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A Black Death Mass Grave at Thornton Abbey, Lincolnshire: the discovery and examination of a 14th-century rural catastrophe

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Excavations undertaken by the University of Sheffield at Thornton Abbey, Lincolnshire unexpectedly revealed a previously unknown medieval cemetery, which included a large single mass grave contained within a subcircular depression. This burial included the remains of at least 48 men, women, and children, who had clearly been struck down during a single catastrophic event. Radiocarbon dating suggests this took place in the 14th-century, and the positive identification of the pathogen *Yersinia pestis* from sample skeletal remains confirms that they probably died as a result of the Black Death, which first arrived in North Lincolnshire during the spring of 1349. Such mass graves are extremely rare, and this is the first confirmed Black Death mass burial to have been found in the UK outside of a major town, providing unique evidence for the devastating impact of this epidemic upon an ordinary small rural community.

Keywords: UK, Thornton Abbey, Black Death, Mass Grave, *Yersinia pestis*

Introduction

The devastation caused by the appearance of the so-called Black Death, or second great plague pandemic, in England during 1348-9 is hard to underestimate. It is generally recognised that between one third and half the population died in less than two years, and reoccurring outbreaks throughout the 14th-century, whilst less devastating, still took a significant toll on the population (Horrox 1994: 3-4). To date, the archaeological evidence for this disaster, in England at least, is relatively slight. It is well documented that in London two emergency cemeteries were opened specifically to cope with the overwhelming numbers of plague dead. Archaeological excavations at East Smithfield have confirmed the presence of one of these, and shed light on how the urban authorities were forced to cope with the growing emergency, particularly through the use of mass graves (Grainger et al. 2008). That the Black Death had an equally devastating effect on more dispersed rural communities is well documented, most

eloquently by Hatcher's (2008) narrative account of the suffering experienced by the villagers of Walsham, Suffolk which was drawn from the extensive surviving manorial court records. Nonetheless, in many accounts of the Black Death there is an assumption that rural communities, with their far smaller populations, might have been better placed to cope with the ordinary burial of the dead, and not needed to resort to the use of mass burials, apparently corroborated by the lack of archaeological evidence for non-normative burial practice in rural cemeteries. However, results of excavation recently undertaken within the precinct of Thornton Abbey, Lincolnshire questions this position, and demonstrates that isolated rural communities could face similar, if even greater, challenges in the face of such catastrophic mortality.

Thornton Abbey was founded as an Augustinian house in 1139, and due to its involvement in the burgeoning wool trade, the abbey prospered during the later Middle Ages (Figure 1). Shortly before its closure on 12 December 1539, during the Dissolution of the Monasteries, it was said to have an annual revenue of £591 0s 2³/₄d, making it one of the richest monastic houses in England (Page 1906: 165-66). The roughly rectangular monastic precinct, defined by moats, banks and walls on three sides and a stream on the fourth, covers an area of some 30 hectares and represents one of the most complete monastic precincts in the country (Coppack 1991: 37). Since 2011, the University of Sheffield has undertaken a comprehensive archaeological characterisation of the entire monastic precinct, including geophysical and topographical survey, as well as targeted excavation.

During 2013, the focus of the excavation shifted to an area referred to as a 'hillock' or 'mound' situated to the south of the inner precinct wall close to a secondary medieval entrance into the outer precinct (Figure 2). Rather than being an artificial mound, this feature is now known to be a natural promontory of glacial sand and gravels extending from the higher ground to the west, which was later truncated by the construction of the boundary moat of the monastery. Today, as in the medieval period, this area remains the precinct's highest point, rising over 2-3m above the remainder of the flat monastic enclosure. It was thought that the mound, with its distinct earthworks, might be the location for possible post-Dissolution, rather than medieval, activity. To confirm this possibility, an earth resistance survey was undertaken which showed a clear sub-rectangular high-resistance feature measuring approximately 15 x 10m in the north-eastern corner of the mound (Figure 3). This feature was directly aligned with a breach in the inner precinct wall and the earthwork remains beyond that was thought to be a mansion built in 1607 (Roberts 1984). As such, it seemed likely that some subsidiary post-medieval structure or garden feature was located here and, therefore, a trench was opened to explore this area of the site.

