

Contextualising Previous Excavation: The Implications of Applying GPS Survey and GIS Modelling Techniques to Watton Priory, East Yorkshire

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CURRENT understanding of archaeological sites often relies upon plans compiled before the advent of modern archaeological techniques. Such plans were often created with a specific purpose in mind that might be less helpful for modern study. In this paper, the potential of applying new approaches to prospection, using GPS and GIS technologies, is examined with relation to Watton Priory, East Yorkshire. The results of this study demonstrate how the previous plan of the site is spatially limited, with features extending into the wider landscape. Furthermore, it appears that some of the interpretations of the site based upon this earlier plan might be incorrect due to these. It is concluded that the re-appraisal of sites is crucial prior to the construction of new interpretations.

The data that provide the major proportion of the available information regarding monastic sites stem from early excavations. Commonly these excavations were fuelled by a characteristic desire to reveal the plan of a site. This 'wall-chasing' approach has been criticised for what may be regarded as a number of methodological limitations. In particular, there is the danger that the plan revealed might merely reflect the preconceptions of the excavator rather than providing an accurate understanding of the site's layout. Furthermore, such 'wall-chasing' approaches risk missing the idiosyncrasies of a site and thereby failing to reveal many of the more interesting and potentially important features. At another level, these early excavations detached contextual information from the plan, by failing to include both the stratigraphy and finds assemblage which are systematically revealed by modern excavation techniques.

In this paper the results from topographic survey and digital modelling of Watton Priory, East Yorkshire, are presented using highly accurate high-resolution survey methods. This re-evaluation of the site demonstrates that the evidence from the earlier excavation work was spatially limited, and that the Priory walls actually extend far further than the area investigated by the original excavators. Furthermore, it notes that the additional features revealed by this new survey shed light on some of the uncertainties of the original excavations. The results confirm the importance of critically assessing earlier data sources, and with serious consequent implications for the re-use and storage of data.

Finally, this research demonstrates that through the application of an ever-increasing suite of technological approaches it is possible to develop a clearer understanding of sites, where such previous work has taken place and advocates re-appraisal, in a non-destructive manner. The survey subsequently provides the basis for future management of the site, and acts as a tool for directing future work on the ground.

BACKGROUND

Archaeological interpretation is often based upon new data being placed within the context of the corpus of previous research. Previous excavation and interpretation of a site provide the backdrop for interpretation made in the present and as such the work of previous researchers should be considered within its own context. Research into monastic sites provides an example of the need for this type of reasoning. Numerous sites have been investigated over many years, and current understanding of many of these sites rests upon the plans made during excavations that were undertaken more than a hundred years ago using contemporary methods. These plans also rely upon the interpolation of the positions of walls between the excavation trenches in which portions of them have been revealed. Interpretations and generalisations in the present are therefore based upon the plans of sites that have been generated from what might be considered a dubious methodology.

Theoretical approaches, methods and priorities of excavation change through time, and sites are usually excavated with a particular focus or a question in mind. Arguably, in the case of monastic sites, this question has often been the reconstruction of the ground plan in order to link the site to what is known of the appropriate Order, and to provide a context for historical sources. This approach has even characterised relatively recent excavation, as at the Carthusian monastery at Hinton Charterhouse, Somerset, which was investigated as recently as the 1950s.¹ The limitations of this approach are rooted in the problem of when to stop — at what point may it be considered that the full plan has been achieved, and on what grounds is the decision based? Fundamentally, the implications of using potentially incomplete plans in current interpretation are readily apparent and potentially seriously flawed.

WATTON PRIORY — A CASE STUDY

The Gilbertine Priory of St Mary at Watton was founded during the middle of the 12th century, surviving until the Dissolution of the 16th century, although it was founded on the site of a possible earlier nunnery recorded in the 7th century.² The earlier house was not mentioned in Domesday and so it would appear that it had ceased to exist some time prior to the 11th century. Watton Priory was the largest house in the Gilbertine Order, being founded as a double house providing accommodation for both nuns and canons. Contact between nuns and canons was

¹ P. C. Fletcher, 'Recent excavations at Hinton Priory', *Somerset Archaeol. Nat. Hist. Soc.*, 96 (1951), 160–5.

