Archaeological Investigation Report

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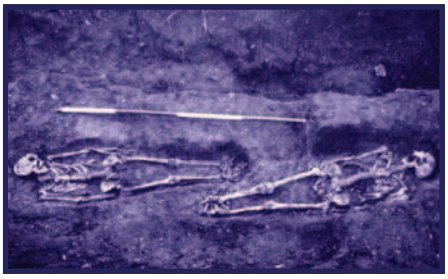

Archaeological Investigation Report

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ENVIRONMENT AGENCY

Client: Jackson Civil Engineering Ltd
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Archaeological Investigation Report

Jackson Civil Engineering Ltd. on behalf of the Environment Agency

St. Ives and Hemingford Flood Alleviation Scheme
St Ives, Cambridgeshire

NGR TL 29645 71228

ARCHAEOLOGICAL INVESTIGATION REPORT

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SUMMARY

From September to November 2006, Oxford Archaeology (OA) carried out an archaeological watching brief and subsequent excavation on behalf of the Environment Agency at the Flood Alleviation Scheme in Hemingford Grey near St. Ives, Cambridgeshire (NGR TL 29645 71228).

The work was commissioned by Jackson Civil Engineering Ltd. on behalf of the Environment Agency and was carried out during work on the flood defences of the south bank of the River Great Ouse. The initial watching brief revealed a burial ground dedicated to the Society of Friends (the Quakers), which dates from the late 1600s to early 1700s. Oxford Archaeology carried out an excavation of all burials and deposits that were to be affected by the construction works. The excavation area was approximately 16.56 sq. m in size and contained at least sixteen inhumations in earth-cut graves. Some disarticulated human bone was recovered. Limited finds assemblages were also recovered during the excavations.

The skeletons were in good condition, although many were incomplete, having been truncated by the insertion of later graves and modern intrusions. Evidence for disease was frequent among the burials and includes instances of amputation of the lower legs and scoliosis, a spinal deformity. Evidence of burial practice was recovered including items such as coffin nails and coffin fixtures and fittings.

1 INTRODUCTION

1.1 Scope of work

1.1.1 Between the 12th September and the 4th October 2006, Oxford Archaeology (OA) carried out an archaeological watching brief and excavation at the Flood Alleviation Scheme in Hemingford Grey near St. Ives, Cambridgeshire (Fig. 1) on behalf of the Environment Agency (EA).

1.1.2 The work was commissioned by Jackson Civil Engineering Ltd. in response to the discovery of human remains during works on the southern bank of the River Great Ouse, prior to the building of flood defences.

1.1.3 A verbal consultation took place between OA and Andy Thomas, Principal Archaeologist with Cambridgeshire County Council, from which agreement was reached as to how OA would carry out the watching brief and subsequent excavation of the burial ground.

1.2 Location, geology and topography

1.2.1 The site lies along the southern bank of the River Great Ouse at Hemingford Grey, Cambridgeshire (NGR TL 29645 71228). The excavation site is situated on a narrow strip of Hemingford Meadow between the River Great Ouse and the back garden of a new house on Meadow Lane (Fig. 2).

1.2.2 The site covers an area of approximately 16.56 sq. m and lies at approximately 8.04 m OD. The underlying geology comprises alluvium over 1st terrace river gravel (BGS sheet 187).

1.3 Historical background

The following history is taken from *Village History* by Mary Carter (Carter 2005).

1.3.1 During the Roman and Saxon periods, Hemingford Abbots and Hemingford Grey were part of one estate. The name Hemingford means "the ford of the people of Hemma or Hemmi", who was presumably a Saxon chief. In the 9th century the estate was split into two and the Danes built a new settlement at the Thorpe in the eastern part of the old estate. By 1066 Little Hemingford, or Hemingford by St. Ives, was acquired by Ramsey Abbey, the major landowner in the area.

1.3.2 Payn of Hemingford, a tenant of the abbey, started building the Manor House and parish church before he died in 1166. The Manor House is one of the oldest inhabited buildings in the country and was originally a stone hall with an external staircase to the first floor and cellars underneath. A moat still surrounds the Manor House on three sides and the Norman windows can be seen on the south and west side of the house. The parish church has been enlarged and altered over the centuries but parts of the medieval building have survived in the nave and south aisle. The original tower collapsed in the middle ages and a new tower was built topped with a spire. In the 18th century it was destroyed by a hurricane and the spire was levelled off and eight ball finials placed on the angles.

1.3.3 In 1276 the village acquired its modern name from the de Grey family, the new owners of the manor. In the 15th century, Henry VII seized the manor from George Grey the 3rd Earl of Kent, as he was unable to pay his debts. The manor was leased to various nobles, amongst who was the great-grandfather of Oliver Cromwell. By the 17th century the manor was owned by the Newmans, who were also part owners of Hemingford Abbots. In 1704 it was sold to Cornelius Denne, a merchant in St Ives and Bedford, who passed it to James Mitchell of Fowlmere and his descendants.

1.3.4 At the beginning of the 17th century, the Ouse was blocked by weirs and overgrown by weeds. There had been frequent complaints over the centuries, particularly from citizens of Huntingdon, that the millers at Hemingford had diverted the water preventing the passage of their boats up river. At one stage travel was almost impossible between Ely and Huntingdon. By 1625 the river was cleared as far as St. Neots and later to Bedford. The village became a convenient stopping place for horse drawn barges taking coal to Bedford or cereals to Kings Lynn.

1.3.5 A large number of changes took place within Hemingford Grey during the 19th and 20th centuries. The St. Ives Union Workhouse was built on the edge of the village to house paupers from the whole district and a church school was built at a grand cost of £387. There was a smaller school for children who lived at the other end of the village although both schools were eventually closed and replaced by the present day school. The Reading Room was built to commemorate Queen Victoria's Diamond

Jubilee. The current windmill in Hemingford Grey was built in 1820 and was the last working mill in the county.

1.3.6 The watching brief site "seems to have been a dissenting burial place in the 17th and early 18th century" (Carter 1998), and it is recorded that at least 17 people were buried there between 1687 and 1721.

2 PROJECT AIMS

2.1.1 To identify and record the extent, condition, quality and date of the archaeological remains in the areas affected by the development. As a result of the initial watching brief and discovery of numbers of interments:

2.1.2 To remove the human remains in accordance with the conditions of the burial licence issued by the Department for Constitutional Affairs (DCA) under Section 25 of the Burial Act of 1857 and dated 12th September 2006.

2.1.3 To make available the results of the archaeological investigation.

3 ARCHAEOLOGICAL DESCRIPTION

3.1 Methodology

3.1.1 The overburden was removed under close archaeological supervision by a tracked excavator fitted with a 1.7 m wide toothless grading bucket. Excavation by machine proceeded in spits down to the top of the visible grave cuts.

3.1.2 The human remains were then hand excavated with due care and consideration given the nature of these particular archaeological deposits. Each deposit was allocated a unique context number.

3.1.3 All excavation, recording and lifting of the human remains was undertaken in accordance with methods detailed in the *OA Fieldwork Manual* (ed. D. Wilkinson 1992).

3.1.4 All graves were planned at a scale of 1:10 and a general site plan was made at a scale of 1:50. A representative section of the site was also drawn at a scale of 1:10. All excavated features were photographed using colour slide and black and white print film. A general photographic record of the work was made. Recording followed procedures detailed in the *OA Fieldwork Manual* (ed. D. Wilkinson 1992).

3.1.5 Finds were recovered by hand during the course of the excavation and bagged by context.

3.1.6 No samples suitable for palaeo-environmental investigation were uncovered during the course of the watching brief.

3.2 Soils and ground conditions

3.2.1 The development area beneath overburden consisted of natural gravelly sand and silt deposits. The soil divisions were clearly defined with little or no mixing between the contexts. The weather conditions were good.

3.3 Deposits

3.3.1 The underlying natural, a mixture of compact beige flinty gravelly sand (6) and a soft brown sandy silt (5), was encountered at an average depth of 1.5 m below ground level. This was overlain by a 0.9 m thick layer of dark brown-black flinty sandy silt (3), interpreted as the graveyard soil. Finds including pottery, human remains, animal bone, and coffin nails were recovered from this deposit.

3.3.2 Sixteen complete or partial skeletons in graves (Contexts 11, 13, 18, 20, 23, 30, 31, 35, 41, 43, 44, 48, 52, 53, 57, and 61) were excavated within layer 3 (Figs 3 and 4 and see Section 5 below). Sealing these skeletons and the graveyard soil (3) was a 0.15 m thick layer of compact gravel (65) that contained no finds. Overlying this was a compact black-grey sandy silt (2) with a maximum thickness of 0.25 m, which in turn was overlain by a 1 m thick layer of modern build up (66), consisting of lenses of silty soil and rubble, and sealed by the present topsoil (Fig. 5)

3.3.3 Pottery was recovered from layer 2 dating from the 12th century to the 19th century; no finds were recovered from layer 66.

3.4 The burial ground

3.4.1 The graves were aligned approximately either NW-SE or NE-SW and were sub-rectangular in shape with vertical sides. The graves were all either aligned parallel to the adjacent river or at right angles to it. They varied in dimensions from 1.8 m in length by 0.55 m wide (e.g. grave 59) to 2.6 m in length by 0.9 m in width (e.g. grave 15). From the top of the machined to level, the grave depths varied from <0.1 m to 0.45 m, with the majority being between 0.25 and 0.4 m deep. The original depth of the graves has been lost by the later construction work and rebuilding of the river bank. The graves exhibited a high level of inter-cutting. A number of graves were also truncated by modern intrusions. All of the grave fills comprised re-deposited graveyard soil (3).

3.5 Stratigraphic phasing

3.5.1 The historical record and the stratigraphic relationships between the graves suggest a continual use of the burial ground. The apparent random locations of the graves and the large amount of inter-cutting between them suggest that there were no visible markers used for the graves.

3.5.2 The large amount of inter-cutting resulted in the disturbance of earlier inhumations. The resultant charnel was often re-deposited in the backfill of the later grave in the sequence.

3.6 Post-burial ground activity

3.6.1 After the burial ground went out of use, there was a considerable amount of build up over the area (layers 2 and 66), probably the result of reinforcing and raising the riverbank to prevent flooding. A modern feature truncated the graveyard to the north-east and had disturbed grave 63.

4 THE BURIALS

4.1 Burial ground population

4.1.1 The excavation area revealed sixteen individual skeletons, each contained within a single grave. The skeletal assemblage comprised nine males, five females and two of undetermined sex. The charnel that was recovered from the graveyard soil and from within individual graves consisted of a large quantity of disarticulated material.

4.2 Burial practices

Body position

4.2.1 Body position could be determined for all sixteen inhumations. They were all supine with both arms extended by their sides; the legs were fully extended and straight.

4.2.2 Four skeletons were aligned NW-SE with their heads to the NW (11, 18, 23, 43 and 44). Skeletons 31 and 35 were aligned NW-SE with their heads to the SE. Three skeletons were aligned NE-SW with their heads to the SW (13, 41 and 57). Skeletons 20, 30, 48, 52, 53 and 61 were all aligned NE-SW with their heads to the NE.

4.2.3 Of the seven inhumations whose skulls remained *in situ*, two were facing to the NE (41 and 53), four were facing to the NW (31, 35, 52 and 57) and one was facing forward (13). Examples of the burials are presented as Figs 6, 7 and 8 and in plates 8 - 15 at the end of this report.

Coffins

4.2.4 All the individuals were interred within coffins, although only the coffin nails survived in most cases. A small amount of coffin wood from the lid was recovered from coffin 42. Fittings were recovered from three coffins (contexts 14, 29 and 57 - see Metalwork report, Section 7).

Burial Clothes

4.2.5 Evidence of burial shrouds comes from the presence of copper alloy shroud pins located within graves 8, 24, 28, 36, 40, 50 and 58. The use of a shroud did not preclude the use of a coffin, as a shroud was used merely to clothe the body. It is possible that the other bodies were also clothed in a shroud, but that these were sewn at the head and feet rather than being pinned.

4.2.6 A small amount of pottery was recovered from the grave fills but this represented backfill from the graveyard soil rather than material contemporary with the burials (See Pottery report, Section 7 - Other Finds).

5 HUMAN SKELETAL REMAINS: INTRODUCTION AND METHODOLOGY

By Sharon Clough and Louise Loe, Oxford Archaeology

5.1 Introduction

5.1.1 All sixteen skeletons were interred in individual earth-cut graves, which also contained the iron remains of coffins. The skeletal assemblage comprised nine males, five females and two of undetermined sex. In addition to the skeletons, a quantity of disarticulated human bone was recovered from the graveyard soil and from within individual graves. Disarticulated material of this type and date presents very limited information and in accordance with current recommendations (Mays *et al* 2004) was not formally examined for this report.

5.1.2 Standard anthropological and palaeopathological examination was undertaken to evaluate the mortality and morbidity of the population with the following objectives:

- Reconstruct the demographic and physical profile of the sample by analysing biological indicators of sex, age and stature, and skeletal anomalies.
- Explore the range and extent of pathological conditions in the sample.
- Compare these parameters with those estimated for the skeletal remains of other populations that are similar in date and type.

5.2 Methodology

5.2.1 The skeletal material was examined in accordance with national guidelines (Brickley and McKinley 2004; Mays *et al* 2004). This involved laying each skeleton out on the work bench in correct anatomical position and completing an inventory to detail which parts had survived. Dentition was recorded using the Zsigmondy system (Hillson 1996).

5.2.2 The condition of each skeleton was recorded as excellent, good, fair or poor depending on the level of fragmentation and surface preservation of their bones. The completeness of each skeleton was estimated as a percentage of 100.

5.2.3 The biological sex of all skeletons was estimated by employing characteristics of the skull and pelvis (Ferembach *et al* 1980 and Schwartz 1995), as well as metrical data (Giles 1970). Ages were estimated by employing a combination of methods. These relate to the pubic symphysis (Todd 1921; Brooks and Suchey 1990), the auricular surface (Lovejoy *et al* 1985), cranial suture closure (Meindl and Lovejoy 1985) and the sternal rib ends (Schwartz 1995). Miles' (1962) dental attrition method was also employed, however this was afforded less importance because the method tends to under-age skeletons from more recent populations.

5.2.4 Where possible, adult stature was estimated by taking the maximum length of any available complete long bone and applying it to the appropriate regression formula devised by Trotter (1970). Measurements of the femur were employed in preference, followed by the tibia, humerus, radius and ulna (in that order). Stature could not be calculated for individuals of unknown sex. All possible males and possible females were, however, included.

5.2.5 Measurements of other long bones and skulls were taken (where appropriate) and utilised to calculate indices, to explore patterns or variations in the physical attributes of the population. The presence and absence of non-metrical traits was scored to explore whether familial groupings could be identified (Schwartz 1995, Berry and Berry 1967, Hillson 1996). Any skeletal pathology or bony abnormality was described and differential diagnoses explored, with the aid of radiology, with reference to standard texts (Aufderheide and Rodriguez-Martin 1998; Ortner and Putschar 1985; Resnick 1995).

6 HUMAN SKELETAL REMAINS: RESULTS

6.1 Condition and completeness

6.1.1 None of the skeletons survived completely. This was primarily as a result of the inter-cutting of graves and truncation from modern activity on the site. However, most skeletons were in an excellent condition with the majority of their elements present. This meant that most observations as regards anthropology and palaeopathology could be made. Details of each skeleton are presented in Appendix 3.

Table 1: Completeness of the assemblage

Completeness (%)	Number of individuals
0-25	5
>25-50	3
>50-75	3
75-100	5

Table 2: Preservation of the assemblage

Preservation			
Poor	Fair	Good	Excellent
0	0	2	14

6.2 Biological age and sex

6.2.1 The assemblage comprised sixteen adults, of whom nine were male and five were female. Sex could not be estimated for two skeletons owing to missing elements. The youngest individual in the assemblage was a male aged between 18 and 25 years. The oldest were a female and a possible male, both over 50 years of age. Six skeletons could not be aged more precisely than adult. Of the 10 individuals who could be more precisely aged, most were assigned to the mature adult age categories.