The Mass Grave

Rather than the expected structural remains, the excavation immediately produced multiple articulated human skeletal remains. Although cut features were initially difficult to see at first as the mound consisted almost purely of sand, the arrangement of the skeletons indicated they were from a single burial event rather than individual interments, and this was the cause of the high resistance geophysical anomaly. Although ordinarily a cut feature might be expected to create a lower resistance, a high reading may have been caused by the sandy matrix of the mound itself, the digging and immediate backfilling of the grave, and the placement of such a high density of bodies, resulting in a looser fill which allowed water to drain more freely and thus creating a high resistance geophysical anomaly comparative to the undisturbed surroundings. A Tigre Resistivity Profiler revealed it to be a shallow feature, only 40-60cm deep, with a slightly irregular flat base and shallow sloping sides (Figure 3), which correlated with the distribution of burials. This led to the interpretation of this feature as a mass grave.

Over the course of two summer field seasons in 2013-14, the feature was fully excavated. Given the sandy soil conditions, poor bone preservation, the numbers of dead involved and time required to excavate them, the whole grave could not be exposed at once. Instead, skeletons were individually located, excavated, recorded using georectified photography and lifted at once to minimise deterioration of the bones. Consequently, it was only possible to reconstruct a full plan of the burial in post-excavation (Figure 4).

Deposition and treatment of the dead

Throughout the grave, the dead were deposited and treated with great care. In almost all cases, apart from for the very young, it was apparent that the bodies were bound in shrouds, due to the transversal compression of the shoulders suggestive of their having been bound (see Nilsson Stutz & Larsson 2016 for an overview of the evidence for the wrapping of bodies). The bodies were all placed into the grave a single layer in eight overlapping rows, often with the lower legs and feet of the adults from one row being placed between the heads of another (Figure 5). None were intercutting, although some were clearly touching when fleshed, but occasional differences in level between the rows of bodies might suggest that the grave was filled over the course of several days or weeks, with each phase being partially backfilled, rather than in one instance (Duday 2008: 50). Throughout the grave younger children were interspersed between larger individuals, with a particular clustering around the northern corners of the grave. With the exception of a single late medieval double oval loop belt buckle, which was probably an

accidental inclusion within the grave as it was not in direct association with a body, no personal artefacts or other dress accessories were found.

After the burial had been backfilled, there continued to be occasional much later interments cutting through the grave, whilst later quarrying had disturbed and partly removed portions of the centre and easternmost edge. This subsequent disturbance, along with the fact that many of the skeletons were in a fragmented condition when found, masked the true extent and layout of the grave. However, when the original layout of the bodies is reconstructed using digital data from the positions of the skeletons, the true simultaneous nature of the burial becomes clear (Figure 6).

The population, dating and possible cause of death

In total, a minimum of 48 individuals was recovered, although given the later disturbance subsequent burials and quarrying this is probably an underestimation of the original number who were buried here. Biological age of these individuals was estimated from dental and skeletal growth and development in the non-adults (Moorrees et al. 1963; Anderson et al. 1976; Scheuer et al. 1980; Scheuer & Black 2000) and degenerative changes of the skeleton and dentition in the adults (Miles 1962; Lovejoy et al. 1985; Brooks & Suchey 1990). The age categories observed were young child (1-5 years), older child (6-11 years), adolescent (12-17 years), young adult (18-24 years), prime adult (c.25-34 years), mature adult (c.35-44 years) and older adult (c.45+ years). The burial exhibited a high proportion of non-adults (56.2%; 27/48), aged between one and 17 years at the time of death, and no infants below 12 months were recovered, the mortality profile of the assemblage is shown in Figure 7. However, this might in part be explained by the harsh soil conditions that resulted in very poor bone preservation, especially in the young (Figure 8). Amongst the adults for which an accurate sex estimation could be attained using morphological characteristics of the skull and pelvis (Buikstra & Ubelaker 1994), there was a greater representation of males in comparison to females (males = 11; females = 6). However, the presence of both men and women indicates that despite the location of the grave within the outer precinct of the monastery, those buried there must have been members of the local secular community rather than the monastic population. Given the number of dead who were buried in a single episode, it seems likely that the grave was a response to a single catastrophic event.

