St. Johns Priory,

Pontefract,

West Yorkshire.

(SE 4630 2260 site centred)

Earth Resistance Survey

Contents

Summary

A resistance survey covering an area of 2.2ha was carried out at the site of St. Johns Priory, Pontefract, a Scheduled Ancient Monument. Anomalies caused by the previously excavated structural remains of the cloister, new chapter house and parts of the church can be readily identified. Many other high resistance linear anomalies that possibly also represent structural remains have been identified in areas that have not previously been excavated. However, the depth of 'dissolution debris' and quarry waste make definitive interpretations difficult. Curvi-linear anomalies were also detected that may caused by trenches relating to the siege of Pontefract Castle during the Civil War.

Archaeological Services WYAS

14 St John's North, Wakefield WF1 3QA

(Cover illustration after Bellamy 1965)

1. Introduction

1.1 Archaeological Services (WYAS) carried out, with the permission of English Heritage and Wakefield Metropolitan District Council, an earth resistance survey at the site of St. Johns Priory, Pontefract, West Yorkshire, a Scheduled Ancient Monument, number 498 (see Figs 1 & 2).

1.2 The objectives of the survey were threefold:-

- *to enhance the understanding of the priory precinct layout in the context of the excavations carried out from the 1950's to the 1980's and if possible define its extent;*
- *to determine whether any infilled trenches from the Civil War siege lines around Pontefract Castle could be detected;*
- *to evaluate the presence and extent of any other sub-surface archaeological features within the priory area and, where possible, to characterise any such features.*

1.3 The scheduled site covers an area of 3.3 hectares of which approximately 2.2 hectares was surveyed between July 24th and August 17th 1992, at which time the survey area was under long grass and scrub vegetation.

1.4 The site inclines upwards from its southern boundary at the Wash Dike to Ferrybridge Road at its northern end. It is bounded to the west by Mill Dam Lane and to the east by Box Lane and is divided into three terraces, aligned approximately east to west.

1.5 The geology comprises Lower Magnesian Limestone bedrock with a varying depth of overburden which contains colluvial and 'dissolution debris' material (see 2.10).

2. Historical and Archaeological Background

2.1 The Cluniac priory of St. Johns in Pontefract was founded in *c.*1090 by Robert de Lacy. It survived as a religious centre for nearly 450 years until it was closed in 1538 during the Dissolution, after which many of the priory buildings were destroyed and the stonework re-used for the construction and repair of local buildings, most notably New Hall and Pontefract Castle.

2.2 During the Middle Ages it is believed that limestone was quarried at the northern end of the site in an area where detailed observations were made in the late Victorian period during works for the construction of the Malthouse (Fowler 1873). The waste created by the quarrying was probably used centuries later during the landscaping of the terraces in the 1930's (see Section 2.5).

2.3 Pontefract Castle, which is less than two hundred metres south-west of the priory, was circumvallated during the Civil War. Early versions of the siege maps (as cited in Boothroyde 1807; Holmes 1887) suggest that the siege works cut through the priory precinct on a north-south alignment. These maps also suggest the presence of earthwork fortifications (the Tanalian Guard) within the eastern part of the precinct. Both authors also indicate the presence of Grange Chapel, later referenced as a barn, within the precinct area. However, it is not known whether this building was part of the priory complex, whether it was a later addition or where it might have stood.

2.4 Pontefract Corporation took over ownership of the priory site in the 1930's and landscaped parts of the site, probably enhancing the three terraces that are visible today. The enhancement of these terraces and the associated landscaping has resulted in varying depths of overburden across the site. The depth and compaction of this material will affect the distribution and retention of moisture in the ground which in turn will affect the resistance of the ground to the passage of an electric current (see Section 2.6 below).

2.5 The priory site was first excavated in 1957 under the direction of C.V. Bellamy and, in the following 20 years, the church and claustral buildings, together with some ancillary buildings, were systematically excavated (Bellamy 1965). These small-scale excavations, which were backfilled between each digging season, revealed that most of the structures were multi-phase. One of these phases involved the addition of a polygonal chapter house, a design that became popular in England in the 13th and 14th centuries (Gilyard-Beer 1958). It was the adoption of this design that led to later buildings being aligned on many different orientations and not just on the traditional north to south/east to west alignment observed during the construction of earlier priory buildings. This is certainly true at St. Johns where it was found that the non-claustral buildings in particular were often at oblique angles to the main priory buildings (Bellamy 1965).

