Pontefract Castle,

Pontefract,

West Yorkshire.

(SE 4605 2236 site centred)

Earth Resistance Survey

Contents

Summary

A resistance survey covering an area of *c.* 0.7ha was carried out over the Inner Bailey at Pontefract Castle as part of the ongoing research into the history of the castle. High resistance anomalies interpreted as archaeological structural features and a low resistance anomaly possibly representing the motte ditch were detected, although the latter anomaly may reflect underlying changes in the depth and composition of the subsoil.

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Cover illustration of Pontefract Castle c. 1625-1630- artist unknown

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1. *Introduction*

1.1 Archaeological Services (WYAS) carried out, with the permission of English Heritage and Wakefield Metropolitan District Council, an earth resistance survey within the Inner Bailey of Pontefract Castle, West Yorkshire, a Scheduled Ancient Monument, number 13298 (see Figs 1 & 2).

1.2 The objectives of the survey were to expand upon and enhance a previous earth resistance survey that had been carried out within the Inner Bailey (Gater *et al* 1982). The data from this earlier survey had been hand recorded and is no longer available. It was therefore hoped that a more comprehensive survey, coupled with modern survey procedure (data logging) and processing, would enhance the archaeological record for this part of the monument.

1.3 The survey covered all of the Inner Bailey (*c*. 0.7 hectares), and an area to the south-west of the revetment wall adjacent to the "north tower" and motte. It was carried out using a Geoscan RM15 resistance meter on June 5th and June 16th 1998 at which time all the surveyed areas were under short mown grass.

1.4 The solid geology comprises Ackworth Division sandstones of the Carboniferous Upper Coal Measures which are cross-bedded and which are known to weather rapidly where they outcrop (Goossens and Smith 1973). Overlying the bedrock is a variable depth of overburden that in places within the Inner Bailey results in the current ground surface being between 2m and 2.5m above the 11th century ground surface (Roberts 1990, 17).

1.5 It was recognised that this depth of overburden could potentially affect the resolution of any deeply buried anomalies so three areas were resurveyed with the mobile probe separation increased to 1m. It was hoped that the theoretical increased depth penetration afforded by this set-up would improve the resolution of the anomalies detected in the initial survey and possibly reveal other anomalies.

2. *Historical and Archaeological Background*

2.1 Situated on a prominent hill near major trade routes Pontefract Castle was an important and imposing stronghold, from the late 11th century until its destruction at the hands of Cromwell's forces in 1649. It enjoyed a reputation as one of the most secure fortresses in Britain and was feared as a place of imprisonment and execution for high ranking nobles.

2.2 Between the Civil War and the present day the castle and its grounds have been used for a multitude of purposes including stone quarrying, liquorice growing and sporting recreation.

2.3 No conservation or archaeological investigation was carried out on the site until the late 19th century when the castle was converted into a Victorian pleasure park. In the 1960's work was started by the Pontefract and District Archaeological Society that aimed to achieve a greater understanding of the castle remains. This work was continued in the early 1980's with a series of archaeological excavations initiated by the Archaeology Unit of the West Yorkshire Metropolitan County Council. It was at this time that it became official policy to excavate, conserve and display the ruins as an historic monument (Roberts 1990).

2.4 Two previous geophysical surveys have been carried out within the Inner Bailey area. The first of these was the resistance survey carried out in 1982 by Gater *et al.* This survey identified high resistance anomalies thought to indicate building remains adjacent to the northern curtain wall and a possible extension to the Norman chapel. A low resistance curvi-linear anomaly was also detected in the south-eastern corner of the Inner Bailey that was thought to represent the line of the early motte ditch.

2.5 The area encompassing this low resistance anomaly was later surveyed using ground penetrating radar (Fenning and Brislin 1993). The results identified reflections indicative of layered soils and strata with the soil/bedrock interface being tentatively identified at a depth of between 2m and 2.5m below current ground level. The survey also identified an infilled ditch with a depth which varied from 3m, along the eastern-most traverses, to in excess of 6m in the west, and a width of between 10m and 14m.