Table 3: Age and sex distribution of the assemblage

Sex	Age category				
	18-25 yrs	**25-35 yrs**	**35-45 yrs**	**45+ yrs**	**Adult (18+)**
Male	1	1	2	2	
Male?		1		1	
Male??					1
Female				1	
Female?				1	
Female??					3
Undetermined					2

Key: Male? = probable male; male?? = possible male; Female? = probable female; Female?? = possible Female; Undetermined = sex not estimated

6.3 Stature

6.3.1 It was possible to estimate the living stature of 14 of the 16 skeletons. The femur is considered to be the most accurate long bone for stature estimation and was used in eight instances. Stature for males ranged from 1.58 metres to 1.73 metres (5'1" - 5'6"). The female heights ranged from 1.44 metres to 1.66 metres (4'7" - 5'4").

6.4 Non-metric traits

6.4.1 Non-metric traits are minor anomalies in the morphology of the skeleton and are of no pathological significance. They may be present as localised deficiencies of bone (for example, as extra blood vessel openings or foramen), or as extra bone (for example, as wormian bones in the cranial sutures). Non-metric traits have been used to indicate genetic relationships between individuals. However, their value has been questioned as many traits may be environmentally produced. Gruneberg (cited in Tyrell 2000, 290) postulates that the expression of a genetically inherent trait requires certain environmental factors to coalesce and overcome a certain threshold before the trait may be expressed. These factors do cast doubt on the value of non-metrical traits as indicators of familial relationships. However, Sjovold's 1984 study of a European post-medieval sample with known familial relationships indicated that, overall, cranial non-metric traits are more heritable that post-cranial traits (cited in Start and Kirk 1998, 171).

6.4.2 Owing to sample size no attempt was made to examine non-metric traits by sex, although it has been noted that some are more common in one sex than the other. For example, the septal aperture, a hole in the distal humerus, is more common among females than it is among males (Saunders 1989).

Table 4: Frequency of non-metrical traits

Non-metric trait	Number observed L (%) R (%)	Number of elements available for observation L R

Double facet calcaneus	7 (63.6)	7 (63.6)	11	11
Exotosis in trochanteric fossa	2 (25)	2 (25)	8	8
Suprascapula notch	3 (37.5)	2 (40)	8	5
Femoral plaque	1 (12.5)	1 (12.5)	8	8
Bipartite cuneiform	1 (10)	1 (10)	10	10
Bipartite foramina cervical vertebrae	3 (42.8)		7	
Accessory vertebrae	1 (14.2)		7	
Accessory sacral vertebrae	2 (40)		5	
Lambdoid ossicle	2 (28)	1 (14)	7	7
Mastoid foramen	1 (16.6)	1 (16.6)	6	6

6.4.3 In the present sample, two cranial and eight post-cranial traits were observed. The most frequent non-metrical trait was the double facet on the calcaneus (63.6%).

6.5 Dentition

6.5.1 Of the sixteen individuals, seven had dentitions available for study. Assessing of the status of dentitions recovered from archaeological sites may indicate the quality of diet, nutrition, health and oral hygiene in the past.

Dental caries

6.5.2 Caries refers to cavities that result from the demineralisation of teeth when they are attacked by acids that develop when food sugars, especially sucrose, are fermented by bacteria. Caries involved four of the seven dentitions (57.1%), or 16 out of 122 teeth (13.11%) that were available for examination.

Dental calculus

6.5.3 Calculus is mineralised dental plaque. It was observed on five of the seven dentitions (71.4%), or 81 out of 122 teeth (66%). Two individuals, a 25 to 35 year old male (skeleton 13) and an 18 to 25 year old male (skeleton 53) had calculus on all of their teeth. Calculus can obscure other dental conditions, thereby biasing observations. It may also prevent caries from occurring (Waldron 2001, 127).

Periapical cavities

6.5.4 These are identified as openings or holes in the periapical bone of the mandible or maxilla at the apex of the tooth root. They arise as a result of inflammation of the dental pulp that can occur as a result of trauma, caries or attrition. Depending on severity, these cavities may contain granulation tissue (a 'granuloma'), a fluid filled sac (a 'periapical cyst') or a pus filled sac (an 'abscess'). Granulomas and periapical cysts are usually asymptomatic.

6.5.5 Abscesses, however, may result in a persistent fever, a general feeling of being unwell and, when they burst and discharge their contents, halitosis. Acute absecsses may lead to osteomyelitis (bone infection) which in turn may be fatal causing, for example, septicaemia. Four skeletons (57% of all skeletons with surviving tooth sockets) had five periapical cavities between them (skeleton 52, a 40 to 50 year old male had two cavities).

6.5.6 All were too small to be diagnosed as periapical cysts, however, it was not possible to determine whether they were granulomas or abscesses.

Periodontal disease and ante-mortem tooth loss (ATML)

6.5.7 Inflammation of the soft tissues of the jaw (gingivitis, or gum disease) subsequently transfers to the bone (periodontitis). The resulting resorption of bone can result in tooth loss (ante mortem tooth loss) as the roots are exposed.

6.5.8 Ante-mortem tooth loss may also result from abscess development secondary to caries, periodontal disease secondary to calculus formation, pulp exposure and abscess formation secondary to severe attrition, dental intervention ('pulling' teeth) and trauma.

6.5.9 Out of 148 tooth sockets that had survived for examination, 64 (43.2%) exhibited the vertical bone loss and porosity that is associated with periodontal disease. This involved two individuals, skeleton 52, a 40 to 50 year old male and Skeleton 57 a 30 to 40 year old male.

6.5.10 Sixty out of 180 tooth sockets (33.3%) displayed remodelled new bone, indicative of antemortem tooth loss. This involved six skeletons. The most teeth that had been lost before death from any one jaw was 32, all of the teeth that had belonged to skeleton 41, a mature adult female.

Dental enamel hypoplasia

6.5.11 Dental enamel hypoplasia (DEH), identified as lines or grooves on the surfaces of the teeth, were observed on three individuals, predominantly on the lower incisors and canines. They involved 22 out of 122 teeth (18%).

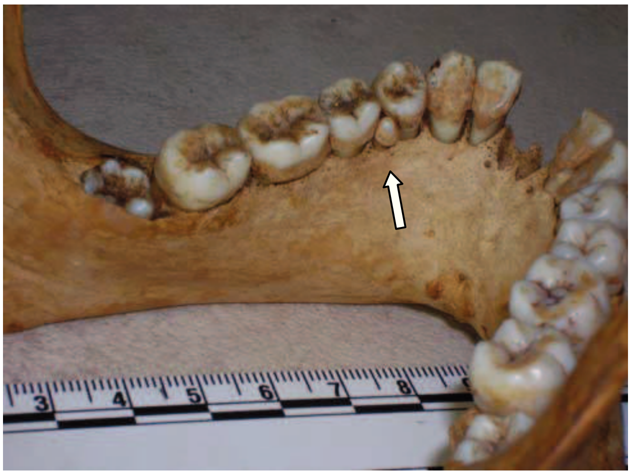
6.5.12 Dental enamel hypoplasia occurs as a result of disruption to the growth of the dental enamel, which occurs during childhood (one to seven years).

Dental anomalies

6.5.13 This refers to anomalies that may be inherited or may relate to cultural modifications. The third molars of skeleton 35 were absent and this is likely to be the result of inheritance. An extra or supernumerary tooth is another anomaly that was identified.

6.5.14 This involved the dentition of skeleton 53 and it was located between the lower right premolars on the lingual side. It took the form of a small 'peg' shaped tooth (Plate 1). This individual also had shovelled upper incisors.

Plate 1: 'Peg' shaped tooth (arrowed), mandible skeleton 53



6.5.15 Three skeletons showed evidence for cultural modification to their teeth. The first, skeleton 35, had a pipe facet, identified as extreme attrition or wear involving the lower right canine and premolar and the upper right canine teeth. This pattern was caused by repeated clutching of the hard stem of a clay pipe between these teeth (Plate 2).

6.5.16 The second, skeleton 31, exhibited similar wear on the lower right canine, but the adjacent teeth were absent, thus diagnosis is speculative.

6.5.17 Lastly, skeleton 52 had an overbite and significant molar tooth loss which had resulted in an unusual wear pattern whereby, owing to these factors, they were uncharacteristically worn indicating their use to chew food instead.

Plate 2: Pipe facet (arrowed), mandible and maxilla skeleton 35

6.6 Palaeopathology

6.6.1 The conditions that were identified fall into the following broad categories: congenital and developmental abnormalities, trauma, circulatory disorders, joint disease, infection and inflammatory change and metabolic conditions.

Congenital and developmental abnormalities

6.6.2 Developmental abnormalities refers to abnormalities in growth or development. They may not become evident until during childhood, or they may be present at the foetal stage, or at birth. The most common abnormalities are relatively minor and never present signs or symptoms. However, some of the severe abnormalities are incompatible with life.

Congenital abnormalities involving the spine

6.6.3 Most developmental abnormalities involved the spine. Three skeletons (35, 53 and 57) had extra vertebral segments (a relatively common phenomenon). Skeleton 35 had an extra sacral segment and skeletons 53 and 57 had extra lumbar vertebrae, that belonging to skeleton 57 being fused, or sacrilised, to the sacrum.

6.6.4 Skeleton 57 also had cleft neural arches of the sacrum, changes that are consistent with the condition spina bifida occulta (Plate 3). In life, the cleft would have been covered with tough fibrous tissue, which would have protected the spinal column. Also relevant to this section is skeleton 13 which presented an example of sacralisation. This is discussed in a later section ('Conditions of the spine').

Plate 3: Spina bifida occulta, skeleton 57

6.6.5 Cleft neural arches were also present on the first sacral segments of skeletons 35 and 53, changes that would have been of no consequence to the health of these individuals.

6.6.6 Skeleton 52 had aplasia of the left articulating facets of the 5th lumbar and first sacral vertebrae. The right spinous process of the third cervical vertebra had also failed to fully develop. The right superior facet of the atlas vertebra of skeleton 57 was undeveloped.

Other congenital abnormalities: Os cuneiform mediale bipartum

6.6.7 This is an anomaly whereby the medial cuneiform develops as two separate bones, rather than one, *in utero* (Scheuer and Black 2000). This defect involved both the left and right first cuneiforms of skeleton 52 (Plate 4). The two components of the right cuneiform displayed eburnation, or polishing of bone, where they articulated. This is osteoarthritis (see below) and is a secondary change associated with this condition.

Plate 4: Left and right bipartite cuneiforms, skeleton 52

Circulatory disorders

6.6.8 Osteochondritis dissecans was identified on the distal humerus of skeleton 52, a 40-50 year old male, and the ulna of skeleton 53, an 18-25 year old male. This is a condition in which restricted blood supply to the ends of convex joint surfaces leads to necrosis (bone death) and the detachment of a small segment of bone.

Epidemiological features of this condition include a predisposition among males between the ages of 10 and 25 years (Aufderheide and Rodríguez-Martin 1998).

6.6.9 In the present sample, the changes were observed as small, circular, excavations on the right and left elbows of skeleton 52 and on the left elbow of skeleton 53. The elbow is a common site for this condition to occur and may be associated with strenuous activity involving the upper limbs. Another example of a circulatory disorder was observed in the spine of skeleton 35 and is discussed in detail below (under 'Conditions of the spine').

Trauma and Treatment of trauma or surgical intervention

6.6.10 The right distal and middle phalanges of skeleton 20 were fused. The fusion was right across the joint and probably represents healed traumatic injury that was sustained to the hand a long time before the individual died.

Amputation

6.6.11 The lower leg bones (the tibiae) of a 50 + year old skeleton, possibly male (skeleton 18), had been amputated above the ankle (Plate 5). The amputation had been performed at the same level on both legs that had been cut perpendicular to their long axes. The margins of the cuts were smooth and remodelled which had resulted in fusion between the tibiae and fibulae. This indicates that the amputation had been performed a long time before the individual died and is confirmed by the atrophic appearance of all of the lower limb bones, reduced bone turn over as a result of prolonged disuse. A small cloaeca (an opening in the bone through which pus would have drained in life) was present and is diagnostic of bone infection. The smooth, organised appearance of this lesion and the surrounding bone indicate that the infection had healed by the time the individual died. A series of Harris' lines indicate episodes of arrested growth in childhood (see below).

Plate 5: Amputated tibia and fibula, skeleton 18

Osteoarthritis

6.6.12 Osteoarthritis (OA) is a disease that involves synovial joints. Osteophyte (new bone on the joint surface and/or around the margin of the joint), eburnation (polished bone resulting from the loss of cartilage), alteration to the contour of the joint and joint surface porosity are the skeletal manifestations of this disease.

6.6.13 Diagnosis rests on the identification of eburnation or at least two of the other changes (the other changes can also occur as a part of different disease processes) (Rogers and Waldron 1995).

6.6.14 In the Hemingford Grey sample multiple joint OA was identified on skeleton 52, a 40 to 50 year-old male. The joints that were affected were the left and right elbows and wrists, the left hip and the right ankle. Skeleton 13 had OA involving most costo-vertebral joints and is discussed below. Osteoarthritis involving the spine is dealt with in the following section.

Conditions of the spine: Schmorl's nodes, osteophytosis and Osteoarthritis

6.6.15 The most frequent condition of the spine was intervertebral disc herniation in the form of Schmorl's nodes (Table 5). This involved five skeletons, all males. Schmorl's nodes is extremely common in skeletal populations and occurs as a result of herniation of the intervertebral disc into the end plate of the vertebral body.

6.6.16 Osteophytosis, or new bone on the joint surface and/or around the margin of a joint, was observed on the spines (any joint except costo-verterbal joints - see above) of six skeletons, five males and one possible female. Osteophytosis is a very common occurrence in skeletal populations, particularly in the spine owing to the consequences of a constant upright posture.

6.6.17 It may be associated with a pathological process and accompany other skeletal abnormalities (for example, trauma), or it may occur on its own as a normal accompaniment to ageing (Rogers and Waldron 1995).

6.6.18 Osteophytosis also involved other joints besides the spine of five skeletons. However, all examples (spines included) were unremarkable and, while noted in the catalogue, will not be explored in further detail in this report.

6.6.19 Osteoarthritis involved the spines of four skeletons, three males and one possible female and was identified on cervical, thoracic and lumbar vertebrae.

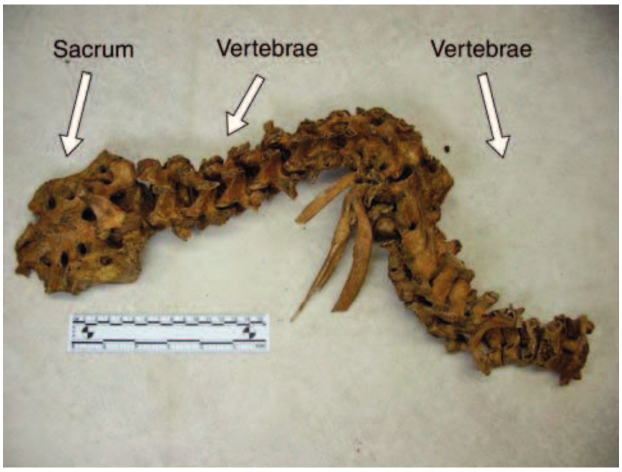
Table 5: Frequency of conditions involving spine

	No. vertebrae present			No. with Schmorl's nodes (%)		No. with osteophytosis (%)			No. with spinal osteoarthritis (%)		
	CV	TV	LV	TV	LV	CV	TV	LV	CV	TV	LV
Male	28	49	21	14 (28.6)	4 (19.0)	12 (3.6)	31 (63.3)	11 (52.4)		6 (12.2)	1 (4.8)
? Male	7	12	5			4 (57.1)	4 (33.3)	4 (80)			
? Female	4	0	0			4 (100)			4 (100)		
Total	39	61	26	14 (28.6)	4 (19.0)	20 (51.3)	35 (57.4)	15 (57.7)	4 (10.3)	6 (9.8)	1 (3.8)

Idiopathic scoliosis

6.6.20 The vertebral column and ribs belonging to skeleton 13, a 25 to 35 year old male, displayed very complicated changes that are consistent with severe longstanding scoliosis (Plate 6). Scoliosis refers to lateral curvature of the spine with rotation of the vertebrae within the curve. The vertebrae are typically wedge shaped, the disc spaces are reduced, the neural arches and vertebral processes display asymmetry and the transverse processes are short and plump on the convex aspect and long and slender on the concave aspect (Aufderheide and Rodriguez-Martin 1998). In the present example, the vertebral column had a double curve and thus resembled an 's' shape. This is the usual pattern seen in scoliotic spines (Aufderheide and Rodriguez-Martin 1998).