2.6 Prior to the start of the 1976 digging season, the University of Bradford conducted a resistance survey in an area adjacent to the south-west corner of the refectory (Pocock 1978). This survey was subsequently extended westwards and southwards almost to the site boundaries, to cover a total area of 1500m^2. Several high resistance linear features were identified which were interpreted as structures. Regions of low resistance were also detected and these were interpreted as robbed out wall trenches or silted up water channels. Despite the multi-phase nature of the site it was expected that there would be a good correlation between the geophysical interpretation and the archaeological remains given the monumental nature of the surviving masonry uncovered during earlier excavations. Initially, as the survey area was excavated there appeared to be little correlation between the interpretation and the excavated features. However, as the excavation progressed a slight correlation began to emerge. The lack of clarity was believed to be caused by the masking effect of a layer of building rubble, '*dissolution debris*', encountered immediately below the ground surface which was produced by the demolition of the priory buildings in the late 1530's.

2.7 A second resistance survey was carried out a year later (1977) over an area, south-east of the later chapter house, which had been partially excavated in 1965 and then differentially backfilled. Larger stones and rubble had been deposited at the bottom of the trench with soil above while excavated walls were only covered by soil. It was concluded that it was much easier to interpret the data collected over areas that had been excavated and differentially backfilled than from unexcavated areas (Pocock 1978); the grading of the backfill material clearly reduced the masking effect of the overlying rubble enabling a clearer image of the solid masonry to be seen.

3. Results and Discussion

3.1 Data Presentation

3.1.1 The resistance data are all presented as greyscale plots. In Figure 2 the data are overlaid on an Ordnance Survey base map at a scale of 1:2500 with a greyscale plot and an interpretative overlay displayed in Figures 3 and 4 at a scale of 1:1000. A large scale 1:500 plot is presented as Appendix 2.

It should be noted that the interpretation is based on analysis of the data at a number of different ranges and not just within the range used for the figures presented.

3.2 General discussion

3.2.1 It can be observed from the data that the site is geophysically very complex, with a number of different types and strengths of anomalies being identified, most of which probably have an archaeological origin. This complexity was not unexpected as the excavations had demonstrated that there were many phases of rebuilding during the period of occupation, as well as several major changes in land use, including major landscaping, subsequent to the priory's dissolution.

3.2.2 The success of the resistance survey in identifying surviving *in situ* masonry associated with the priory, is significantly dependent upon the depth of overburden. Bellamy (1965) reported finding up to five feet of 'dissolution debris' on top of the surviving masonry during his years of excavation. Indeed the results have shown that where the depth of overburden is greatest, *i.e* on the upper terrace, there is a masking or distortion of the geophysical response from the structural remains that are known to survive.

3.2.3 Previous resistance surveys (Pocock 1978) suggested that the most easily interpretable results would be obtained over the areas which had been excavated, particularly those which had been differentially backfilled. Unfortunately it was not known whether all the excavated areas were backfilled by grading the infill material so that no definite conclusion can be drawn about the relationship between of the depth of overburden, its degree of sorting and the 'detectability/interpretability' of the geophysical anomalies.

3.2.4 The positive effect that backfill sorting can have on the geophysical response is illustrated by the anomalies to the south-east of the cloister. Most of this area has not been excavated and so there is a greater variation in the resistive background. Consequently the anomalies are less well defined. However, further north, where the cloister and the chapter house were both fully excavated and systematically backfilled, the walls are still clearly visible until the increased depth of overburden on the upper terrace reduces the contrast making interpretation difficult.

3.2.5 A striping effect can be seen over two grids in the centre of the southern part of the survey area. It is not known what caused this striping but it can be seen that there is little or no loss in resolution of the low resistance anomalies, thought to be due to sewer trenches, that cut straight through these grids.

3.3 General resistance trends

3.3.1 One of the most obvious features of the data is the difference in background resistance levels between the northern and southern halves of the site. Over most of the northern half of the site the levels are very high (>500 ohms), whilst to the south they are generally less than 200 ohms. This dichotomy predominantly reflects the landscaping of the site into upper and middle terraces and the increasing moisture content of the low lying ground adjacent to Wash Dike (see also Section 3.3.5).

3.3.2 There are two exceptions to this generalisation; the areas of high resistance to the south-west of the cloister which are probably caused by accumulations of building debris, and the linear areas of high resistance in the south-eastern corner which are probably caused by the middle-lower terrace edge.

3.3.3 The edge of the upper terrace passes across the south-western corner of the church, the north-west corner of the cloister and just to the north of the later chapter-house (see Fig. 3). North of this line the background resistance levels are high in comparison with resistance levels to the south.