² W. H. St John Hope, 'Watton Priory, Yorkshire', *Trans. East Riding Antiq. Soc.*, 8 (1900), 70–107.

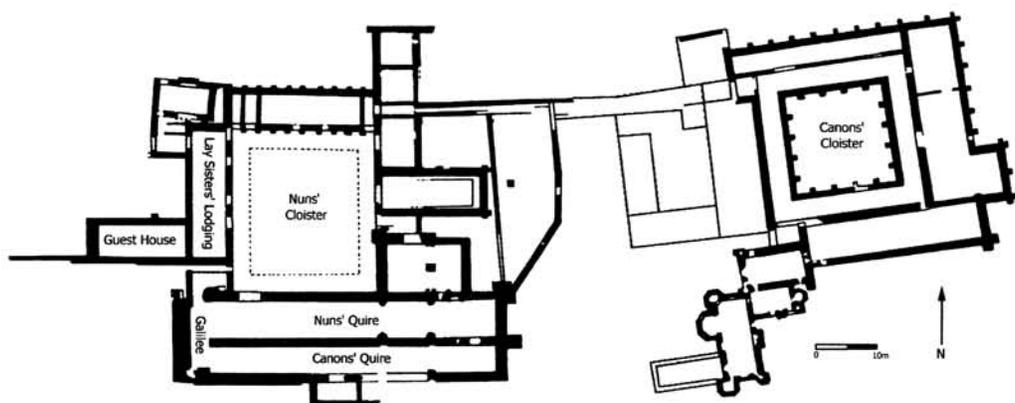


FIG. 1

Plan of Watton Priory (after St John Hope).

prohibited other than during exceptional circumstances in the church and infirmary. Even then, segregation was maintained through a wall in order to prevent the nuns and canons from seeing one another. This supposedly strict segregation has huge implications when studying the layout of the site.

Watton Priory provides an example of a site where current knowledge is based primarily upon the reports of excavators working more than a hundred years ago. In this case the excavator, W. H. St John Hope, was relatively progressive in terms of archaeological practice. He undertook excavations with the Rev Dr Cox under the auspices of the East Riding Antiquaries Society, beginning in September 1893 and continuing intermittently until the final investigations in 1898. The focus of this early work was to discover the plans of the various buildings and to understand the site's layout, since its significance was that it held the potential to provide the first detailed understanding of the spatial arrangement of a double Gilbertine Priory. In this way, three key aims underlay the rationale of the excavators. Firstly, it appeared that the monastery had a double house from its conception until the Reformation, while others in the Gilbertine Order had become single houses. It therefore held the potential to yield valuable information about the plan and layout of such sites. Secondly, the site was open and undeveloped, containing only one standing building that was itself part of the original monastic complex, therefore providing the opportunity for easy access for excavation. Finally, the discovery of a survey undertaken at the Reformation gave dimensions of part of the monastic buildings, which was considered as a useful focus for the investigations.³ A reproduction of the plan resulting from St John Hope's work is shown in figure 1.

A number of points may be raised concerning this early excavation work at Watton Priory. Primarily, if the plan was created on the basis of 'wall-chasing' excavation, then details and subtleties lying outside of this structured pattern of trenches are unlikely to have been revealed. As a consequence, interpretations based upon the plan are unlikely to be thorough, and are more likely to be

³ St John Hope, *op. cit.* in note 2.

inaccurate. This is particularly intriguing since it is mentioned in the original report that other earthworks existed on the site at the time of excavation. It was noted that, 'If an older monastery stood here, some of these earthworks may be of Saxon origin,' but that these may be later since '... the construction of such enclosures was the first duty of every Gilbertine monastery'.⁴ This passage highlights the equivocal nature of our understanding of the site and presents certain hypotheses for testing. If the structures represent Saxon activity then these earthworks could be extremely important in providing further detail from this period. However, if they are contemporary with the post-c. 1150 site, then what additional detail can they add to the understanding of the plan, and therefore the interpretation of the site? St John Hope did not record the positions of these features, and consequently we cannot tell whether there were also other features that were either not noticed or not recorded at the time of the excavation.