Plate 6: Scoliosis, vertebrae and sacrum skeleton 13



6.6.21 There are numerous factors that may give rise to scoliosis, the most common being idiopathic (of obscure aetiology), in which inheritance is believed to play a significant role. Congenital conditions, osteomalacia (deficiency in the formation of bone), paralysis, trauma and neoplastic disease are among the other conditions that may be associated with this deformity (Aufderheide and Rodriguez-Martin 1998; Ortner and Putschar 1985).

6.6.22 In order to fully explore the aetiology of this deformity in the present specimen, detailed records were made based on macroscopic and radiological analysis. These are summarised below according to anatomical location. Detailed notes and sketches are included in the archive.

Vertebral column

6.6.23 The 9th to 11th vertebral bodies and the posterior facet joints from the 7th thoracic vertebra to the first lumbar vertebra were fused down the right hand side, and complete fusion had occurred between the 4th to 6th thoracic vertebral bodies and facet joints. The inter-vertebral disc space between the 10th and 11th thoracic vertebrae displayed a smooth walled circular lesion. The macroscopic and radiographic appearance of this lesion is not consistent with the lytic defects that are observed in neoplastic disease or infection. This is more likely to be a pressure defect from a restricted, pulsating blood vessel, the aorta, or one of its branches.

Ribs

6.6.24 Right and left upper ribs showed angular deformities, others showed smooth erosions, probably the result of pressure defects from restricted surrounding soft tissues. Several ribs were fused to the vertebrae and/or each other. They were often atrophic (abnormally reduced in size) and there was one probable cervical rib. Secondary osteoarthritis was present on the surviving costo-vertebral and costo-transverse joints.

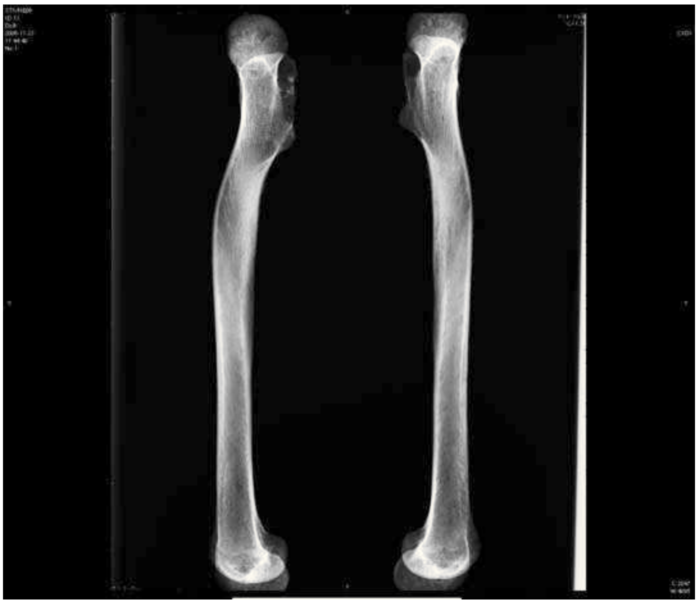
Sacrum and pelvis

6.6.25 The fifth lumbar vertebra showed evidence for shifting of the lumbosacral border in a cranial direction ('lumbarisation'). The assimilation was bilateral and symmetrical. This is a developmental defect that, in itself, would have been of no consequence to the overall health of the individual.

Lower limb bones

6.6.26 The upper shafts of both femora (Plate 7) displayed anterior bowing, particularly the right. Mild medial bowing was also present in the tibiae and fibulae. Bowing deformities in adults may result from disruption to the mineralisation of growing bone, or osteomalacia. This is usually caused by vitamin D deficiency but may also arise as a result of generalised malnutrition or diseases where there is extreme loss of calcium (for example, kidney disease). Scoliosis is common among individuals with this disease. However, in the present example, the radiographic appearance of the bones does not confirm this diagnosis. Alternative diagnoses includes infantile rickets, also a disease in which there is disruption to the mineralisation of bone, but this time during childhood. Chronic intestinal disorders, insufficient amounts of calcium and phosphorus in the diet, chronic renal tubular failure and, most common, vitamin D deficiency are among the aetiological factors associated with this disease (Zimmerman and Kelley 1982).

Plate 7: Radiograph showing anterior bowing deformities of left and right femora, skeleton 13



6.6.27 Harris' lines, or lines of arrested growth, were visible on the radiograph of both tibias. These defects occur as a result of disruption to growth during childhood as a result of non-specific health stress (Lewis and Roberts 1997).

6.6.28 A similar spinal deformity, kypho-scoliosis, was diagnosed based on changes in the thoracic spine of skeleton 35, a male aged 35 to 45 years. The changes include anterior wedging of the fifth and sixth thoracic vertebral bodies, which also had shallow erosions on their inferior surfaces. In addition, the left side of the body of the sixth thoracic vertebra was slightly wedged and fusion between the right posterior facet joint of the third and fourth thoracic vertebrae. Diffuse marginal osteophytosis was present on the vertebral bodies throughout most of the spine. Adolescent osteochondritis, or Scheurmann's disease (a condition in which there is disruption in the blood supply which results in an erosion on the antero-lateral aspect of the vertebral bodies) leading to collapse of the spine so that it adopts a lateral curvature (or sideways) with vertebral rotation, associated with an anteroposterior (or forwards to backwards) hump in the spinal column (kyphoscoliosis), is the most likely diagnosis. Preservation does not permit confirmation of the kyphoscoliosis, although some limited reconstruction makes this a strong possibility.

Infection: Non-specific bone inflammation

6.6.29 Periostitis and sinusitis are included in this section. Periostitis involves the outer surface of the bone (the periosteum) and manifests as fine pitting, striations and layered new bone. In archaeological populations it is most commonly observed on the tibia. Four skeletons (13, 30, 43 and 53) from Hemingford Grey had periostitis involving both right and left tibias (Table 6). Changes were also observed on two femurs belonging to skeleton 53, one humerus and one rib (skeleton 52).

Table 6: Frequency and distribution of periostitis

	Number observed for periostitis		Number with periostitis	
	Left	**Right**	**Left (%)**	**Right (%)**
Rib	97	81		1 (1.2)
Humerus	7	6		1 (16.7)
Femur	8	8	1	1 (12.5)
Tibia	12	11	4	4 (36.4)

6.6.30 Sinusitus is believed to result from inflammation of the mucous membrane (in the nasal bone) and is diagnosed by the presence of new bone on the maxillary antra (Boocock *et al.* 1995). Upper respiratory tract infections, poor living conditions, environmental pollution, congenital abnormalities, dental disease and specific infectious diseases such as tuberculosis and leprosy are among the aetiological factors associated with this condition (Lewis 2002:21). In the present sample one skeleton showed evidence for this condition (skeleton 57, a 30-40 year-old male), that is 33% (one out of three sinuses that were available for examination).

Metabolic disease

6.6.31 Cribra orbitalia (pitting in the orbits) was observed on the right and left orbits of skeleton 13, that is one out of six left orbits (16.7%) and one out of six right orbits (16.7%) that could be observed. Iron deficiency anaemia is responsible for these changes which is why they are discussed under this heading. Anaemia may be genetic or acquired. However, the genetic form is rare in Britain and, therefore, it is likely that skeleton 13 had acquired the condition. Factors associated with this are a deficient diet, chronic blood loss, parasitism, lead poisoning and infection (Stuart-Macadam 1991).

Neoplastic disease

6.6.32 An ivory or button osteoma is the only condition that was observed in this category. This is a smooth, small, benign outgrowth of cortical bone and was present on the left parietal bone of skeleton 35 and the left parietal bone of skeleton 13. Such osteomas are very common and usually occur on the outer table of the skull or in the sinuses. In life, they usually present no symptoms.

Ossified thyroid cartilage

6.6.33 The thyroid cartilage, a structure that is located in the anterior of the neck and forms the laryngeal prominence (the 'Adam's apple') may ossify (turn into bone) in life. Two individuals showed evidence for this, skeletons 35 and 41. This phenomenon is of no pathological significance and is usually associated with advanced age.

Enthesophyte

6.6.34 This refers to new bone formation at sites where tendons, ligaments and joint capsules insert into bone. New bone on the posterior spur on the calcaneus where the achilles' tendon attaches at the back of the heel bone is one such example.

6.6.35 Although enthesophytes have been linked to activity whereby they are believed to arise as a result of muscular exertion leading to repeated trauma to the tendons, they may also accompany other diseases, for example, diffuse idiopathic skeletal hyperostosis (a disease involving fusion of the spine and associated with obesity and diabetes).

6.6.36 Nearly all the individuals from Hemingford Grey had at least one bone affected by enthesophytes and this information is detailed in the skeletal catalogue. However, in all, the changes were relatively isolated and primarily involved the bones of the legs, hips, elbows and ankle, sites that are typically affected by these changes.

6.6.37 This pattern of site involvement suggests that activity rather than systemic diseases were causing these changes in the present sample. This requires testing through more detailed analysis that is beyond the scope of this report.

Cortical defects

6.6.38 These are identified on dry bone as erosions in areas where muscles insert into bone. They have no known associations with pathological conditions and are generally regarded to be the result of repeated microavulsions of the outer surface of the bone as a result of intense mechanical stress (Bufkin 1971, 492; Panhuysen *et al.* 1994).

6.6.39 One skeleton, skeleton 53, an 18 to 25 year-old male, had defects located on the proximal humerus where the *Pectoralis major* and *Teres major* muscles attach to the bone and on the inferior aspect of the medial portion of the clavicle in the region of the costo-clavicular ligament. Compared to most skeleton populations, these defects were notable for their size and degree of expression (Loe *pers comm*.).

6.7 Discussion

6.7.1 A summary of the main findings described in this report are presented in Table 7.

Table 7: Summary of Results

Criteria	**Summary**	
MNI	16	
Preservation	Good or excellent and of mixed completeness	
Age		
Sex	Nine males, five females, two of undetermined sex	
Stature	Males: 1.58 metres to 1.73 metres; Females: 1.44 metres to 1.66 metres	
Non-metric traits	Most frequent cranial trait: lambdoid ossicle Most frequent post-cranial trait: double calcaneal facet	
Pathology	**Joint diseases:**	Osteoarthritis present only
	Conditions of the spine:	Osteoarthritis, Schmorl's nodes, osteophytosis all present. Scoliosis and kyphoscoliosis (probable) present (two skeletons).
	Infection:	Only non-speicific bone inflammation if the form of Periostitis (five skeletons) and sinusitus (one skeleton)
	Metabolic	Cribra Orbitalia (one skeleton) Possible rickets (one skeleton)
	Congenital & developmental:	Sacralisation (two skeletons) Extra vertebral segments (three skeletons) Spina bifida occulta (one skeleton) Cleft neural arches (two skeletons) Aplasia of neural arches (two skeletons) Bipartite cuneiform bones (one skeleton)
	Circulatory	Osteochondritis dissecans (one skeleton) Scheurmann's disease (one skeleton)
	Neoplastic	Button osteoma (two skeletons)
Trauma	Possible healed fracture involving finger bone (one skeleton) Amputation (one skeleton)	
Dentition	348 teeth present Ante-mortem tooth loss, caries and calculus most common conditions observed Periodontal disease, abscesses and enamel hypoplasia also present.	

Key: MNI = Minimum number of individuals

6.7.2 Of the skeletons that could be assigned to an age range, the majority fell into the older age categories and none were younger than 18 years. However, disarticulated infant and child bones were recovered from grave fills during excavation and therefore demonstrate the presence of a younger component to the population.

6.7.3 Non-metric traits were examined both cranially and post-cranially. A very limited number of cranial traits was observed and includes the mastoid foramen (an extra opening on the sides of the skull) and the lambdoid ossicle (an extra bone on the back of the skull). The fact that cranial non-metric traits are believed to be more genetically controlled than post-cranial traits (see above) does not mean that familial relationships are not demonstrated in the population. Rather, the sample is too small and the results, statistically non-viable. Their low frequency in the present sample is not surprising given the fact that not all skulls had survived and, where they did, relevant areas were not available for examination.

6.7.4 Some traits, particularly those involving joint surfaces, may be functionally induced. For example, Os Acromiale, represented as non-fusion of the acromial process of the scapula, has been linked to activity induced trauma occurring at a young age (Stirland 1998). The most frequent post-cranial trait, the double facet on the calcaneus, is also frequent in other archaeological populations. For example, nine out of 16 (56.3%) cases were observed among the Quaker skeletons recovered from Vancouver Centre, Kings Lynn, (Mahoney in Brown 2005).

6.7.5 The frequency of the different dental conditions observed in the sample are within the ranges that have been reported for other post-medieval populations (Roberts and Cox 2003). Dental disease during this period did not show a significant change from the preceding period, except for periodontal disease that increases dramatically (Roberts and Cox 2003). The pipe facet and in fact, any cultural modification other than treatment, is rare for this period and indicates a long term smoking habit.

6.7.6 Another dental condition, enamel hypoplasia, provides a valuable insight into the quality of lives that the individuals had during childhood. This is because it is a condition that reflects growth arrest during the formation of the enamel. This growth arrest may occur as the result of a variety of factors, malnutrition and childhood illness being among these. Enamel does not remodel once it has formed and, therefore, hypoplastic defects are useful indicators of generalised childhood health stress. A low frequency of enamel hypoplasia was identified in the sample, perhaps indicating low levels of health stress among this group.

6.7.7 Calculated statures are comparable to two other Quaker sites of 18th-19th century date. Stature from Vancouver Centre, Kings Lynn, Friends burial ground (Mahoney in Brown 2005) had an average of 1.69 m for males and 1.61 m for females. The average statures for Kingston-upon-Thames (Start and Kirk 1998) were 1.68 m and 1.60 m for males and females respectively. Calculations for the Hemingford Grey population suggest that average heights were lower than these examples. However, in the context of several different post-medieval British populations discussed by Roberts and Cox (2003), they are within the expected range.

6.7.8 The scoliosis and amputations excepted, the range of pathological conditions that were observed in the sample is similar to that recorded elsewhere (for example, see Roberts and Cox 2003). Joint disease, in the form of osteoarthritis, is not a surprising find: it is the most common pathological condition to be seen in skeletal populations (Rogers and Waldron 1995). Great attention has been focused, in the archaeological literature, on the relationship between OA and activity and occupation (see Jurmain, 1999). However, it is very unlikely that occupation and activity will have played a unique role in the manifestation of OA in this sample. Many factors, including age, sex, ancestry, and genetic predisposition, as well as activity and occupation, play a part in the manifestation and course of the disease. Except in rare instances, when a pattern of OA occurs that it unique to an activity or occupation, it is impossible to determine which of these factors was responsible for this disease (Waldron and Cox, 1989). The distribution of the disease in the present sample would not seem to be directly associated with a specific activity or occupation.

6.7.9 Congenital conditions were relatively common among the sample. Most involved the spine and all would have been of no consequence to the overall health of the individuals affected. The conditions reported here are among those typically seen in skeletal populations.