3.3.4 Approximately 40m south of the upper terrace is the middle/lower terrace edge, which passes south of the cloister and the southern range. No excavations have been carried out south of this terrace. The lowest terrace slopes gradually down from this edge to Wash Dike at the southern limit of the site.

3.3.5 In general the resistance values decrease from north to south primarily reflecting water run-off downslope. The periodic flooding of the land adjacent to Wash Dike probably also contributes to this pattern due to the accumulation of moisture retentive silts following inundation. This moist soil provides a relatively easy path for the electrical current leading to generally lower readings in this part of the site.

3.4 Non-linear anomalies and resistive boundaries

3.4.1 A major high/low resistive boundary can be seen running from east to west across the centre of the site (**T^1**) following the upper/middle terrace edge. In the eastern part of the site the anomaly follows the terrace edge by turning sharply to the north before again turning east. There is also a less distinct boundary on the same east/west alignment which also reflects a terrace edge (**T^2**). Although these anomalies correspond with existing terraces along much of their length they may not be wholly responsible for the major resistance change. A sub-surface feature, such as an outcrop in the underlying geology, which the terrace respects, might partly account for the observed resistive contrast.

3.4.2 The second, lower, terrace in the south of the site is identified as a resistive boundary in the western half of the site but as distinct linear areas of high resistance in the east (Fig. 3 - **T^3**).

3.4.3 In the north-western part of the site, to the north of the main priory area, three parallel, high resistance, curvi-linear anomalies can be observed. High resistance anomalies are often indicative of structural remains but they may also indicate cut features that have been infilled with a material that is more resistive than the surrounding soil matrix. In this case the strength of the anomalies, and their location in an area with a very high resistive background, suggests a very substantial structural feature or ditches infilled with stone material. Such material would be readily available in post-medieval times (quarry waste) and in post-dissolution times ('dissolution debris'). Infilled Civil War siege works might explain the anomalies although they would appear to be on the wrong orientation according to the documentary evidence.

3.5 Low resistance linear anomalies

3.5.1 There are a number of low resistance anomalies across the site which are thought to have a modern origin. These include **P^1**, which is caused by the unconsolidated backfill surrounding a modern sewerage pipe; its position and orientation corresponds exactly with such a feature identified during Bellamy's excavation. This anomaly also appears to form the terminus for Anomaly **P^2**

which by inference is almost certainly also a trench for the sewer. It should be noted that **P**^{2} crosses part of the excavated area although it was not recorded during the dig. This suggests that the trench was dug after the final phase of the excavation in 1978.

3.5.2 Anomaly **P**^{3} is aligned roughly perpendicular to **P**^{2} although any possible point of intersection or bisection with **P**^{1} would be outside the survey area. It cannot be determined whether **P**^{3} is also a sewerage pipe trench.

3.5.3 Other much shorter linear anomalies include **P**^{4} and **P**^{5} in the south-eastern corner of the site and the conjoining anomalies, **P**^{6}, in the south-western corner. Any of these anomalies might be archaeological, either infilled ditches or robbed out foundation trenches, although a modern cause such as a service pipe trench should not be discounted.

3.5.4 Of the two remaining low resistance anomalies, **P**^{8} might be the robbed out foundation trench locating the northern half of a possible structure. Anomaly **P**^{7} might have a similar origin.

3.6 High resistance linear anomalies

3.6.1 The most identifiable of all the anomalies is **B**^{1} which consists of two concentric squares of high resistance, the inner 20m wide and the outer 30m wide. These anomalies are caused by the cloister walls. The position of the anomalies closely matches the location and geometry of the excavated wall foundations as shown on the post-excavation plan.

3.6.2 To the south of the cloister is Anomaly **B**^{2}. It probably represents the unexcavated southern and western sides of the refectory.

3.6.3 North-west of **B**^{2}, and to the west of the cloister, a series of small linears of varying orientations, **B**^{3}, can be observed. This area was not excavated in detail but the few trenches that were dug did reveal a wall feature aligned obliquely to the main claustral structure. These anomalies may indicate the presence of features associated with this wall or with the cloister itself.

3.6.4 West of the cloister, but north of the modern sewer, are several linears (**B**^{4}) which are on the same alignment as the cloister. These anomalies possibly represent the inner and outer walls of a building thought to be the prior's lodging. The linear anomaly directly adjacent, and parallel to, the modern sewer probably represents stone upcast from the sewer trench and not a structural feature.

3.6.5 The outer, eastern, wall of the cloister can be observed as a strong anomaly which continues south (discontinuously), beyond the limits of the cloister. At right angles to this anomaly are three short linears, which probably represent internal wall divisions, and a possible structure, **B**^{5}, which probably represents part of the first chapter house.