3. Results and Discussion

3.1 The resistance data are presented in Figure 2 as a 1:1250 greyscale plot overlaid on an Ordnance Survey base map and as a 1:1250 greyscale plot with an interpretative overlay in Figures 3 and 4. Large scale 1:500 plots of the data together with the data from the areas re-surveyed with the increased mobile probe separation are displayed in Appendix 4.

3.2 One of the most noticeable aspects of the data is the low contrast and uniformity of the background resistance, which varies by no more than 30 ohms across the site. This uniformity suggests an even distribution of sub-surface moisture across the site, which tends to indicate an homogeneous sub-soil. It can be seen that the background resistance does decrease from the north-west to the south-east and that this decrease is relatively constant. This may indicate an increasing depth of soil cover in the south-east part of the bailey or a preferential accumulation of moisture due to topography or variations in soil morphology.

3.3 Resistance anomalies are not usually detected at depths of greater than 1m (using the standard resistance equipment set-up - see Appendix 1) but as stated earlier it is believed that in places the depth of soil cover is up to 2.5m. The fact that discrete high and low resistance anomalies have been identified suggests that the depth of soil varies across the site or that some of the features are so large that they produce a detectable geophysical contrast at greater than normal depths. Alternatively the anomalies may be more recent features that are relatively close to the surface.

3.4 Within this generally uniform background the most striking anomalies are the high resistance linear/curvi-linear anomalies that can be observed along parts of the outer edges of the survey area. Several of these anomalies are adjacent to extant building remains and so probably indicate the presence of these structural remains or associated accumulations of building rubble. The other high resistance linear/curvi-linear anomalies represent modern compacted sand/gravel pathways.

3.5 Two other high resistance linear anomalies have been identified within the area of low resistance in the south-east corner of the bailey. The shorter of these anomalies can be seen, in Figure 2, to align with steps in the corner of the Inner Bailey and so may indicate the presence of a path. However, Gater *et al* (1982) believed that this anomaly represented the footings for World War II barrage balloons. More recently, when a trench for an electricity cable was dug in this area a dome of red "Victorian" brick was identified that was tentatively identified as a drain. This probably explains the anomaly.

3.6 The second high resistance linear anomaly corresponds with a slight terrace at the edge of the grassed area as the ground slopes away towards the path. It is probably not archaeologically significant.

3.7 In the area adjacent to the motte, south-west of the revetment wall, an area of low resistance can be observed. Much of this area is about 2m above the rest of the Inner Bailey and there are extant earthworks near the postern gate (which sits in the bottom of the motte ditch). It is possible that the area of low resistance may be due to the infilled ditch associated with the motte and the extant earthworks. However, due to the depth of soil cover over this area it is thought unlikely that the ditch would produce the observed geophysical response. It is more likely that the anomaly reflects the drainage pattern for ground water run-off from the motte.

3.8 As was noted in Section 3.2 the resistance decreases to the south-eastern corner of the survey area, possibly reflecting changes in geology and increased soil cover. It can be seen that in places the edge of this area of low resistance is well defined, particularly close to the revetment wall. This edge corresponds closely with the possible ditch anomaly identified by Gater *et al* (1982) and the location of the infilled ditch identified by Fenning and Brislin (1993) and so may represent part of the motte ditch. However, as the radar survey estimated there to be between 2m and 2.5m of soil cover in this area it is possible that this anomaly and the corresponding resistance anomaly from the earlier survey do not represent the ditch but rather reflect a geological change that affects the sub-surface moisture content.

3.9 Within this area of low resistance is a finger like projection of very low resistance which runs north-eastwards from the pathway and the magazine air-shaft. This anomaly was also identified during the earlier resistance survey where it was interpreted as a possible drainage ditch or a build up of water adjacent to the magazine steps. Part of the anomaly extends into the area assumed to be located over the infilled motte ditch suggesting that if the response is due to a cut feature that it is relatively recent in origin.