6.7.10 Another spinal condition observed in the population was Schmorl's nodes that are identified on dry bone as depressions either on the superior or inferior surface of the vertebral bodies. Although also associated with degenerative disease, Schmorl's nodes have also been linked to activity and trauma, especially in adolescence, or metabolic disorders (Jurmain, 1999). The presence of ostephytosis in the spine is to be expected in the present sample. This is because the condition, particularly when it involves the spine, is common among older individuals.

6.7.11 Most of the periosteal lesions in the sample were focal and involved the tibia indicating that they probably relate to relatively mild, solitary conditions such as mild trauma or leg ulcers. One skeleton (53) had multiple element involvement, possibly associated with systemic disease, either infective and non-infective. For example, this could include septic arthritis, tuberculosis, neoplastic disease and scurvy (Ortner 2003; Resnick 1995; Aufderheide and Rodriguez Martin 1998). However, no other changes were observed on this skeleton that would suggest a more specific diagnosis. Periostitis involving the ribs is associated with pulmonary infection such as tuberculosis. However, the changes that were observed on the rib belonging to skeleton 52 are unlikely to relate to this because they occurred on the head of the rib, whereas in pulmonary diseases they usually affect the pleural surface of the bone.

6.7.12 Evidence for circulatory disorders was observed in two instances. While congenital abnormalities have been implicated in its aetiopathogenesis, the tendency for osteochondritis dissecans to be common among athletes has led to the suggestion that it is caused by repetitive low-grade chronic trauma or microtrauma. This is among a range of conditions identified in the sample (for example, cortical defects and enthesophytes) and that have an activity related component in their aetiology. Further, none of the examples described in this report show associations with other disease processes (for example, joint disease). While it must be remembered that there are many changes in skeletal remains for which causative factors remain elusive, this may suggest that activity-related stress as a result of hard labour was common among this group. This hypothesis requires testing through further detailed analysis.

6.7.13 By far the most interesting pathological conditions identified in the assemblage are the amputation and the scoliotic spine. Both conditions would have shown outwardly visible deformities in life, would have caused discomfort and, given their longstanding nature, reflect care and compassion in the community. These are factors that cannot usually be observed in archaeological human bone alone.

6.7.14 Very few amputations have been reported in the archaeological and palaeopathological literature. This is not because amputation was rarely practised in the past, but because many individuals died from haemorrhage and sepsis before their bones had a chance to heal. Un-healed, amputated bones are difficult to identify archaeologically, being very difficult to distinguish from other skeletal modifications that may occur around the time of death when the bone is still relatively fresh (for example, autopsy). This includes factors such as fractures incurred shortly before death and taphonomic alteration which, in this context, refers to breakage of bone in the burial environment (for example, breakage by animals).

6.7.15 Among the examples that have been reported are a seventh century male with a healed amputation of the left forearm and right lower leg from Tean Island in the Scilly Isles (Brothwell and Møller-Christensen 1963). Leg amputations or autopsies are also described for four juveniles and five adults from an eighteenth to nineteenth century cemetery hospital in Gloucester (Waldron 2001).

6.7.16 Factors that may have lead to amputation in the past rarely leave signs on the bones. They include injuries associated with accidents, bone infection (osteomyelitis), gangrene, tumours, advanced joint disease, congenital anomalies and, less relevant here, ritual and punishment. In the present specimen there are no indications, such as underlying disease, that would account for the amputations. However, the fact that both limbs had been amputated suggests that disease (for example, infection or a congenital abnormality involving the feet) leading to surgery was likely.

6.7.17 By the 18th century, amputation by surgeons was common. This involved cutting the soft tissues in the area to be amputated and sawing through the bone while the patient was held down by the surgeon's assistants. Once the bone had been cut away, the arteries were tied and the open wound was sutured. The procedure did not take long, in some cases, less than a minute as the following excerpt, on the work of a surgeon called Robert Liston, shows:

'Amputations were his special delight and…in his hands the use of the saw followed the flash of the knife so quickly that the student who turned his head for even a moment found that the amputation was completed when he looked round again.' (Coues 1922 in Waldron 2001, 113)

6.7.18 In the mid-19th century a mortality rate of up to 60% is reported for amputations and this did only significantly decline until antiseptic was introduced by Lister (who was, interestingly, born into a Quaker family himself) in the later 19th century (Waldron and Rogers 1988). This highlights just how unusual the present example is.

6.7.19 Scoliotic spines are rarely identified in the archaeological record. It is unlikely that this is because the condition did not exist in the past but because diagnosis rests on survival of complete and well preserved spines. Examples may be provisionally diagnosed. However, often limited bone survives to confirm diagnosis. The Hemingford Grey example is, therefore, special because it presents a unique opportunity to study a pathological condition that is rarely confirmed archaeologically.

6.7.20 It is very difficult to diagnose the causative factors associated with the condition from archaeological bone alone. In living people with the condition, knowledge of the onset (for example, infancy, adolescence or adulthood) of the condition can be extremely important because there are distinct epidemiological features associated with different age groups. In the present example, the macroscopic and radiological appearance of the remains suggests two possibilities. The first, idiopathic scoliosis, may have started to develop in infancy (under three years of age) arising as a result of a birth defect, disease of the nerves and muscles (such as muscular dystrophy or cerebral palsy), injury, infection or a tumor. Other forms of idiopathic scoliosis, juvenile and adolescent, are less likely because the pattern of skeletal involvement is more consistent with the infantile form (Aufderheide and Rodriguez-Martin 1998). However, the bowed lower limb bones belonging to this skeleton suggest that calcium deficiency during growth - rickets - may have caused the deformity instead. Of course it is possible that the individual had suffered from both conditions during his relatively short life.

6.7.21 Whether or not the scoliosis is idiopathic or related to rickets, it started in childhood. The presence of enamel hypolasia and Harris' lines, non-specific indications of compromised health during childhood, are in keeping with this. There is no doubt that as the severity of the changes progressed, they would have caused extreme disability and discomfort for the individual during life who would have, because of the deformity, walked with a rolling gait. Despite its spectacular appearance, the condition probably would not have caused extreme back pain as one might think. However, a curvature as advanced as this would have resulted in diminished lung capacity, leading to the development of restrictive lung disease and perhaps ultimately, death.

6.7.22 Other confirmed cases of scoliosis from Britain to have been described in the palaeopathological literature include an adult female and an un-aged male from within the post-medieval crypt at Christ Church, Spitalfields, London, but neither is attributed to a cause. Twenty-seven examples are described from the post-medieval churchyard of St Martin's, Birmingham however, only three are in the same league as the Hemingford Grey example, in terms of there being no doubt that the condition was present. One non-British example is also worth mentioning here: a Spanish priest who was massacred in 1680 during the Pueblo revolt and who, it is suggested, developed his scoliotic spine as a result of childhood rickets, as evidenced by limb bone deformities (Aufderheide and Rodriguez-Martin 1998).

6.7.23 In addition to skeletons 13 and 18, one further example of deformity is suggested, although this is less conclusive. This is the spine belonging to skeleton 35 which, changes suggest, had a kyphoscoliosis. The changes were not severe but they would have affected the individual's posture, again changes that would have been outwardly visible during life.

7 OTHER FINDS

7.1 The Pottery

by John Cotter, Oxford Archaeology

Introduction and Methodology

7.1.1 A total of 79 sherds of pottery weighing 1,453g was recovered. This is all medieval and post-medieval in date (about 75% medieval and 25% post-medieval by sherd count). For each context the total pottery sherd count and weight were recorded on an Excel spreadsheet, followed by the context spot-date which is the date-bracket during which the latest pottery types in the context are estimated to have been produced or were in general circulation. Comments on the presence of datable types were also recorded, usually with mention of vessel form (jugs, bowls etc.) and any other attributes worthy of note (e.g. decoration etc.) - see Appendix 2.

Date and Nature of the Assemblage

7.1.2 Overall the pottery assemblage is in a very fragmentary condition, although the sherds themselves are quite fresh. Ordinary domestic pottery types are represented.

7.1.3 A range of pottery types from the 12th to the 19th century is represented. These are detailed in the table in the appendix. The medieval pottery types are East Anglian in character and include sherds of early medieval shelly ware tempered with coarsely crushed Jurassic limestone containing abundant fossil shell.

7.1.4 This is similar in appearance to late Saxon St. Neots-type ware (*c* 850-1150) which was produced over a wide area of the south-east Midlands - although the vessels here are typologically of later date. A simple thumbed cooking pot rim in this fabric probably dates to the 12th century although most pieces (including bowl rims) probably date to the 13th-14th century.

7.1.5 Glazed jug sherds in Ely-type ware are also likely to be of this date. A simple cooking pot rim in Ely-type ware could be of 12th or early 13th-century date. Grey sandy wares, including a bowl rim with a pouring lip and several cooking pot rims, are also likely to be of 13th-14th century date.

7.1.6 Late medieval wares include Bourne D ware (15th-16th century) including jug sherds with crude decoration in white slip and hard sandy oxidised wares which might also be Bourne types.

7.1.7 The smaller post-medieval collection includes 17th-18th century glazed local red earthenwares, German Westerwald grey stoneware, an 18th-century Staffordshire slipware dish and a piece of 19th-century Staffordshire transfer-printed whiteware.

7.2 The Metalwork

By Sharon Clough, Oxford Archaeology

7.2.1 The assemblage of metalwork from Hemingford Grey represented the fittings of 16 wooden coffins. There were 358 iron nails from 21 contexts and 28 copper alloy shroud pins from eight contexts. Two graves contained the iron remains of coffin grip plates and grips, and brackets together with copper alloy upholstery pins. A further grave (57) produced iron upholstery pins.

Post-medieval burial tradition

7.2.2 In the late 17th to early 18th century, when the burial ground was in use the occupation of the full-time undertaker was in its infancy.

7.2.3 Coffins and their decoration were copied from decorative devices and ornamentation used on furniture. The coffins used by the Quakers would have been no different to those used by the Church of England at this time. It is only in the later periods, as coffins became more elaborate, that the Quaker burial stood out in its simplicity.

7.2.4 The single-break flat-lidded coffin, angled at the shoulders appeared *c.*1675. Previously, the gabled, trapezoid coffins, as seen in 17th century illustrations of the Black Death, were popular. Traditionally the coffin was made of elm, selected because it tended not to split and was watertight. The inside of coffin was sealed with pitch and in the 18th century it became popular to put bran or sawdust in the base of the coffin over which an undersheet was tacked in place. The outer wooden case was upholstered in black fabric held in place by iron or bronze upholstery pins. Coffins of this period were usually quite plain, decorated only by simple grips on the side panels of the coffin. The grips were meant to steady the coffin when carried. The grip plates were a backing plate to the grip. Unlike the more elaborate coffins of the middle to late 18th century, 17th century coffins lacked the decorative stud work and metal coffin furniture (such as departum plates, lid motifs and escutcheons). The identity and date of death of the deceased was sometimes spelt out in upholstery pins on the lid of the coffin. No such letters were discerned on the coffin lids from Hemingford Grey, but the side panels of the coffins were simply decorated by a single row of upholstery pins.

7.2.5 Angle brackets stamped or cut from thin sheets of iron were spaced along the edge of the lid at intervals on coffins 14 and 29. These however, were decorative as well as functional (Fig. 9).

7.2.6 Until the second and third quarters of the 17th century not all bodies were buried in coffins; but they did have shrouds. The 16th century shroud was a sheet gathered at head and foot ends tied in a knot. Corpses were sewn in; hence the absence of shroud pins. This declined in popularity and was replaced by the 18th century with a more tailored long-sleeved shift with draw-strings, a cap and bonnet had been a feature from the 1630s (Litten 1991). In 1660, an Act of Parliament (The Woollen Act) decreed that all persons had to be buried in shifts, shrouds and winding-sheets made of woollen material. This Act was further strengthened by another in 1678. The quantity of shroud pins in eight graves suggests that the occupants were dressed in the more tailored shift that had been pinned in place. Though no fabric survived it is assumed to be wool from the date of the Act.

Nails

7.2.7 The coffin nails were of iron construction and handmade. They varied in length from 38 mm to 80 mm. Each had a flat square head and a tapering 4-sided shaft. They were recovered from around the skeleton, particularly the head and foot areas. They are therefore nails used in the construction of the coffin, and were not for decorative purposes. All 16 graves contained at least one *in situ* coffin nail suggesting all were coffin interments.

Shroud pins and clothing accessories

7.2.8 These small pins made of copper alloy varied in length from 25-28 mm. They had a round head and long tapering shaft, ending in a point. They were recovered from seven graves and distributed all over the skeleton. Shroud pins were used to hold shroud fabric in place. The pins suggest that these individuals were not buried in their ordinary clothes, but in purpose-made burial clothes or cloth. This is confirmed by the lack of other fastenings (such as buckles, buttons and toggles).

7.2.9 Two copper alloy aglets were recovered from context 19. These enclosed the ends of laces (of clothing, as well as shoes) and were popular in the 16th and 17th centuries. They have been found on shroud clothes and represent further evidence of specific burial clothing of the tailored 'night dress' variety.

Grips, grip plates and brackets

7.2.10 Coffin 14 (containing skeleton 13) and coffin 29 (containing skeleton 30) both had grip plates, grips and brackets. Coffin 14 had six grips and grip plates and six brackets (Fig. 6). Due to truncation, coffin 29 had only four remaining grips and plates and two brackets. These were distributed around the exterior of the coffin and served both a practical and decorative purpose.

7.2.11 The grips and plates were made of iron. Coffin 14's plate was slightly larger than that of coffin 29. The design was a simple rectangle with rounded ends (Fig. 9). A similar design of grip and plate was found at St Luke's church, Islington, London (Boyle *et al* 2005) in an earth-cut grave (grip type 4 and plate type 1). Although the burial itself was undated, the churchyard is known to have been in use from approximately 1733 to 1853.

7.2.12 Another similar, though more elaborate plate design, was found on a coffin in the crypt of Rycote Chapel, Oxfordshire (Witkin 2004), dated to 1699. As the burial ground at Hemingford Grey was in use from 1680s to the 1720s, it is suggested that burials 14 and 29 date to the latter period of use.

7.2.13 The bracket types have not been recorded previously at other sites and therefore have no parallel. These have now been included in the coffin fittings data set currently being compiled by Oxford Archaeology. Brackets served a dual purpose of holding down and decorating the coffin lid.

Upholstery pins

7.2.14 Coffins 14 and 29 had upholstery pins or tacks, which were hammered into the wood of the coffin primarily to hold in place the fabric which covered the exterior of the coffin.

7.2.15 As coffins became more elaborate upholstery pins were arranged in more complex geometric patterns, losing their original purpose to become part of the decoration. At Hemingford Grey, the small number of upholstery pins recovered from the graves suggests that they were used only for holding the fabric.

7.2.16 Coffin 14 had larger pins than coffin 29 (12 mm to 7 mm diameter head). Both were made of copper alloy. During excavation it was noted that the pins from coffin 29 were in fact facing the interior of the coffin which, given their smaller size, may suggest they were holding fabric on the interior of the coffin. Several of these pins were still *in situ* in the preserved wood of the coffin.

7.2.17 Iron upholstery pins were found in context 57. There were five pins and no other metal finds from this context.

Table 8: Metalwork

Context	No. nails	No. shroud pins	No. grips	No. plates	No. brackets	No. upholstery pins	Other
1	1				1		
2	2						
3	19						
8	23	4					
10	27						
14	54		6	6	6	55 Cu alloy	
17	34						
19							2 lace tags, Cu alloy
21	8						
24		10					
26	19						
28		3					
29	19		4	4	2	51 Cu alloy	
33	9						
35	4						
36		1					
37	14						
40	12	9					
42	11						
44	1						
46	7						

50		5					
51	26						
55	12						
57						5 Iron	
58		6					
60	54						
62	2						

8 DISCUSSION AND CONCLUSIONS

8.1.1 This remarkable and unusual assemblage, though small, is a rare opportunity to study individuals of this period from a non-conformist (Quaker) burial ground. Very few Quaker burial grounds have been archaeologically excavated in England and most date to the late 18th and 19th centuries.