3.6.6 Immediately east of **B**^{2} a linear with a right-angled return, **B**^{6}, can be observed which possibly represents part of the warming house.

3.6.7 On the southern edge of the site is another series of interconnecting linears, **B**^{7}, that suggest the presence of a rectangular structure.

3.6.8 East of the first chapter house a strong, sub-circular anomaly, **B**^{8}, can be observed. This anomaly represents the decagonal later chapter house.

3.6.9 South-east of the later chapter house a series of interconnected anomalies, **B**^{9} and **B**^{10}, can be observed. These probably represent the remains of inner walls and passages and a possible building, or courtyard area, which has two smaller structures to its south.

3.6.10 South-west of the cloister, outside the excavated area, there are a number of discontinuous linear anomalies, **B**^{11}, of differing alignments. Some of these may be associated with the adjacent terrace edge while others may represent structural remains. Some of the linears may be associated with the low resistance anomalies **P**^{6}. It is possible that the anomalies indicate the presence of a structure (the high resistance anomalies) which has had some walls robbed out (the low resistance anomalies).

3.6.11 Two discontinuous, curvi-linear anomalies (**A**^{1}), in the south-west corner of the site, aligned approximately from north-north-east to south-south-west, can be identified. These anomalies are very faint in places and it cannot be determined with any certainty whether they represent one continuous feature or are simply coincidental alignments of anomalies. It is thought that Civil War siege lines cut the priory precinct on a north to south alignment (Boothroyde 1807; Fowler 1873) so, whilst it is a tenuous link, it is possible that these anomalies represent part of this siege line.

3.6.12 The remainder of the identified anomalies are located on the upper terrace where the depth of debris above the archaeological features is known to be greatest. This makes interpretation of possible archaeological anomalies more difficult especially as there is also less evidence from the excavation plan to aid in interpretation. For example, it can be seen that the anomalies representing the walls of the cloister become much less visible on the upper terrace and it is virtually impossible to identify the walls of the church despite the excavation plan.

3.6.13 The anomalies to the north of the cloister area consist of linears and more general areas of very high resistance, many of which have linear edges. Directly to the north-west of the cloister an area of very high resistance can be observed. This anomaly corresponds with the north-western corner of the church and has several linear edges, which may indicate the presence of structural remains. The most noticeable of these linear edges are Anomalies **A**^{2} and **A**^{3}. Anomaly **A**^{2} is located just outside the south-west corner of the nave and corresponds closely with an external structure. Anomaly **A**^{3} is inside the nave and may indicate internal walls. The most easterly linear edge of Anomaly **A**^{3} has a similar orientation to, and is closely aligned with, some of the pillars that form the southern aisle of the nave. It is known from the excavation plan that these pillars, and those forming the northern aisle, have a continuous stone foundation. It is possible that part of Anomaly $\mathbf{A}^3$ is caused by this stone foundation.

3.6.14 To the north of Anomaly $\mathbf{A}^3$ is an area of high resistance that corresponds to the centre of the nave. No internal detail can be made out in this area although some of the small, isolated patches of high resistance might be piers defining the northern aisle. Immediately to the north are a series of interconnected linears, $\mathbf{A}^4$, that appear to be outside the excavation area which may indicate the presence of structural remains. There are several different alignments of anomaly, possibly indicating the presence of multi-phase features.

3.6.15 North-east of $\mathbf{A}^4$ are a series of highs which describe a rectangular anomaly, $\mathbf{A}^5$, with a possible opening or extension in the northern side. In close proximity to this anomaly are three areas of very high resistance and the two low resistance linears of Anomaly $\mathbf{P}^7$. All of these anomalies may indicate the significant structural features, parts of which may have been robbed out.

3.6.16 In the north-western corner of the survey area there is a complex of three possible interconnecting structures on slightly varying alignments, $\mathbf{A}^6$,$\mathbf{A}^7$ and $\mathbf{A}^8$, the latter of which is roughly perpendicular to the high resistance curvi-linear anomalies referred to in Section 3.4.3.

3.6.17 The eastern half of the upper terrace is characterised by a complicated arrangement of interconnected linears and a large amorphous area of high resistance. The majority of these anomalies lie outside the church. Several sizes and orientations of possible structures have been interpreted which are not inconsistent with a multi-phase site.

4. Conclusions

4.1 The site has an extremely complex architectural history with 'walls overlying earlier walls (sometimes on a different orientation), ..., and the whole covered with a general scatter of loose mortar and masonry' (Pocock 1978). This complexity, complicated by modern landscape changes, has made interpreting many of the anomalies very difficult.