SURVEYING WATTON

The site of Watton Priory currently lies under grass, with parts of the walls uncovered by the excavations at the end of the 19th century still visible on the surface. Some areas of the old excavation trenches have been left open, providing a variable topography consisting of walls, spoil, earthworks and undisturbed ground. It has been demonstrated previously that high-resolution topographic survey followed by digital landscape modelling can be used to identify buried features that do not provide any clear indication of their existence on the surface,⁵ and consequently the site was surveyed using differential Global Positioning System (GPS) equipment.⁶ This equipment uses the positions of satellites to identify positions on the ground to a very high accuracy (in this case ± 0.02 m) through calibration between two data receivers.⁷

Other forms of prospection are available to the modern archaeologist when studying such sites including a range of geophysical survey techniques and aerial photography. Each of the different forms of site prospection has advantages and disadvantages, and geophysical survey have been very successful in revealing information regarding the plans of sites. High-resolution survey was chosen as the initial survey method at Watton as current aerial photographic data from the site has produced poor results due to the interference of tree coverage in important areas of the site, while the variable topography of the site would also benefit from a micro-topographic survey.

GPS was chosen in preference over optical methods for the survey at Watton for two main reasons. Firstly, the technique provides a fast and efficient recording of points — typically, it is possible for a single surveyor to record far in excess of a thousand accurate positions in a day. Secondly, there is no need to maintain a line

⁴ St John Hope, *op. cit.* in note 2, 71.

⁵ H. P. Chapman and R. Van de Noort, 'High-resolution wetland prospection, using GPS and GIS: landscape studies at Sutton Common (South Yorkshire), and Meare Village East (Somerset)', *J. Archaeol. Science*, 28 (2001), 365–75.

⁶ H. Fenwick, 'Medieval sites in the Hull valley: distribution and modelling', 183–91 in R. Van de Noort and S. Ellis (eds.), *Wetland Heritage of the Hull Valley, an Archaeological Survey* (Hull, 2000). The technique is outlined in detail in Chapman and Van de Noort, *op. cit.* in note 5.

⁷ See A. Leick, *GPS Satellite Surveying* (New York, 1995), for a description of the process.

of sight between the surveyor and the base station, which means that complex traversing is not required, unlike the situation when optical methods of survey are used. The key limitations of GPS lie in the need to keep a clear view of the sky in order to maintain radio contact with the satellites overhead. As a result, in areas of high tree cover or building density, the application is limited. At Watton trees currently follow the edges of the fields within the precinct and an avenue of trees crosses the north of the site, thereby causing some limitation in the survey, but the principal features of the site are largely open.

The site was surveyed in transects across the site recording positions at paced intervals of approximately 3 m. In areas of higher topographic variation where this resolution was unlikely to be able to sufficiently record the surface features, points were recorded at an increased surface density. This method of variable resolution survey has been demonstrated to provide a more accurate data sample for generation into a digital elevation model (DEM) representation of the site.⁸ Due to tree and building coverage across parts of the site it was surveyed in three separate areas. Overall, a total of 3,800 points were recorded over a total area of 2.17 ha, providing a sample density of 0.2 per sq m.

DATA PROCESSING METHODS

The data from the three surveys were processed and corrected to National Grid co-ordinates using software developed by R. Middleton (University of Hull). It was then imported into Geographical Information System (GIS) software for further processing — in this case ESRI ArcInfo, run through a UNIX platform.

Each of the three survey areas was considered separately. The point data resulting from the survey were initially transformed to form a triangulated surface, and this was re-sampled to provide a cell-based surface. The resulting gridded data structure provides a mathematical surface constructed from square cells each of a given regular size, in this case 0.5×0.5 m, with each cell representing an interpolated height.