The radiocarbon evidence from two sampled skeletons from the centre of the grave, provide a consistent date of cal AD 1295-1400 (at 95.4% probability) and AD 1295-1404 (at 95.4% probability), whilst ceramics and two silver pennies of Edward III (r. 1327-77) found

within the grave fill provide a terminus post quem of first third of the 14th century. Whilst there are potentially many factors that might account for this mass fatality, the most likely cause is the Black Death, which arrived in this part of northern Lincolnshire during spring and early summer of 1349 (Horrox 1994: 10). In that year, the chronicle at the Cistercian Abbey of Louth Park, 40km to the south of Thornton Abbey, recorded that ‘obierunt multi Monachi de Parco Lude. Inter quos obiit Dompnus Walterus de Luda, Abbas’ (many of the monks of Louth Park died. Among them died Walter of Louth, abbot) (Venabals 1891: 38). The situation was as serious, if not worse, at Meaux Abbey just 18km from Thornton. Its chronicle noted that, of the original community of 50 monks and lay brothers, just ten survived the Black Death and, perhaps more significantly given the Thornton evidence, that ‘major pars tenentium nostrorum in diversis locis obissent’ (the majority of our tenants in different places be dead) (Bond 1868: 37).

Whilst the initial outbreak of plague in 1349 would seem the most likely cause of mass death in the 14th-century, it should be noted there were a number of subsequent, and no less deadly reoccurrences throughout the second half of the century (Bolton 1996). An outbreak in 1361/2 was particularly virulent in eastern England, and appeared to several contemporary chroniclers to have disproportionately targeted children (Horrox 1994: 85). Indeed, the Louth Park Chronicle was caused to note ‘fuit mortalitas hominum, sed maxime juvenum et puerorum, unde pestilentia puerorum communtier nuncupatur’ (there was a mortality of men, but chiefly adolescents and boys, as a result it is commonly called the pestilence of boys) (Venabals 1891: 40). Given the broad range of the radiocarbon dates, the mass grave from Thornton could easily have resulted from this or one of the other subsequent outbreaks of plague during the latter half of the 14th century.

Identification of *Yersinia pestis*

Given the distinct possibility that the mass grave resulted from the arrival of the Black Death, molar teeth from 16 individuals were sent to the McMaster Ancient DNA centre in Ontario, to see if any evidence for the pathogen *Yersinia pestis* had survived, although given the generally poor state of skeletal preservation, it was not anticipated that there would be a very significant chance that DNA would survive. Ancient DNA was extracted using a customised protocol for ancient samples (Dabney et al. 2013), with each extract molecularly screened for the presence of a plague-specific gene (Wagner et al. 2014). Of 16 individuals sampled, one (Sk36) tested consistently positive for *Yersinia pestis* across all technical replicates. To further confirm the presence of plague in this individual, the extracted DNA was converted into the format required

for next-generation sequencing, a process known as DNA library preparation (Meyer & Kircher 2010). Sequenced molecules were inputted into multiple taxonomic classification programmes to identify the presence of *Yersinia pestis* via an ensemble approach (McIntyre et al. 2017).

Only 1 molecule in Sk36 was identified as having sequence similarity to *Yersinia pestis* and 11 molecules were identified at the species complex level for *Yersinia pseudotuberculosis*. Given these low-abundance estimates, a whole genome capture approach was used instead to try to increase the proportion of available *Yersinia pestis* molecules for analysis. This process removes contaminants and uninformative sequences and has contributed to the successful retrieval of ancient pathogens including plague (Bos et al. 2011), cholera (Devault et al. 2014), and smallpox (Duggan et al. 2016). Whole genome enrichment for *Yersinia pestis* dramatically improved recovery rates, transforming the *Yersinia pseudotuberculosis* complex from nearly indistinguishable from sequencing noise to the second-most abundant taxa (Figure 9). Sensitivity at the species level also improved, with *Yersinia pestis* becoming the third most abundant taxa. The abundance of *Homo sapiens* also rose, in both Sk36 and the negative control which may be caused by sequence similarity between the baits and the human genome. Furthermore, marker gene analysis predicted *Yersinia pestis* to be the only identifiable species based on successful alignment to 17 marker genes.