8.1.2 This burial ground at Hemingford Grey gives a unique insight into Quaker burial practice at a time when the Society of Friends was still emerging and developing. The individuals in this burial ground chose to turn their backs on mainstream religion, subjecting themselves to potential social exclusion and condemnation.

8.1.3 The Parish Register records that these were local people from Hemingford and surrounding villages. We can also infer from the register that several families were involved, where repeated surnames occur, for example Grey and Peacock. The register does not record age at death, or occupation. Through the skeletal analysis it has been possible to get an impression of the Quaker population. These were adult individuals who lived from 18 to over 50 years, with the majority in the older age range. There were men and women buried here, with more men, which reflects the entries in the register (see below). These individuals had many skeletal pathologies, many demonstrating activity related stress, which suggests that these were physically active people.

8.1.4 The Act of Toleration in 1689 allowed Quakers to worship as they saw fit. Before this date they were subjected to intense persecution through legislation which fined them for non-attendance at Church of England, for gathering at unlicensed meetings and refusing to swear oaths or pay tithes. From the earliest times Quakers set aside their own burial areas since they would not countenance interment in consecrated ground. It was not uncommon for burial to take place in private gardens.

8.1.5 Disused burial grounds where there was no meeting house adjacent are considered for sale in the 1995 *Book of Discipline* as Friends have seldom felt sentimental attachment to burial grounds (Stock 1998). Quaker doctrine encouraged its members towards simplicity in their lives and this was reflected in death and burial practice. Public conception of how the Quakers were burying their dead is disputed below by George Fox, who is traditionally credited as the Founder of Quakerism,

8.1.6 '*And all you that say, That we Bury like Dogs, because that we have not superfluous and needless things upon our coffin, and white and black Cloth with Scutcheons, and do not go in Black, and hang Scarfs upon our hats, and white Scarfs over our Shoulders and give gold Rings, and have Sprigs of Rosemary in our hands, and Ring* *the Bells. How dare you say that we Bury them after the vain Pomps and Glory of the World?*' George Fox 1682, quoted in the Journal of the Friends' Historical Society 1911 (Stock 1998).

8.1.7 In keeping with the non-conformist attitude, alignment of the graves at Hemingford Grey was not of the traditional west-east of the Church of England. The graves at the burial ground at Hemingford Grey were aligned NE-SW or NW-SE, with the head at either end. They were aligned with the river, or perpendicular to it, true north does not appear to have been a consideration.

8.1.8 The high level of crowded, inter-cutting burials suggests there was no use of burial markers. This is typical of early non-conformist behaviour: in the minutes from a meeting in 1717 it was recommended that current upstanding monuments be removed and that further gravestones not be erected (Stock 1998).

8.1.9 Some graves appear to have been placed directly into older ones, perhaps as a family plot. Stock (1998) quotes Clarkson 1807, that Quakers are sometimes buried near their relations. Grave 15 in particular had a significant amount of charnel crammed into the grave at the head end. All the graves were earth cut, the most simple available, and therefore within Quaker doctrine, though at this time brick shaft graves and vaults had not yet become popular.

8.1.10 The skeletons were all supine with their arms by the sides and legs straight. They were dressed in shrouds as evidenced from the quantity of shroud pins found with all the burials. There was no other evidence for clothing, nor any grave goods.

8.1.11 All the graves had evidence for a coffin in form of nails. Two graves (grave 15/coffin 14 and grave 27/coffin 29) had more elaborate coffins, with brackets and grips with plates and upholstery pins. At this date elaborate coffin decoration was not yet in popular circulation, power-assisted methods of raising patterns in sheet iron had yet to be created (1769), which would enable cheap coffin fittings to be mass produced.

8.1.12 These simple plates and grips were in keeping with Quaker doctrine, but as at this date they were expensive to produce they may not be of a type specifically made for Quaker burial.

8.1.13 This is one of the few Quaker Burial grounds to have been archaeologically excavated in Britain. It is also quite probably the earliest excavated burial ground that does not continue in use into the 19th century. Other large excavated sites are the Quaker burial ground at King's Lynn 1779-1835 (Brown 2005), the Friend's burial ground at Kingston Upon Thames 1664-1814 (Bashford and Pollard 1998) and the Quaker burial ground at Bathford, Bath 1703- 1845 (Stock 1998).

8.1.14 A further site at Calne, Wiltshire (Mumford 2006) had a watching brief undertaken which revealed two graves with coffin fittings, though no burials were removed. That Quaker burial ground was in use from approximately 1672-1851. Further small excavations or watching briefs have been undertaken in England, though are limited in number.

The Parish register

8.1.15 The Vicar at Hemingford Grey Parish Church noted some of the burials which took place in the parish register, distinguished from those in his own church by their location 'at Wobourn or Oubourne'.

8.1.16 This list gives an indication to the age and sex of individuals buried at this place and interestingly that they came from neighbouring villages as well as Hemingford Grey to be buried there. Though there are 17 entries, there is no doubt that many more burials that took place.

Hemingford Greye Register booke 1674-1793

(Spellings are as written in the register)

1681 Joh Maytin Junio Woborn i ye 10th
1687 Henry Borcham of HG buried at Oubourn in this parish Aug 23
1687/8 Isabole Barnes of St Ives buried at Oubourn Feb 25
1687 Deborah Peacock of St Ives was buried at Oubourn Mar 24
1688 John the son of M Peacock of St Ives was buried at Oubourne June 12
1688 Richard Blunting of Fen-Stanton was buried at Oubourne Aug 17
1688 Robert the son of John Borsham of Fon-Stanton was buried at Oubourn Aug 26
1688 Elizabeth Grey of Fen-Stanton was buried at Oubourn Jan 5th
1688 John Apethorpe was buried at Oubourn Jan 10
1702 Elizabeth Grimsby of ye Parish of Feriys Stanton was buried at Wobourne July 21
1702 George son of George and Elizabeth Grey was buried at Oubourn Oct 15
1703 A female child of John Rogers of Hemingford Abbott was buried at Wobourn July 9
1703 William Grey of Ferity-Stanton was buried at Wobourn Jan 13
1704 Sarah Grey an infant was buried at Ouborn June 14
1708 Sarah wife of John Rogers was buried at Wobourn June 17
1715 John Pozland was buried at Wobourn April 17
1721 John Martin was buried at Wobourn Jan 10

APPENDICES

APPENDIX 1 ARCHAEOLOGICAL CONTEXT INVENTORY

Cxt	*Type*	*Depth / Height*	*Width x Length*	*Comments*	*Finds*	*Date*
1	Deposit			Machined out human remains	Human bone	C 17/18th
2	Layer	0.25 m		Sealing layer	Pot, animal bone, metal	C 18/19th
3	Layer	0.9 m		Graveyard soil	Human bone (Charnel)	C 17/18th
4	Natural			Natural gravels	-	-
5	Natural			Natural sandy silt	-	-
6	Natural			Natural gravels	-	-
7	Layer			Same as 5	-	-
8	Fill	0.45 m	2.6 x 0.9 m	Grave fill	Human & animal bone, pot, Fe nails,	C 17/18th
9	Fill	>0.1 m	0.9 x 0.3 m	Grave fill	-	C 17/18th
10	Coffin		0.9 x 0.3 m	Coffin remains - wood staining and nails	Fe nails	C 17/18th
11	Skeleton		0.93 x 0.27 m	Adult male - only legs remain	Human bone	C 17/18th
12	Fill		0.6 m x 0.05 m	Human bone, left fibia and partial foot	Human bone	C 17/18th
13	Skeleton		1.55 x 0.46 m	Adult male - complete	Human bone	C 17/18th
14	Coffin		1.8 x 0.5 m	Coffin remains - nails, brackets, handle and upholstery pins	Fe nails, brackets, handle, and upholstery pins	C 17/18th
15	Cut	0.45 m	2.6 x 0.9 m	Sub-rectangular grave cut	-	C 17/18th
16	Cut	0.4 m	1.85 x 0.6 m	Sub-rectangular grave cut	-	C 17/18th
17	Coffin		1.85 x 0.6 m	Coffin remains - nails	Fe nails	C 17/18th
18	Skeleton		1.35 x 0.5 m	Adult male - Skull, left humerus and scapula missing, double leg amputee	Human bone	C 17/18th
19	Fill	0.4 m	1.85 x 0.6 m	Grave fill	Pot	C 17/18th
20	Skeleton		0.55 x 0.25 m	Adult - Only feet and right leg remain	Human bone	C 17/18th

21	Fill		>0.55 x 0.25 m	Grave fill, not fully visible	Sub-adult human bone, Fe	C 17/18th
22	Cut		>0.55 x 0.25 m	Sub-rectangular grave cut - inferred	-	C 17/18th
23	Skeleton		1.3 x 0.35 m	Adult male - Only lower half remains	Human bone	C 17/18th
24	Fill	0.4 m	1.4 x 0.5 m	Grave fill	Pot, human bone, shroud pins, Fe nails and fittings	C 17/18th
25	Cut	0.4 m	1.4 x 0.5 m	Sub-rectangular grave cut	-	C 17/18th
26	Coffin		<1.4 x 0.5 m	Coffin remains - Nails	Fe nails	C 17/18th
27	Cut	0.4 m	1.8 x 0.4 m	Sub-rectangular grave cut	-	C 17/18th
28	Fill	0.4 m	1.8 x 0.4 m	Grave fill	Human bone, Fe	C 17/18th
29	Coffin		1.75 x 0.35 m	Coffin remains - Nails, brackets, grips, and upholstery pins	Fe nails, brackets, grips, and upholstery pins	C 17/18th
30	Skeleton		1.65 x 0.3 m	Adult female - Only left half remains	Human bone	C 17/18th
31	Skeleton		0.8 x 0.5 m	Adult female - Only top half remains	Human bone	C 17/18th
32	Fill	0.4 m	0.96 x 0.6 m	Grave fill	-	C 17/18th
33	Coffin		0.96 x 0.6 m	Coffin remains - Nails	Fe nails	C 17/18th
34	Cut	0.4 m	0.96 x 0.6 m	Sub-rectangular grave cut	-	C 17/18th
35	Skeleton		1.75 x 0.45 m	Adult male - Complete	Human bone	C 17/18th
36	Fill	0.36 m	1.95 x 0.75 m	Grave fill	Pot, shroud pin	C 17/18th
37	Coffin		1.8 x 0.5 m	Coffin remains - Nails	Fe nails	C 17/18th
38	Cut	0.36 m	1.95 x 0.75 m	Sub-rectangular grave cut	-	C 17/18th
39	Cut	0.3 m	0.6 x 0.5 m	Sub-rectangular grave cut	-	C 17/18th
40	Fill	0.3 m	0.6 x 0.5 m	Grave fill	Human bone, Fe nails, shroud pins	C 17/18th
41	Skeleton		0.35 x 0.35 m	Adult female - Only skull and top couple of ribs remain	Human bone	C 17/18th

42	Coffin		0.6 x 0.3 m	Coffin remains - Wood and nails	Wood, Fe nails	C 17/18th
43	Skeleton		0.6 x 0.25 m	Adult - Only lower legs and feet remain	Human bone	C 17/18th
44	Skeleton	0.25 m	0.7 x 0.6 m	Skeleton - Adult	Human bone	C 17/18th
45	Cut	0.25 m	0.7 x 0.6 m	Sub-rectangular grave cut	-	C 17/18th
46	Fill	0.25 m	0.6 x 0.3 m	Grave fill	Pot, Fe nails	C 17/18th
47	Cut	0.25 m	0.6 x 0.3 m	Sub-rectangular grave cut	-	C 17/18th
48	Skeleton		0.25 x 0.2 m	Adult - Only feet remain	Human bone	C 17/18th
49	Cut		1.95 x 0.6 m	Sub-rectangular grave cut - inferred	-	C 17/18th
50	Fill		1.95 x 0.6 m	Grave fill	Shroud pins, Neonate skull frags.	C 17/18th
51	Coffin		1.95 x 0.6 m	Coffin remains - Nails	Fe nails	C 17/18th
52	Skeleton		1.8 x 0.5 m	Mature adult male - Complete	Human bone	C 17/18th
53	Skeleton		1.8 x 0.55 m	Young adult male - Complete	Human bone	C 17/18th
54	Fill	>0.1 m	2.15 x 0.55 m	Grave fill	Shroud pins, Animal bone	C 17/18th
55	Coffin		1.85 x 0.55 m	Coffin remains - Nails	Fe nails	C 17/18th
56	Cut	0.25 m	2.15 x 0.55 m	Sub-rectangular grave cut	-	C 17/18th
57	Skeleton		1.8 x 0.45 m	Mature adult female - Complete	Human bone	C 17/18th
58	Fill	0.1 m	1.8 x 0.55 m	Grave fill	Pot, shroud pins	C 17/18th
59	Cut		1.8 x 0.55 m	Sub-rectangular grave cut - inferred	-	C 17/18th
60	Coffin		1.8 x 0.55 m	Coffin remains - Nails, pins/studs	Fe nails, Fe pins/studs	C 17/18th
61	Skeleton		0.7 x 0.15 m	Adult - Only partial left leg and fingers remain	Human bone	C 17/18th
62	Coffin		0.8 x 0.15 m	Coffin remains - Nails	Fe nails	C 17/18th
63	Cut		0.8 x 0.15 m	Sub-rectangular grave cut	-	C 17/18th

64	Fill		0.8 x 0.15 m	Grave fill	-	C 17/18th
65	Layer	0.15 m		Gravel layer	-	C 18/19th
66	Layer	1.0 m		Modern build up	-	C 20th
67	Natural	>0.4 m		Same as 5	-	-

APPENDIX 2 POTTERY ASSEMBLAGE

Ctx	Spot-date	Sherds	Weight (g)	Comments
2	19C	29	786	1x 19C Staffs transfer-printed whiteware. Range 12-18C wares incl 12C cpot rim in sub-St Neots shelly fabric w sl clubbed ext bevelled rim w light int thumbing. Also 11-12C simple clubbed cpot rim fine brown sandy w grey core & sparse calc inclusions. Bowl/pancheon rim coarse oxid sandy ?Bourne-type 15C? Also Bourne D ware (15/16C). Med greywares. PM redwares incl combed slip dec ?Norfolk type dish base & poss Ely Babylon kiln-type redwares. 1x 18C Staffs combed slipware dish
3	17-18C	33	334	Mostly med & late med but incl 4x def PM incl floor sherd (2 joining) Westerwald stoneware ?jug & 2x PM glazed red earthenware. Rest incl Bourne D ware (15/16C), late med sandy oxidised, Prob Ely-type or Lyveden (?LM) reduc sandy w fine calcareous/limestone incls & ext greenish-br glz, ?local reduc med grey sandy ware incl bowl w pouring lip, 4x Jurassic fossil shell-tempered 13-14C incl 3 bowl rims (sub St Neots-type tradition similar to Olney-type, Bucks.)
8	17-18C	11	206	4x PM glazed red earthenware incl 2 black glazed. Rest incl slip-dec Bourne D, LM oxidised sandy, 13-14C prob Ely-type ware incl jug rim
19	13-14C?	1	7	Bs shelly sub-St Neots
24	13-14C?	2	20	Bss prob Ely-type ware incl bs w traces white slip & patchy greenish-br glz. 1 poss cpot bs
35	13-14C?	1	32	Bs prob Ely-type ware reduc sandy w fine limestone incls, jug bs w LM-looking ext greenish-br glaze (similar in context 3)
46	13-14C?	1	39	Prob floor bs sagging base cpot. Prob fairly local hard fine grey sandy w sparse shell (mostly dissolved), rare flint. Ext sooted
58	13-14C?	1	29	Sagging base shelly sub-St Neots cpot/bowl
TOT		**79**	**1453**	

APPENDIX 3 SKELETAL CATALOGUE

Key:
/ - lost PM
X - Lost AM
B - Broken
C - caries
A - Abcess
NP- Not present
R- Root only
U - Unerupted
E - Erupting
PE - Partial eruption
PU - Pulp exposed
=- - Jaw not present
H - Hypolasia
Ca - Calculus
P - Periodontal disease
For stature estimations, the bone that was employed in the calculation is given next to the height.
An inventory for each skeleton is contained in the archive.