The data format of the DEM surface allowed for re-sampling in order to form alternative representations and models that enable the landscape to be understood in different ways. The mathematical cell-based data-format enables exaggeration through the application of simple algorithms. By applying a virtual light source to the model it is possible to highlight some of the less obvious features and anomalous variations of the model (Fig. 2). The previous plan of the excavated site provided sufficient information to enable it to be located relative to the positions of the modern field boundaries.⁹ A digitised version showing the positions of walls could then be draped over the DEM within the GIS environment, thus enabling correlation between the excavations and survey to be examined. Figure 3 shows the DEM with an applied light source highlighting the more subtle features, and with the outlines of the excavated walls overlain upon the DEM.

⁸ M. Fletcher and D. Spicer 'Clonehenge: an experiment with gridded and non-gridded survey data', 309–24 in S. P. Q. Rahtz (ed.), *Computer and Quantitative Methods in Archaeology* (BAR Int. Ser., 446(ii), Oxford, 1988).

⁹ St John Hope, *op. cit.* in note 2.

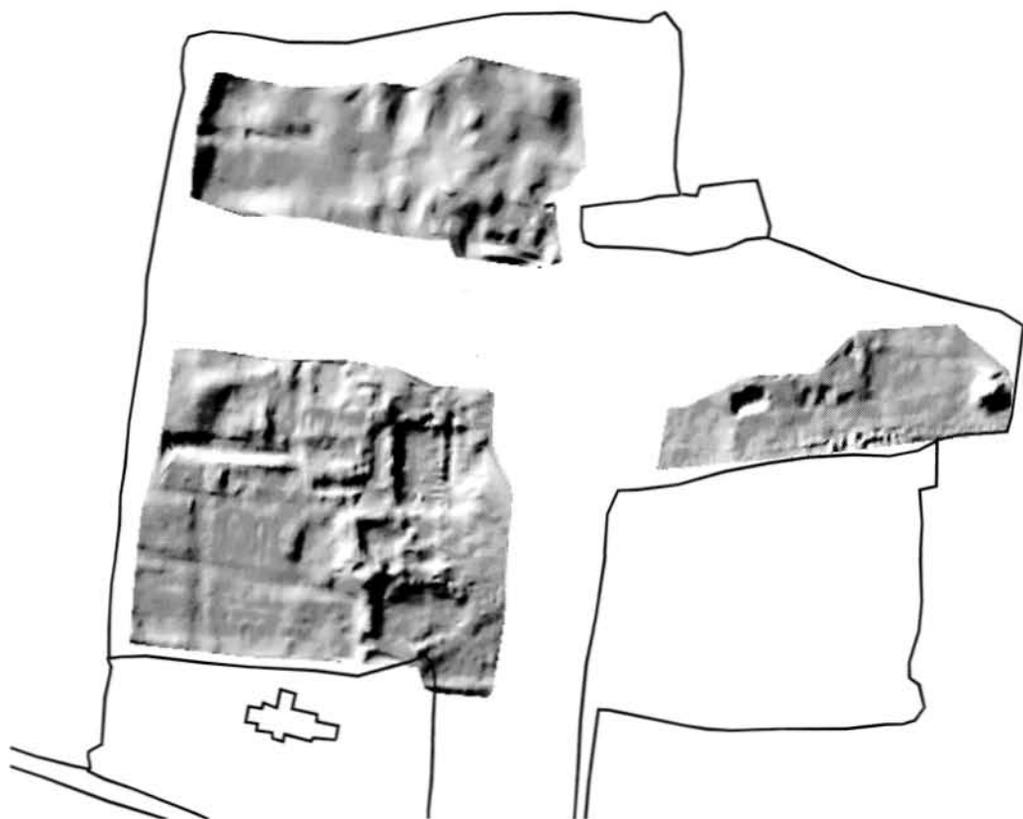


FIG. 2

DEM of the three survey areas of Watton Priory (North to top).

