hypoplasia

Table 2 Osteological and palaeopathological catalogue

Skeleton Number	**13592**
Preservation	5 (very poor)
Fragmentation	Moderate
Completeness	30% Cranium; humerii; left radius; ulnae; femora; tibiae; right foot (1 tarsal); left foot (1 tarsal, 3 metatarsals); unsided foot (1 metatarsal)
Age	26-35 years? (YMA?; based on dental wear)
Sex	Female??
Stature	-
Non-Metric Traits	*Bridging of supraorbital notch* (bilateral), *accessory supraorbital foramen* (right)
Pathology	Cribra orbitalia (right=2, left =0) Sinusitis – nodules of lamellar bone on the floor of the left maxillary sinus
Dental Health	8 tooth positions, 31 teeth present + 1 unidentifiable root 18 teeth with calculus Crescent shaped wear patterns on the distal corners of both lower canines, no other teeth affected

	Right Dentition								Left Dentition							
Present	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P	P	P	P	P	P	P	P
Calculus	-	-	Fb	-	-	-	Sb	-	-	Fb	Sb	Sbl	Mb	Mbl	Sb	Fdb
DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	1	2	4	3	2	2	2	3	3	2	2	2	2	5	3	1
Maxilla	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mandible	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Present	-	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)	P(l)
Calculus	-	Fl	-	-	-	-	Sb	Mb	Sb	-	Fl	-	Fm	Fb	Fd	Fd

DEH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Caries	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Wear	-	4	6	3	2	3	3	4	4	3	3	2	2	5	3	1

KEY:

Present - Tooth presence; am - ante-mortem tooth loss; pm - post-mortem tooth loss; p - tooth present; - - jaw not present; o - erupting

Caries - Calculus; F - flecks of calculus; S - slight calculus; M - moderate calculus; H - heavy calculus; a - all surfaces; b - buccal surface; d - distal surface; m - mesial surface; l - lingual surface; o - occlusal surface

DEH - dental enamel hypoplasia; l - lines; g - grooves; p - pits

Caries - caries; s - small lesions; m - moderate lesions; l - large lesions

Wear - dental wear; numbers from 1-8 - slight to severe wear