Skeleton Number 11

Age	Adult, Possibly older age range				
Sex	Unidentified		R		L
Preservation	Excellent	40%			
Dentition				No dentition	
Stature	1.71-1.74m (5'57"-5'67")	Tibia			

Pathology summary- posterior right tibia midshaft healed periostitis. Right patella osteophytic lipping 4mm medial/posterior aspect. Osteophytic lipping on distal 1st phalanges.
Musculoskeletal changes- marked muscle attachment sites on femur. Right tibia intercondylar area exotosis, torn cruciate ligament?
Non-metric traits- Calcaneus bilteral double facet

Skeleton Number 13

Age	25-35 years																	
Sex	Male		R															L
Preservation	Good	90%	ca	ca	ca	ca	ca	h ca	ca h	ca h	ca h	h ca	ca h	ca	ca	ca	ca	C ca
Dentition			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Stature	1.58 m (5'1")	Femur	C ca	ca	ca	ca	ca	ca h	ca h	ca h	ca h	h ca	h ca	ca	ca	X	ca C	ca

Pathology summary -Scoliosis from right to left starting at T12 up to and involving T1, alignment returns to midsaggittal plane in cervical spine, rib involvement. Sacralisation. Sacpula osteophytes grade 1 around margin of right glenoid fossa. The joint surafce is more than usual anteriorly rotated. Button osteoma left parietal on saggittal suture midway in line with parietal eminences. Right mandibular condyle looks flattened. Slightly enlarged with an altered bony contour. Asymmetry displayed in region of basilar.
Musculoskeletal changes- Right and left calcanea posterior surface enthesophytes grade 2. Bilateral patellae enthesophytes grade 1 anterior surface. Right humerus distal lateral posterior articular surface enthesophytes, from extensor? Would have restricted extension of the elbow.
Non-metric traits - calcaneus bilateral double facet. Bilateral Suprascapular notch, right larger than left .

Skeleton Number 18

Age	50+ years			
Sex	?male		R	L
Preservation	Good	70%		

Dentition No dentition

Stature 1.68-1.69m (5'51"-5'54") femur

Pathology summary - Bilateral amputee above the ankle, evidence for healing resulting in fusion of tibia and fibula distally. Fibula shaft very thin as are femurs and tibias - lack of use of limbs. Osteophytes on thoracic, cervical and lumbar vertebrae.
Musculoskeletal changes - Right scapula glenoid cavity rim small osteophytes superior and inferior. Right humeral head superior rim small osteohpytes, shaft has raised insertion on anterior surface - rotator cuff. Bilateral ulnae olecranon posterior osteophytes reaching superiorly. Also large raised area of bone just inferior to head on shaft. Bilateral femur raised muscle insertion along linea aspera, enthesphytes on anterior surface of greater trochanter neck.
Non-metric traits - Left suprascapular notch. Bilateral third trochanter, exostosis on trochanteric fossa

Skeleton Number 20

Age Adult
Sex ??Male R L
Preservation Excellent 15%
Dentition No dentition

Stature 1.73-1.75m (5'67"-5'74") tibia

Pathology summary - Right distal and mesial pedal phalanges fused (ankylose).

Musculoskeletal changes - Right calcaneus lateral side small tubercle of bone for extensor ligament. Bilateral 1st foot phalanges enthesophytes on plantar surface.
Non-metric traits - calcaneus bilateral double facet

Skeleton Number 23

Age 45+ years
Sex Male R L
Preservation Excellent 55%
Dentition No dentition

Stature 1.61-2 m (5'28"- 5'31") femur

Pathology summary - Schmorl's nodes T12 and L5
Musculoskeletal changes -Right 2nd metacarpal proximal end styloid process very pointed in morphology. Right scaphoid distal superior surface bony projections, enthesophytes. Right patella 2 small enthesophytes on the anterior superior surface.
Non-metric traits - None.

Skeleton Number 30

Age 28-40years
Sex ? Male R L
Preservation Excellent 60%
Dentition No dentition

Stature 1.71 m (5'61") femur

Pathology summary - Bilateral tibia upper midshaft anterior surface healed periostitis.

Musculoskeletal changes - Bilateral 1st cuneiforms enthesophytes grade 1 on medial superior margin, more pronounced on right. Left ilium iliac crest enthesophytes
Non-metric traits Left calcaneus double facet, not right.

Skeleton Number 31

Age 40-50 years
Sex Female

		R																L
Preservation Excellent 50%									/	/		/	X	X	X			
										A								
Dentition		-	-	-	-	-	-	-	-	1	2	3	4	5	6	-	-	
		8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Stature 1.59 m (5' 2")	humerus	X	X	X	X	/	h	/	/	h	/ C	h	C	X	X	X		

h C

Pathology summary - Lower right canine chipped/worn unevenly - pipe facet. Spinal osteophytes, eburnation, Schmorl's nodes and porosity cervical 5 to and including thoracic 12.
Musculoskeletal changes Right calcaneus lateral tubercle enlarged for extensor ligament.
Non-metric traits right calcaneus facet double.

Skeleton Number 35

Age	35-45 years																		
Sex	Male		R																L
Preservation	Excellent	99%			X				/	/						X			
Dentition			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8	
Stature	1.66 m (5'44")	femur	np		X			h	h	h	h Ca	Ca h	h	A		X		np	

Pathology summary - Spinal osteophytes, porosity, eburnation, schmorl's nodes T1-L5. T3&4 fused by inferior process. T4-7 wedge shaped bodies. Sacrum has 6 segments. S1 arch not fused. 3rd cervical vertebra spinous process on left not fully formed. 1 left and 1 right rib ostepohytes on head. Button osteoma left parietal centre towards frontal. Ossified thyroid cartilage.
Musculoskeletal changes - Right and left calcanea, lateral side, groove for extensor ligament, left more prominent than right. Posterior of calcanea enthesophytes (achilles tendon). Left femur posterior large muscle insertions along linea aspera, lesser trochanter, greater trochanter neck on lateral side and anterior. Right femur posterior enlarged muscle insertions along linea aspera, enthesophytes on lesser trochanter and greater trochanter neck lateral and interior sides. Both pelves exhibit enlarged muscle insertion points, especially in the area between the pubis and inferior iliac spine. Right humerus has enlarged muscle attachment sites anterior shaft, relating to *Pectoralis Major* and *Teres Major*.
Non-metric traits - Possible shovelling on upper I2 left, heavy attrition prevents accurate diagnosis. Left maxilla small torus at level of M3. 1 left and 2 right lambdoid ossicles. Right suprascapula notch. Bilateral exostosis in trochanteric fossa.
Pipe facet involving lower right canine and 1st molar and upper right canine. Right transverse process of cervical 3, 4 and 5 bifid bilaterally.

Skeleton Number 41

Age	50+ years																	
Sex	? female		R															L
Preservation	Excellent	30%																
Dentition			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stature	-																	

Pathology summary - Slight porosity on frontal and parietal bones around bregma, possible poroti chyperostosis, though not definitive. Ossified thyroid cartilage. Osteophytes, porosity, eburnation on cervical 2 to and including thoracic 2. All teeth lost antemortem.
Musculoskeletal changes - Bilateral scapulae lipping around glenoid cavity. Lipping on rib articular processes.
Non-metric traits

Skeleton Number 43

Age	Adult			
Sex	?? female		R	L
Preservation	excellent	20%		
Dentition			No dentition	
Stature	1.64-5m (5'38"-5'41")	tibia		

Pathology summary - Bilateral tibia and fibula posterior surface midshaft displays healed periostitis with lamellar new bone growth. Right tibia has a medio-lateral indentation interpreted as a blood vessel marking either side of which is periostitis. Left fibula demonstrates more bony change than tibia. Infection must have lain where tibia and fibula lie perpendicular to one another.
Musculoskeletal changes. - right calcaneus small tubercle on lateral side for extensor ligament. Right talus posterior tubercle is larger than left. Left and right 1st distal pedal phalanges osteophytic growth on medial side.
Non-metric traits - left foot two sesmoid bones

Skeleton Number 44

Age	Adult (older age range)				
Sex	??? Female		R		L
Preservation	Excellent	20%			
Dentition				No dentition	
Stature	1.66-1.68 m (5'44"-5'51")	radius			

Pathology summary T12 inferior articular process ligamentum flavum
Musculoskeletal changes - left tibia proximal fibular facet very slight enthesophytes grade 1
Non-metric traits

Skeleton Number 48

Age	adult				
Sex	unidentified		R		L
Preservation	Excellent	8%			
Dentition				No dentition	
Stature	-				

Pathology summary
Musculoskeletal changes.
Non-metric traits -bilateral calcaneus double facet.

Skeleton Number 52

Age	40-50 years																	
Sex	Male		R															L
Preservation	excellent	90%	?	X	C A ca	R	R	R ca	ca	ca		/	R	ca	ca	ca	ca	?
Dentition			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Stature	1.69-1.71 m (5'54"-5'61")	femur		X	X		ca	ca	ca	/	ca	ca	ca	ca	ca	X	X	X

Pathology summary - Periodontal disease. Unusual attrition caused by overbite and tooth loss. Left 1st incisor crack mesio-distal. Distal right humerus periostitis anterior proximal to condyles and posterior to the olecranon fossa uneven osteophytic bone growth. Distal right humerus epicondyle small raised linear osteophytic bone growth with small patch of eburnation. Right ulna head osteophytic growth on coronoid process proximal direction 5 mm long. Left ulna head olecranon semi-lunar notch medial side small patch of microporotic bone. Spinal osteophytes, eburnation, schmorl's nodes involving cervical 3 to and including lumbar 4. Right lunate eburnation on superior lateral surface. Left lunate eburnation on superior lateral surface. Left 1st proximal pedal phalanx distal end healed fracture (?) on head running superior-inferior. Right ribs, mid rib head end superior surface active periostitis. Left femoral head anterior surface edge towards greater trochanter small area of raised bone with eburnation. Bilateral bipartitie first cuneiforms, with some porous bone to the side of the articulating surface, with micro eburnation on right one. Left articulating facet of lumbar 5 and 1st sacral not fully formed , aplasia. Cervical 3 right side spinous process not fully developed. Right 1st metatarsal distal head is flattened with surrounding osteophytes in the dorso-plantar aspect. Corresponding proximal phalanx articular surface has osteophytic growth on the lateral edge, the distal phalanx also on the lateral edge of the artiuclar surface.
Musculoskeletal changes- Bone former, muscle attachment sites are pronounced all over.
L & R distal humerii osteochondritis dissecans on the lateral epicondyle. Left patella anterior surface linear enthesophytes superior end. Bilateral calcaneii lateral surface tuberosity with dorsal articular surface, for extensor ligament.
Non-metric traits - Left and right mastoid foramen. Bilateral calcaneus double facet. Bilateral femoral plaque

Skeleton Number 53

Age	18-25 years																	
Sex	Male		R															L
Preservation	excellent	97%	pe			ca	ca		/	ca	ca	ca	ca	ca	ca	ca		pe
Dentition			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Stature	1.68 m (5'51")	femur	e	ca	ca	ca	ca	ca	ca	ca	ca	ca	ca	ca	ca	ca	C	e

a

Pathology summary - Possible porortic hyperostosis on the occipital, left and right parietal and posterior of frontal. Orange peel look, though nothing in orbits to suggest cribra, may not be anaemia, scalp infection. Not 'hair on end' enough for diagnosis. Left ulna trochlea notch small 5mm area of necrotic bone, osteochondritis dissecans. Periostitis left femur posterior shaft, runs linear 9 mm wide, related to muscle attachment? Anterior medial shaft area also. Right femur posterior shaft active periostitis runs medial to linea aspera, more distal than left. Left tibia posterior medial margin healed periostitis distal shaft , right tibia anterior midshaft healed periostitis. 6 lumbar vertebrae. 1st Sacral arch unfused.
Musculoskeletal changes - left humerus moderate furrow on upper shaft anterior. Right humerus moderate cortical defect upper shaft anterior surface and a further one more medially. Left and right clavicles have a cortical defect medially inferior, costo-clavicular ligament. Proximal fibulas posterior side just below head , small area of raised porous bone growth and thickened shafts.
Non-metric traits -supernumerary peg-shaped tooth between left mandibular premolars lingual aspect. Shovelling on both upper central incisors grade 2. Bilateral calcaneus double facet. Left scapula notch. Cervical 5 left transverse foramen bipartite, cervical 6 left and right and cervical 7 right only.

Skeleton Number 57

Age	30-40 years																	
Sex	Male		R															L
Preservation	excellent	99%	/	X	/	/	/	X	/	/	/	/	/	/	/	/	X	
												A						
Dentition			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
			8	7	6	5	4	3	2	1	1	2	3	4	5	6	7	8
Stature	1.65 m (5'41")	femur	X	C	C	ca	ca	ca	C		ca	/	ca	/	/	X	X	/
								C	ca		C		C					

Pathology summary - Periodontal disease considerable all over dentition. Sacralisation of 6th lumbar vertebrae. All sacral arches cleft, spina bifida occulta? Cervical 1 right superior facet underdeveloped. Left and right maxillary sinus new bone growth , sinusitis. Schmorl's nodes thoracic 7 to and including thoracic 9, osteophytes lumbars 4 & 5.
Musculoskeletal changes - Left tibia exostosis leading distally from superior fibula facet, 10mm. Right tibia medial superior side inferior to epicondyles small exostosis 7mm . Left and right calcanea lateral sides small tubercle with a smooth area inferiorly for extensor ligament. Right navicular tuberostiy enlarged inferiorly. Left and right clavicles, medial inferior cortical defect, costo-clavicular ligament.
Non-metric traits -1 left lambdoid ossicle. Cervical 5 and 6 double transverse foramina

Skeleton Number 61

Age	Adult			
Sex	?? female		R	L
Preservation	Excellent	15%		
Dentition			No dentition	
Stature	1.44 m (4' 72")	tibia		

Pathology summary - very petite individual
Musculoskeletal changes - left calcaneus enlarged tubercle on plantar lateral surface and slight lip on the lateral surface, small groove for extensor ligament. Left Femoral shaft is very flattened.
Non-metric traits

APPENDIX 4 BIBLIOGRAPHY AND REFERENCES

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APPENDIX 5 SUMMARY OF SITE DETAILS

Client name: Jackson Civil Engineering Ltd. on behalf of the Environment Agency.
Site name: Hemingford Flood Alleviation Scheme, St. Ives, Cambridgeshire
Site code: STIVHE06
Grid reference: NGR TL 29645 71228
Type of work: Removal of canal bank, initial watching brief followed by subsequent excavation of burial ground affected by the proposed construction works
Date and duration of project: 12th September - 4th November 2006, 18 days
Area of site: 16.56 sq. m
Summary of results: Late 17th to early 18th century Quaker burial ground comprising sixteen excavated inhumations. Graves contained associated coffin nails and fittings of the period. Medieval pottery found on the site, presumably from earlier occupation activity.
Location of archive: The archive is currently held at OA, Janus House, Osney Mead, Oxford, OX2 0ES, and will be deposited with Cambridgeshire County Museum in due course under the site code.