RESULTS

The results from this work highlight two principal themes. Firstly, there is a very close and demonstrable correlation between the features visible on the model and the pattern of walls marked on St John Hope's plan. Within the western part of the site, this correlation is dramatically emphasised by the outline of the Nuns' cloister and the surrounding buildings, including the Lay Sisters' lodging and guest houses on its western side, and the buildings on its northern side. To the south, the outline of the church is extremely well defined on the DEM, with this part of the model clearly highlighting some of the internal detail. In the eastern area of the site the outline of the Canons' cloister is visible on the model, though this is less well defined than the Nuns' cloister to the west. Previously it had been considered that many of the upstanding earthworks were in fact the spoil heaps from the excavations rather than the walls of buildings.

The second theme stemming from the survey is that the layout of the walls as determined from St John Hope's plan is extremely limited. Whilst there is considerable correlation between features on the DEM and the positions of the walls on St John Hope's plan, the foundations of many additional structures may

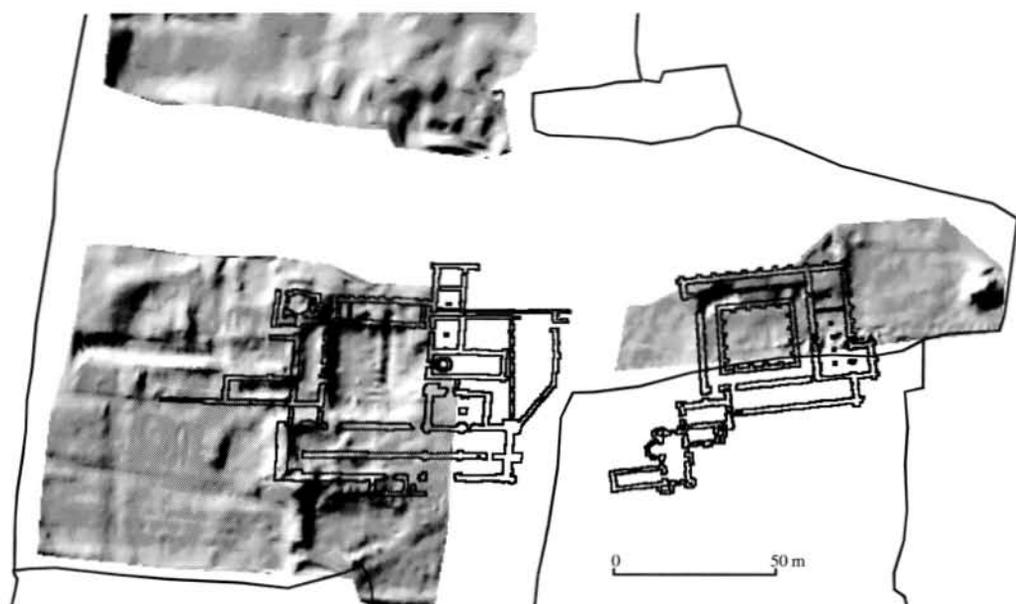


FIG. 3

St John Hope's plan of the site draped on to the DEM derived from the current survey (North to top).

be identified from the DEM as following the same alignments as those excavated. This is particularly notable within the western survey area of the site. Within the centre of the cloister, several linear features aligned north to south are visible, though it is possible that these might relate to the excavation of the site. More dramatically, in the area to the west of the mapped buildings, the 15th-century wall extending westwards from the southern side of the guesthouse appears to continue. Furthermore, a second linear feature running parallel to this wall but to the north is also visible, while additionally, to the south of these, other linear hollow-ways may be seen.

On the southern side of the church further earthwork remains that are not recorded on the earlier plan are highlighted by the DEM. The first of these, which extends southwards from the galilee, is a linear bank. To the east of this, extending along a NE. by SW. alignment, is another bank, although this might relate to a path seen extending to St Mary's Church on a reproduction of an Ordnance Survey 1:2,500 scale map of the area as published by St John Hope.¹⁰ In the eastern area of the site, surrounding the Canons' cloister are fewer unrecorded remains, perhaps due to the smaller area of survey. To the east, however, there is a small hill that relates to a mound again recorded by the Ordnance Survey, which might relate to one of the archery butts recorded in the schedule. In the northern area of the precinct, away from the region of the earlier excavations are a number of quite amorphous features.

¹⁰ *Op. cit.* in note 2.