Given the concordance of multiple lines of evidence including PCR screening, shotgun classification, and whole-genome enrichment there is no question as to the plague content of this sample. However, further genome sequence data is required to identify the precise plague strain present at Thornton Abbey. Currently, it is speculated to be closely related to the East Smithfield strain from the 1348/9 outbreak, and further analysis will reveal how Thornton Abbey plague was connected to other outbreaks of plague in England, and throughout Europe, in order to reconstruct the historical spread of this disease.

The setting of the burial

Later medieval Black Death cemeteries are surprisingly rare in England. The best known are the two historically documented emergency burials grounds established at East and West Smithfield, London. The East Smithfield cemetery has been partially excavated and, in addition to ordinary single interments neatly laid out in rows, is well-known for a series of long mass burial trenches in which the dead were placed side by side (Grainger et al. 2008). Furthermore, recent aDNA analysis of up to 200 samples from East Smithfield has revealed traces of *Y. pestis* in a number of individuals here (Schuenemann et al. 2011; Bos et al. 2011). Very limited excavations earlier in 2014 on the site of the West Smithfield cemetery have also found the

remains of victims of the Black Death and the *Y. pestis* bacterium, although these were all interred in individual grave cuts (Pfizenmaier 2016). The only other late medieval simultaneous burials in England comparable in terms of form, if not size, to Thornton Abbey were excavated at Hereford Cathedral in 1993. Three rectangular pits containing between 200-300 individuals were found (Stone & Appleton-Fox 1993: 46-8). C¹⁴ dated to AD 1335±54, *Yersinia pestis*-specific aDNA has been recovered from tooth pulp from several individuals (Haensch et al. 2010), although the stratigraphic report and full osteological analysis has yet to be published.

What sets the mass burial at Thornton Abbey apart from other 14th-century examples is its rural location and monastic association. Whilst it might reasonably be expected that the concentrated populations of urban centres would be particularly prone to infectious disease, and potentially provide very large numbers of dead who needed a swift burial, this might also have been the case in a rural community. Studies have demonstrated that in many cases mortality rates could be as proportionally high in rural contexts (e.g. Benedictow 1987), although the lower overall numbers of dead requiring disposal would normally have made it easier to continue accepted burial practices (Kacki et al. 2011; Bianucci & Kacki 2012). Furthermore, the location, within a monastic precinct but clearly separated from the usual burial ground around the monastic church (see Figure 2), and of a burial containing an apparently mixed secular rather than religious population requires further explanation. The medieval parish church at Thornton Curtis was the established centre for local secular worship and burial from the 11th century onwards, and it is here that ordinarily interments took place. As such, there must be a particular reason that the mass grave was dug at the abbey, possibly at a point where the parish church could no longer accommodate the high number of victims needing to be buried.

Whilst the parish church might be the prime focus for interment, there was another institution that acted as the focus for medieval burial during the Middle Ages: the hospital. Medieval hospitals were religious institutions that provided a variety of services to the needy including assisting pilgrims, providing alms to the poor, and helping the sick and dying. These centres were usually run along monastic principles and were often attached to an established religious house (Gilchrist 1995: 8-14). Certainly many, if not most, had associated graveyards where the dead could be interred, and excavations have revealed numerous multiple or mass burials. The most extensively excavated example in England is St Mary Spital, where 175 large burial pits were found with multiple interments, of which over 100 contained 15 or more burials, whilst the largest held 43 individuals (Connell et al. 2010: 217).