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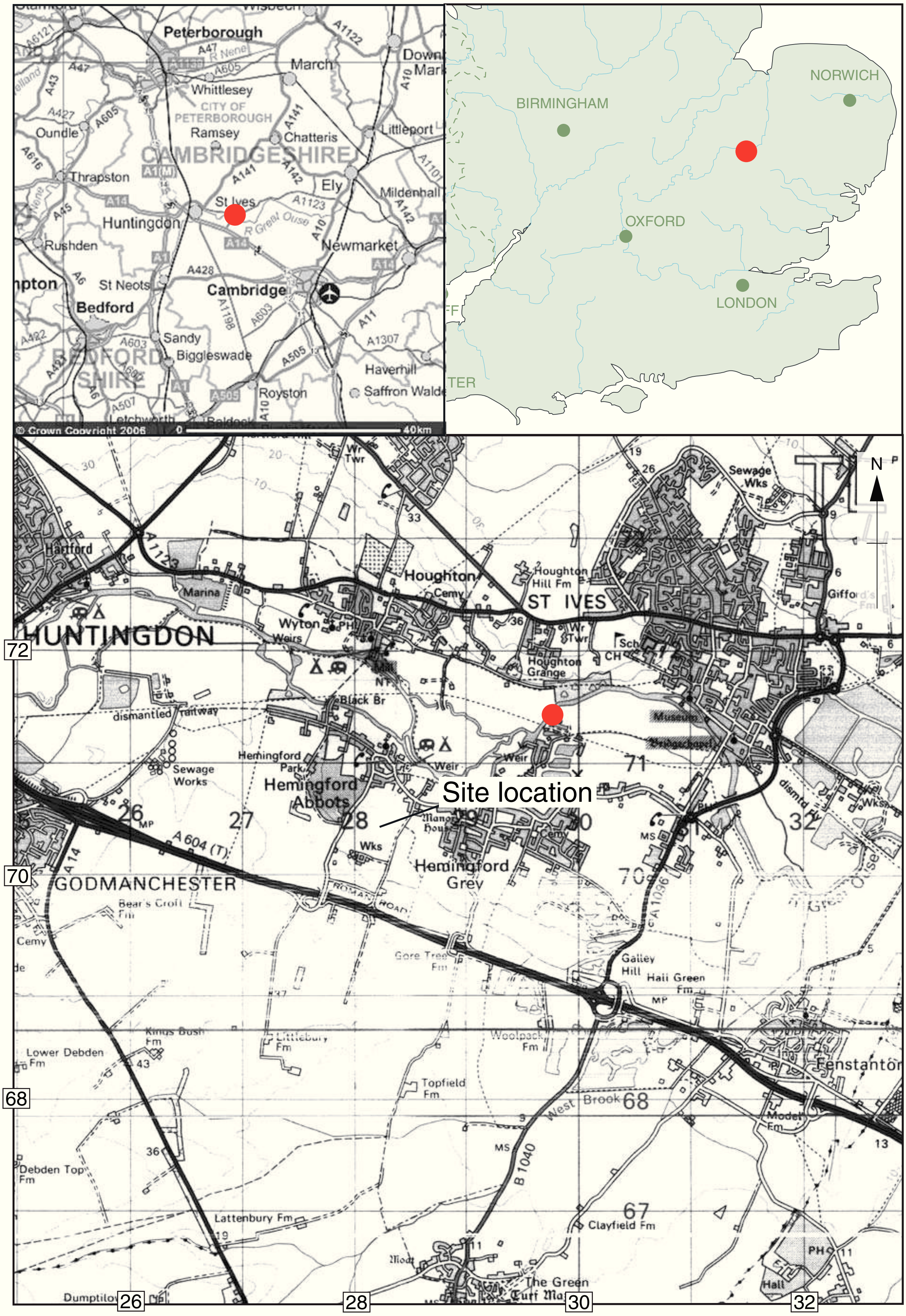

Scale 1: 50,000

Figure 1: Site location

Reinforced bank
Excavation area
OS Grid point
Site location point
OS basemap

Survey Data supplied by:
Jackson Civil Engineering/OA

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0 5 m

Scale at A3 1:200

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Hemingford flood alleviation scheme

Drawing No.	OA1
Date printed	18 Jan 2007
Drawing title	

Figure 2: Watching brief and excavation area

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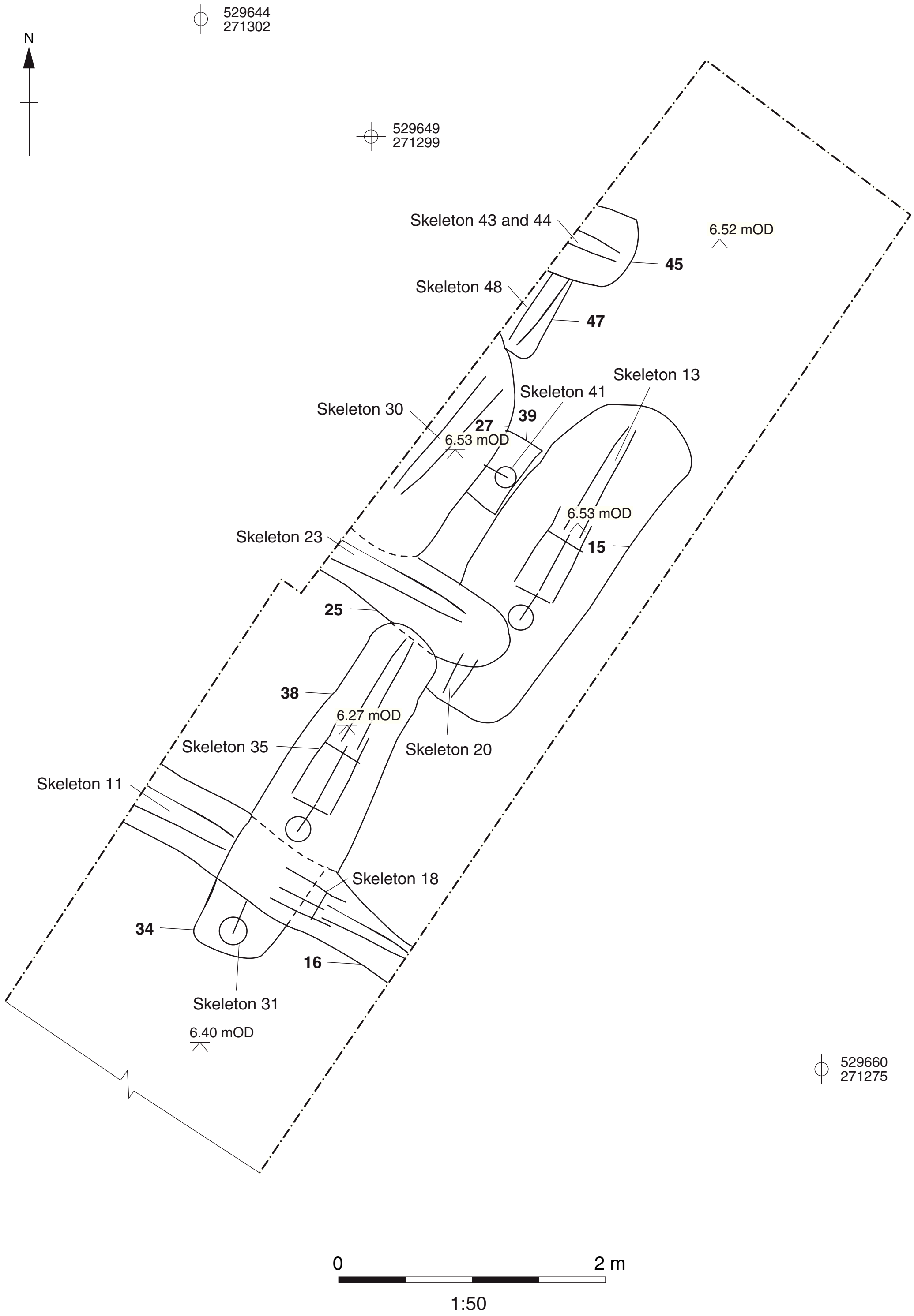

Figure 3: Site plan showing graves 15, 16, 25, 27, 34, 38, 39, 45 and 47

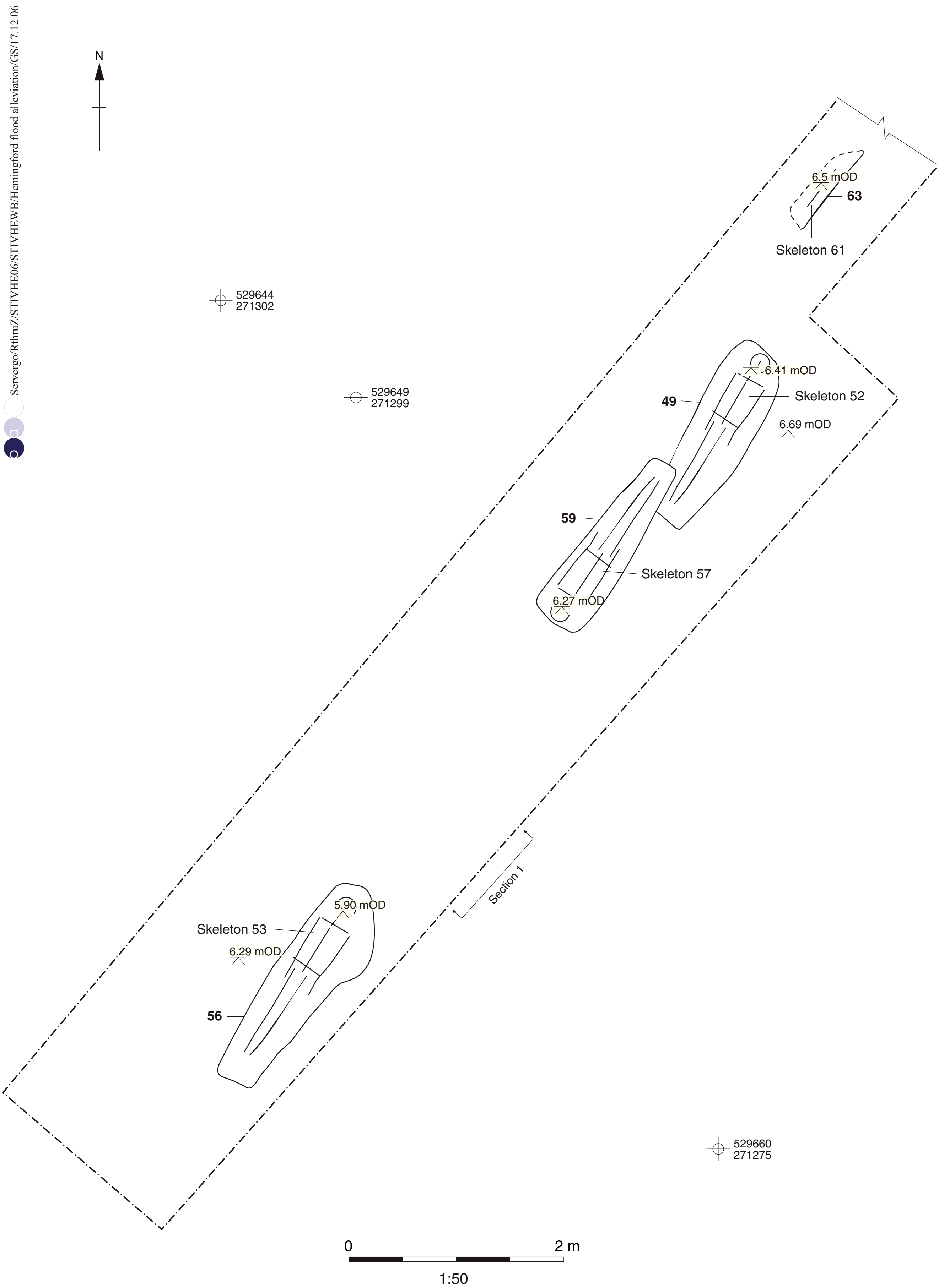

Figure 4: Site plan showing graves 49, 56 and 59

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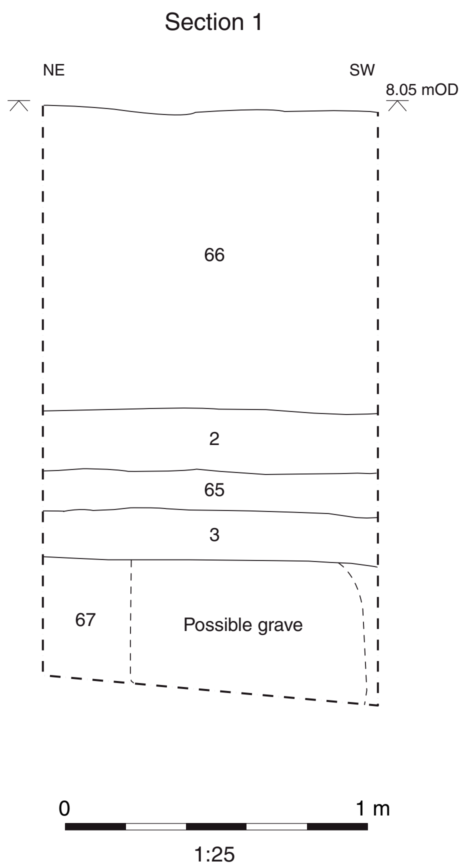