DISCUSSION

The present study at Watton Priory has demonstrated that high-resolution survey and GIS data modelling can be used to provide a model that highlights data from previous excavations. Furthermore, it has demonstrated that this approach provides the potential for highlighting features that have been missed previously, but without the need for intrusive methods to be employed. The validity of certain parts of the model has been demonstrated by overlaying the original excavation data which visibly matched the earthwork features seen through the exaggeration and shading of the DEM. What is required now is for the previously unrecorded features to be examined in order to further validate the DEM and determine the nature of these features. Such further work could include a mixture of further prospection by geophysical survey alongside selective excavation. If these features are proven to be contemporary with the monastic site then their role and significance to the interpretation of the site clearly needs to be addressed.

The new topographic model of Watton Priory has raised a number of questions about the function and interpretation of the site. Firstly, it appears that the buildings and walls on the site might have covered a larger part of the precinct than previously determined, and that these features were probably contemporary with at least the final (15th-century) constructions. Such an extension to the site would almost certainly have implications in relation to its function and arrangement, and as a consequence of this study it is clear that these aspects are not currently understood.

Secondly, the new survey has highlighted areas of the site, both inside the area of the earlier plans and also within the precinct more generally, that would benefit from further investigation. Such an investigation could be focused around geophysical survey and limited trial trenches aimed at particular un-investigated features as highlighted by the new model. Furthermore, it appears from the close correlation of alignments between the previously mapped and newly modelled features that the other earthworks probably reflect the late 12th-century phases of the monastery and not those of the Anglo-Saxon site.

The significance of these results suggests that it is perhaps timely to now reassess more monuments previously excavated in the 19th century and to fundamentally re-evaluate our understanding of them in the light of the evident potential for un-investigated data. The example of Watton Priory demonstrates that additions to the plans can be made even on sites where it is assumed that a fairly complete plan has already been achieved. Re-survey is far from being a new concept and has a long history of use.¹¹ However, the modelling process provides a less subjective methodological approach since it is not purely based upon empirical observations on the ground and it therefore holds the potential to highlight features that cannot be seen in the field or those which may be overseen. In this respect, the potential of the application of this approach to other similar sites is clearly significant.

¹¹ M. Bowden, *Unravelling the Landscape — an Inquisitive Approach to Archaeology* (Stroud, 1999).

Further implications for understanding the archaeological record might also be considered as a result of this research. The re-use of archaeological data has become an increasingly pertinent theme in recent years.¹² Current discourses highlight the need to understand the quality of the data held in archives in order to understand how appropriate its re-use may be. At Watton, a number of foci warrant some mention. Firstly, the original plan of the site was adequately surveyed in order to enable its geo-referencing for direct comparison with the new model. However, the locations of the excavated trenches and areas of spoil were not recorded and as such their impact upon the landscape, and consequently the interpretation of the model, cannot be fully understood. Secondly, site plans such as St John Hope's overview of Watton Priory provide the foundations for current research and the understanding of these sites generally, and Gilbertine monasteries more specifically. Consequently any limitations evident in earlier plans will be perpetuated throughout other levels of subsequent research. The new survey presented here therefore serves in part to highlight these potential limitations.

CONCLUSIONS

This paper has demonstrated the usefulness of high-resolution digital survey and landscape modelling techniques for reassessing and augmenting earlier surveys of monastic sites. It has shown how such approaches can assist in the understanding of sites by raising new questions and highlighting new areas that may not have been studied previously. At Watton Priory this method has indicated that the previously unrecorded earthworks probably relate to the post-1150 occupation of the site. Furthermore, it has demonstrated that the buildings may well have encompassed a larger proportion of the precinct during the final phases of the site, with some features as highlighted by the DEM most certainly extending to the west and south. It has also raised questions about the nature of the occupancy within the remainder of the precinct, and the possibility for an even larger plan size for the largest house in the Gilbertine Order.

ACKNOWLEDGEMENTS

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¹² J. D. Richards, 'Preservation and re-use of digital data: the role of the Archaeology Data Service', *Antiquity*, 71 (1997), 1057-9.