3.10 Part of the cellar/magazine is cut into a rock face and so it is also possible that there is a natural geological fault that was exploited to cut the motte ditch. Thus the low resistance response, whilst being caused by a geological feature, may also represent the motte ditch.

3.11 An area of high resistance that has several linear edges is located in the north-west of the survey area. The linearity and orientation of these anomalies indicates that they are probably structural in nature. The same anomalies were identified by Gater *et al* (1982) who also interpreted them as structural although he stated that it was possible that part of the response could be due to tennis courts whose position was not known at that time. It is now thought that the tennis courts were located more centrally in the Inner Bailey and that they had a grass surface, making it unlikely that they would cause the observed high resistance responses. It is more probable that the anomalies represent archaeological remains with the area of high resistance being caused by a floor/paved area or building rubble and the linears representing wall foundations possibly associated with a 15th century chapel that is believed to have been in this area. However, the linears are also aligned parallel to the adjacent curtain wall and so may represent a range of buildings of unknown function attached to the wall.

3.12 An anomaly was detected by Gater *et al* in the 1982 survey, adjacent to the Norman chapel, but no anomalies were detected in the recent survey. It is known from the 19th century excavation that the nave was square in plan and that part of it was intact under 1.5m of overburden (Holmes 1887). The feature may have been masked by more moisture in the sub-surface during the recent survey.

4. Conclusions

4.1 The changes in background resistance probably reflect variations in the make-up and depth of the overburden which is now thought to be up to 2.5m deep in some areas of the bailey.

4.2 Part of the area of low resistance along the south-western edge of the bailey may reflect the position of the infilled moat that surrounded the 11th century motte and bailey castle. This would confirm the interpretation made during the earlier resistance and radar surveys. However, it should be noted that the top of the cut for this ditch feature is theoretically too far below the current ground surface to be detectable with the standard equipment settings employed during the survey.

4.3 The increased mobile probe separation did not significantly enhance the data in this area, or in either of the other two areas where it was tried.

4.4 A rectangular area of high resistance in the north-west corner of the bailey has been identified. It is thought the linearity of the anomaly suggests that the responses are caused by a structural feature of probable archaeological origin possibly a continuation of the eastern range or a 15th century chapel.

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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Appendices

Appendix 1 Earth resistance survey: technical information and methods
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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 in the vicinity of the feature which increases the potential gradient. It is this potential gradient that is measured to determine the resistance. In this case, the gradient would be increased around the wall giving a *positive* or *high resistance* anomaly.
In contrast a feature such as an infilled ditch may have a moisture retentive fill which is comparitively less resistive to current flow. This will increase the current density and decrease 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 RM15 resistance meter was 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 15m apart and at least 15m away from the grid under survey. This mobile probe spacing of 0.5m gives an approximate depth of penetration of 1m for most archaeological features and so a soil cover of greater than 1m may mask, or significantly attenuate, a geophysical response. To investigate the effects of the depth of overburden on the resistance anomalies detected in the initial survey selected areas were re-surveyed with a mobile probe separation of 1m. All other parameters remained unaltered.

Appendix 2

Survey location information

The site was set out into grids measuring 20m by 20m using an optical square and tapes. At the completion of the survey the grid was tied in using a Geotronics Geodimeter 600 series theodolite to two fixed points (Fig. 2. - PFC2 and PFC3) whose Ordnance Survey co-ordinates are also given on Figure 2. PFC2 is a hole drilled through the mounting bracket of a cast-iron bench (western side) while PFC3 is on the corner of the surviving kitchen wall. During the additional survey the site the site grid was tied in to the same two points.

It should be noted that the Ordnance Survey co-ordinates for 1:2500 digital maps have an error of +/- 1.08m at a 99% degree of confidence. These errors should be taken into account during any re-location of the site grid.

Appendix 3

Geophysical Archive

The geophysical archive comprises:-

1. 3.5 inch floppy disc containing the ‘raw’ data, grid location information, report text and Coreldraw files of all graphics/illustrations

2. library copy of the report

At present these are all held by Archaeological Services (WYAS).

Appendix 4

Resistance data plot (1:500)