Figure 5: Section 1

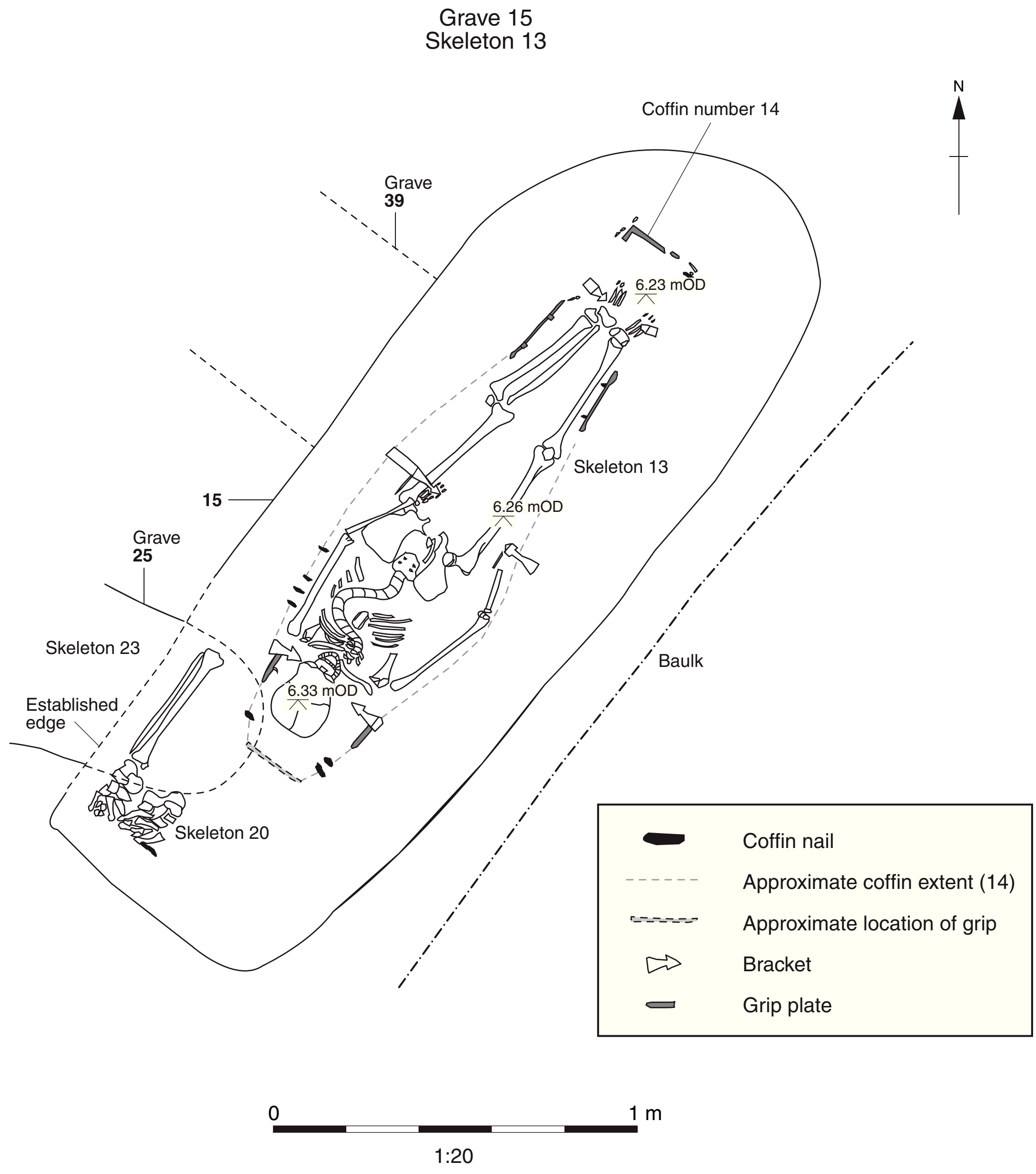


Figure 6: Plan of grave 15 with skeleton 13

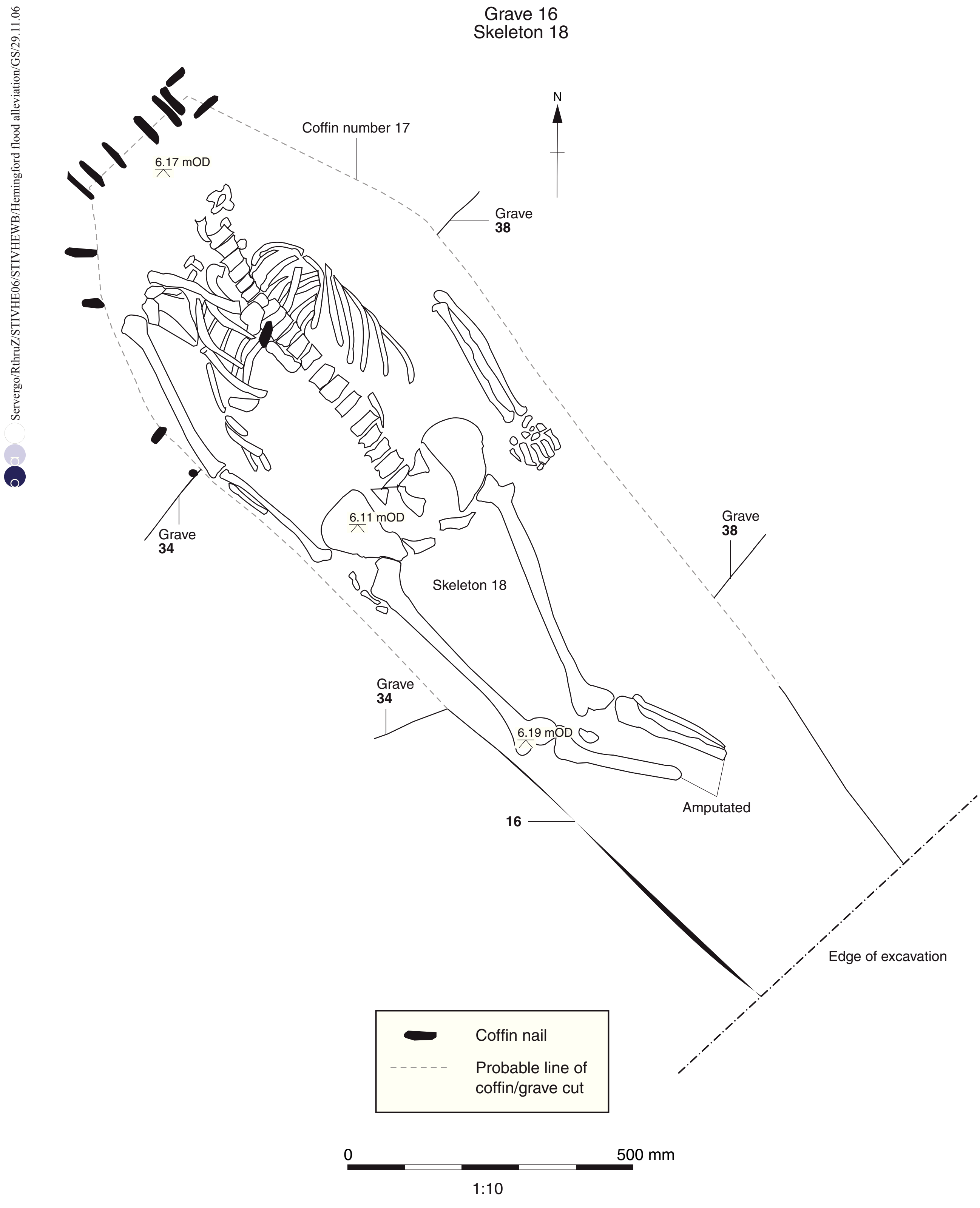


Figure 7: Plan of grave 16 with skeleton 18

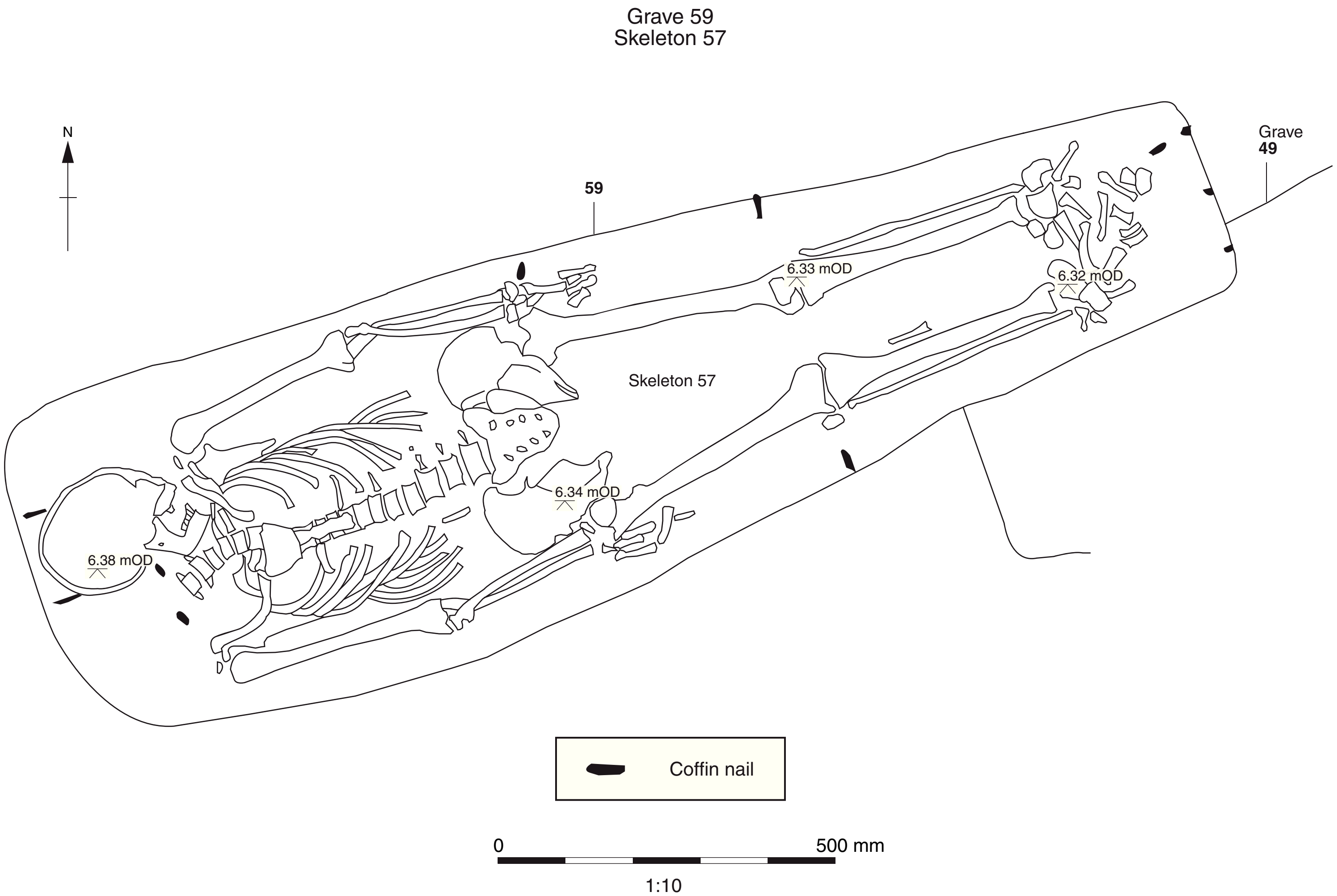


Figure 8: Plan of grave 59 with skeleton 57

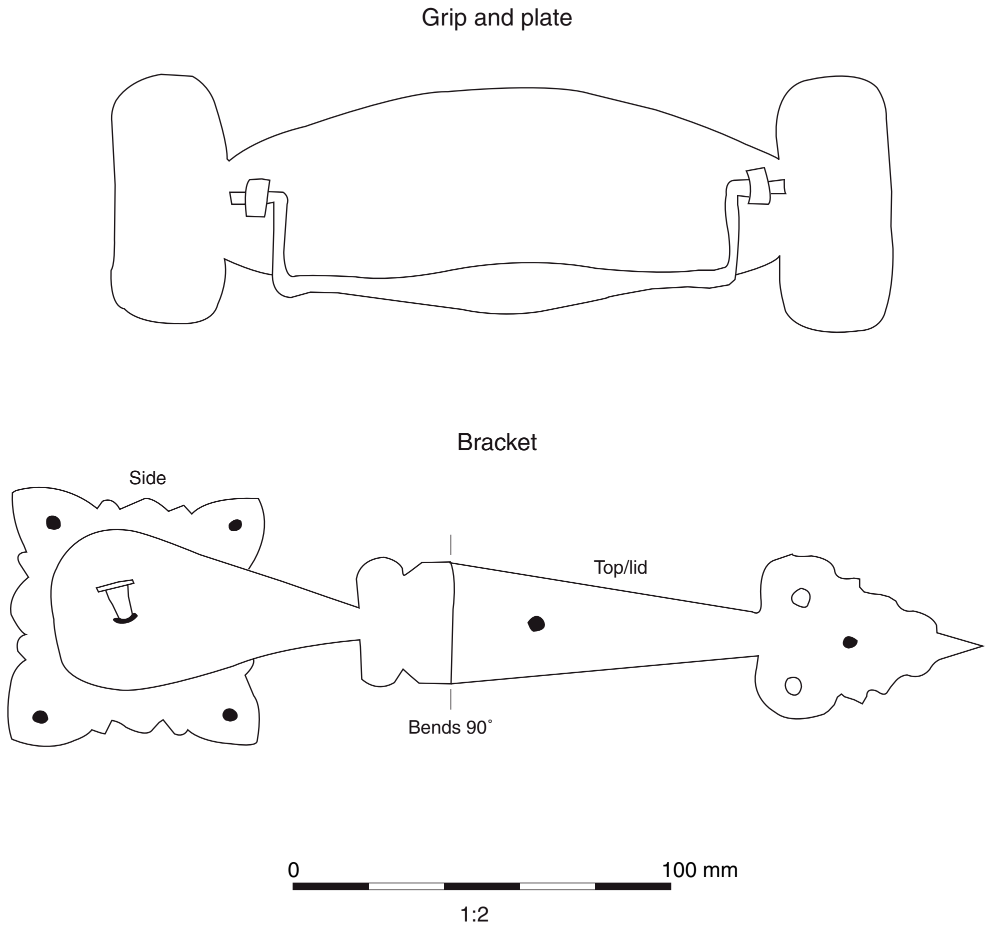


Figure 9: Grip, plate and bracket from coffin 14

Plate 8: View to southwest of skeleton 13 and coffin 14

Plate 9: Close-up of skeleton 13 with scoliotic spine and brackets of coffin 14 *in situ*

Plate 10: Close-up of scoliotic spine of skeleton 13 *in situ*

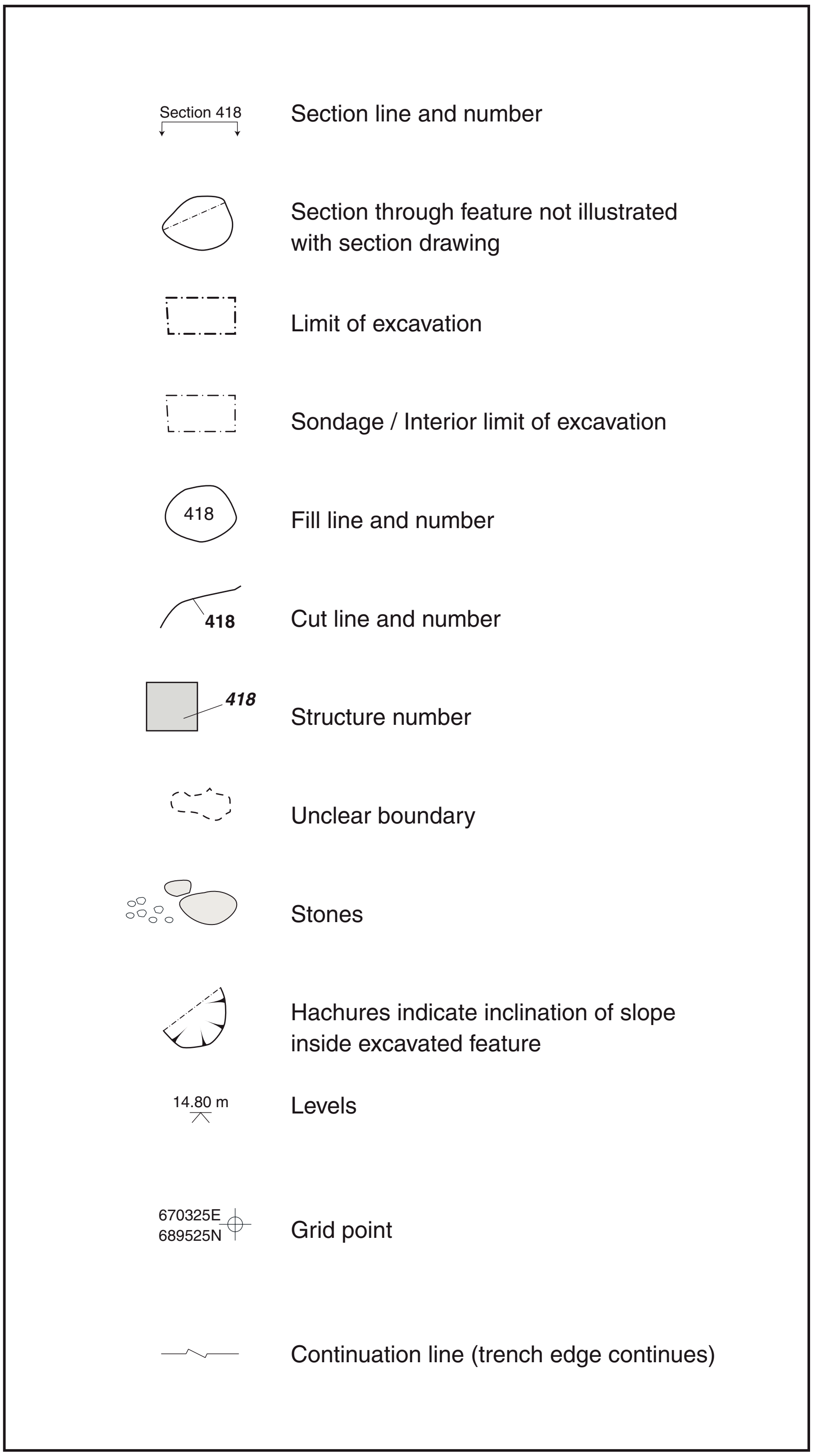
Plate 11: View to northwest of skeleton 18 with above ankle amputation

Plate 12: View to southwest of skeleton 35

Plate 13: View to southwest of skeleton 57

Plate 14: View to northeast of skeleton 52

Plate 15: View to southeast of coffin 29 and skeleton 30



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