Although all the St Mary Spital pits were far smaller in size than the mass grave at Thornton, and largely of an earlier date, it is clear that medieval hospitals were accustomed to handling the burial of large numbers of individuals, and the presence of a community of the religious would have made it possible to manage the numbers of dead. This is a pattern that can also be seen across continental Europe, where the excavations of a number of hospital sites have revealed mass graves. Perhaps the best known is the Heiligen-Geist-Hospital in Lübeck where 21 multiple burials were excavated (Prechel 1996; Lügert et al. 2002); the majority of these contained fewer than ten individuals, although three contained between ten and 25, with two other burials containing 121 and 169 individuals (Lügert et al. 2002: 160). In France, multiple burials have also been found on excavations of hospital sites; at l'hôtel-Dieu le Comte in Troyes, 104 individuals were found buried in ten different rectangular pits (Réveillas 2010: 129-42). Although dating to the late 17th to early 18th century parallels can be drawn with l'hospice Sainte-Catherine, Verdun where two pits containing 23 and 26 individuals respectively were found (Réveillas 2010: 188-94). Finally, at the l'hospital du Saint-Esprit, Besançon an unspecified number of individuals were found in a mass grave (Vaxelaire 2002), although the dating of this latter example is uncertain. Hospitals were not the only locations where mass burials have been identified on the continent. The medieval rural cemetery at Saint-Laurent-de-la-Cabrerisse, southern France, contained three 14th-century burials containing between two and five individuals that tested positive for *Yersinia pestis* (Kacki et al. 2011), whilst mass graves of similar dates, and apparently unconnected to hospitals, at Barcelona, Spain, Ellwangen, Germany (Spyrou et al. 2016), Bondy, France (Tran et al. 2011) and Manching-Pichl, Germany (Wiechmann et al. 2010) contained individuals carrying the pathogen.

Nonetheless, given the potential association between mass burials and hospitals in some circumstances, it is worth re-evaluating the evidence from Thornton Abbey, especially given that secular burial would not ordinarily be expected in this area of the precinct far from the monastic church. Crucially, there is a single reference to a hospital at Thornton, when in 1322 an indulgence was granted for the repair of the chapel of the hospital of St James outside the walls of the monastery (Page 1906: 235). The location of this hospital has never been ascertained, but in light of the presence of the mass burial, focus shifted to the earthwork remains of what appeared to be a large building measuring approximately 21x11m aligned on an east-west axis to the south of the grave. Between 2014 and 2016 two trenches were excavated at either end of the building which, although heavily robbed, was clearly a substantial stone single-cell chapel with a brick-built extension to its western end, probably the

residential section of the hospital complex. Given all these associated factors it now seems likely that the hospital of St James was indeed at this location, and that during the 14th century it became the focus for the treatment, and then burial, of the large numbers of local people afflicted with the Black Death.

Conclusion

Given their relative scarcity, the discovery of any medieval mass burials must be seen nationally important. To a society that valued 'a good death' above all else (cf. Beaty 1970), the universal expectation would have been for the dead to be interred individually and with the full church rites performed. Indeed, even in the known Black Death cemetery at East Smithfield in London, despite the presence of three large mass graves, most were individual burials and this appears to have been the norm when possible. Therefore, a mass burial represents a catastrophic failure of the established system of dealing with the dead, presumably due to the overwhelming numbers needing to be interred, and the scarcity of the living to perform these tasks. The hospital run by the canons of Thornton Abbey was the last and only functioning institution where the local inhabitants could bring the dead and dying in an effort to receive a proper burial and a hope for salvation in the afterlife. Even in such difficult circumstances, and despite the unusual communal nature of the burial, great care was still taken over the corpses, which were in most cases shrouded and laid neatly within the mass grave with the due reverence befitting a 'proper' medieval Christian burial.

What makes the Thornton mass burial especially important is its rural location and the fact it has been completely excavated. All other contagion mass graves from England have been found in urban contexts and would have been formed from a very diverse and widespread population, which would almost certainly have included a large number of individuals from outside of the immediate area, perhaps even from abroad. This is much less likely to be the case at Thornton, and the 48 men, women and children interred here must represent a significant proportion of the local parochial population. Whilst this reflects an acute historical tragedy, it also provides hitherto unseen detail of the response of a small rural community to the devastation caused by the arrival of the plague in the 14th century. Given this, the Thornton mass burial is a discovery that thus far unique in England, and adds significantly to an understanding of the most deadly pandemic to have affected Europe in the last millennium.

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Figure Captions

Figure 1 Location of Thornton Abbey

Figure 2 Location of mass grave within the monastic precinct

Figure 3 Resistivity surveys of the mass grave

Figure 4 Plan of the mass grave with later inter-cutting burials

Figure 5 Detail of interlocking row of burial

Figure 6 Reconstruction of the grave

Figure 7 Mortality profile of the mass grave burials

Figure 8 Poor preservation of infant burials

Figure 9 Species profile comparison for Sk36 between shotgun and *Yersinia pestis* enrichment

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