4.2 The excavation plans indicate that there are many apparently substantial structural features that have not been detected during the resistance survey. The main reason for this is undoubtedly the masking effect of the "dissolution debris". Another potential factor is the way in which the excavation trenches were backfilled; *i.e* which excavated areas had been backfilled by grading the infill material. Whilst it might have been apparent which areas had been differentially backfilled during the Bradford University survey (Pocock 1978) this was no longer the case during the current survey. This means that no definite conclusion can be drawn about the relationship between of the depth of overburden and its degree of sorting to the "detectability/ interpretability" of surviving structures.

4.3 Nevertheless, many anomalies were detected, both within the excavation area and, more significantly, outside it. This suggests that the priory precinct did occupy a larger area than has been excavated to date. Obviously there is a direct correlation between the geophysical anomalies and the excavated features (*e.g* the cloister and the new chapter house), in some areas of the site, particularly on the lower terrace. However, beyond the limits of the excavations, particularly to the north and north-east of the cloister, where anomalies indicative of structural features have been interpreted, a degree of caution should be exercised given the topography of the site, the potential previous land use (*e.g* quarrying) and the masking properties of the overburden.

4.4 Whilst many major parts of the monastic complex were identified through excavation the infirmary range was not located, although it is suggested that it was located to the south-east of the later chapter house, beyond the limits of the excavation (Bellamy 1965). There is no geophysical evidence to support this and, whilst it is usual for the infirmary of a Cluniac priory to be located in this area (Gilyard-Beer 1958), it is possible that the infirmary was located elsewhere. For example, the number and strength of the anomalies to the north of the church suggest the presence of a major range of buildings and it may be that the infirmary is located in this area.

4.5 Two curvi-linear anomalies were identified to the south-west of the cloister which might be caused by infilled Civil War siege trenches.

The results and subsequent interpretation of geophysical surveys should not be treated as an absolute representation of the underlying archaeology. It is normally only possible to prove the archaeological nature of anomalies through intrusive means such as by trial excavation.

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A. Boucher BSc
I. Roberts BSc MIFA

Fieldwork
P. Mills BSc
A. Webb BA

Report
A. Webb
M. Whittingham BSc MA

Graphics
M. Whittingham

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Appendices

Appendix 1 Earth resistance survey: technical information and methods
Appendix 2 Resistance data plot (1:500)

Appendix 1

Earth resistance survey: technical information and methods

1. Technical Information

1.1 The electrical resistance of the earth is predominantly dependant on the amount and distribution of moisture within it. Buried features can affect this distribution so that contrasts between archaeological features and surrounding deposits can be measured. As resistance is predominantly dependant on the water content of features the most striking variation will occur between a masonry structure, which contains no water, and a water retentive subsoil. A less striking contrast can often be measured between the infill of a ditch feature and the sub-soil, as the material making up the infill is less compact than the surrounding soils, thereby retaining more water. In the same way a ditch infilled by stones may retain less water than the subsoil creating a small, but measurable, difference in resistance.

1.2 The method of measuring variations in ground resistance involves passing a small electric current (1mA) into the ground via a pair of electrodes (*current electrodes*) and then measuring changes in current flow (the *potential gradient*) using a second pair of electrodes (*potential electrodes*). In this way, if a structural feature, such as a wall, lies buried in a soil of uniform resistance, much of the current will flow around the feature following the path of least resistance. This reduces the current density around the feature thereby increasing the potential gradient. It is the potential gradient that is measured to determine the resistance. In this case, the gradient would be increased over the wall giving a *positive* or *high resistance* anomaly.
In contrast, a feature such as a water retentive ditch will be less resistive to current flow thereby increasing current density and decreasing the potential gradient over the feature giving a *negative* or *low resistance* anomaly.

2. Methodology

2.1 For archaeological purposes one current and one potential electrode (the *remote* or *static* probes) are fixed firmly in the ground a set distance away from the area being surveyed. The other current and potential electrodes (the *mobile* probes) are mounted on a frame and are moved from one survey point to the next. Each time the mobile probes make a good contact with the ground an electrical circuit is formed between the current electrodes and the potential gradient between the mobile and remote probes is measured and stored in the memory of the instrument.

2.2 A Geoscan RM4 resistance meter and a DL10 data logger were used during this survey, with the instrument logging each reading automatically at 1m intervals. The mobile probe spacing was 0.5m with the remote probes 2-3m apart and at least 15m away from the grid under survey.

Appendix 2

Resistance data plot (1:500)