REPORT ON GEOPHYSICAL SURVEY

NEW RUGBY FIELD
MALTON

Report Number 92/70

Work commissioned by :

MAP

Archaeological Consultancy Ltd.

GEOPHYSICAL SURVEYS of Bradford

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SITE SUMMARY SHEET

92/70 New Rugby Field, Malton

NGR: SE 796 723

Location, topography and geology

The site lies within the eastern outskirts of Malton, directly to the south of Old Malton Road. At the time of the survey the northern part of the field was ploughed and harrowed, while the southern part was under stubble. The topography is relatively flat, with a slight slope downhill from the road to the River Derwent. The geology is thought to be limestone.

Archaeology

The site lies between the Roman fort and the abbey at Malton. It is believed that a road leaving the eastern gate of the fort crosses the northern part of the survey area. Aerial photographic (AP) evidence has suggested that an enclosure may survive at the northern limit of the survey area, to the north of the approximate line of a Roman road.

Aim of Survey

Both fluxgate gradiometer and resistivity surveys were used to assess the potential archaeological remains at this site. It was hoped that the gradiometer results would indicate the position of the enclosure, while a more limited resistivity survey may locate the road. A sample of the remaining area was surveyed to check for any unknown archaeology.

Summary of Results*

The gradiometer evidence for the existence of the enclosure is slight. Although some of the elements of the cropmark are apparent within the magnetic data, it is suggested that ploughing may have destroyed the majority of the features making up the AP evidence. Elsewhere, anomalies that indicate negative archaeological features i.e. ditches have been identified. The Roman road has also proved elusive and may also be a casualty of the plough.

*** It is essential that this summary is read in conjunction with the detailed results of the survey.**

SURVEY RESULTS

92/70 New Rugby Field, Malton

1. Survey Areas (Figure 1)

1.1 The area surveyed at this site can be divided into two. Area A covers the north-western part of the proposed development, while Area B is to the south-east. All suitable land was surveyed in the former using a fluxgate gradiometer and a 1 ha sample was undertaken of the latter. Two small samples of Area A was also surveyed using the resistivity technique (i.e. Areas 1 and 2 on Figure 1).

1.2 A summary of the archaeological evidence supplied by MAP and the two areas that were surveyed are shown in Figure 1.

1.3 The grids were laid out by Geophysical Surveys of Bradford and detailed tie in information has been supplied to the client.

2. Display

2.1 The results are displayed in two formats :- dot density plot and X-Y trace. These display formats are discussed in the *Technical Section,* at the end of the text.

2.2 For each area data plots and simplified interpretation diagrams are produced at 1:500. Summary plots of the archaeological interpretation are at 1:2500.

3. General Considerations - Complicating factors

3.1 There were few complications, with the survey area being either harrowed earth or stubble.

4. Results

4.1 The data will be described by area.

Area A (Figures A1 - 4)

It was expected that evidence for both the enclosure and the Roman road would be found in this area. The magnetic data were collected over the whole of Area A and extended over a small strip to the north-west. This additional work was undertaken to help assess the nature of the anomalies and to map their extent. The two resistance transects were aligned at approximately right angles to the presumed route of the road.

4.2 Magnetic Data

4.2.1 The magnetic data set provides detail on a number of anomalies within this area. However, the origins of many of the anomalies are uncertain. Of particular concern is the general lack of anomalies that can be assigned to the cropmark enclosure. Although there are some elements that may coincide with the AP evidence (e.g. the 'pit' at (A) or the lengths of ditch at (B)), they are intermittent in nature and may represent continuous features partly damaged by the plough.

4.2.2 In general terms the data can be described as resulting from two types of material; ferrous and non-ferrous. The former is itself seen in two forms; the product of small scraps of ferrous material and the response due to a ferrous pipe. The latter is evident at the south-western boundary of the survey area.

4.2.3 The non-ferrous responses are largely the result of linear ditch type features, although there are a number of large amorphous anomalies which may be archaeological. Alternatively, the latter may reflect changes in the near surface geology.

4.2.4 Two linear trends have been highlighted, due to their alignment, as it was thought that they may represent the presence of a road.

4.3 Resistance Data

4.3.1 The resistance data show few changes that appear to relate to archaeological features. There is no evidence to indicate any substantial features.

4.3.2 It is believed that the variation that can be viewed in the filtered data is due to localised changes in the subsoil. Filtering is a process utilised to 'flatten' the background.

4.3.3 Although there is a linear anomaly running through Area 1, it is thought that this represents the change between plough and stubble.

Area B (Figures B1 - B3)

There is no evidence for archaeological features or sites within Area B. However, it was agreed that this area, approximately 3 ha in extent, should be scanned by gradiometer and a 1 ha sample be surveyed in detail.

4.4 The Scan

4.4.1 The whole area was assessed by visually inspecting the continuous output display from the fluxgate gradiometers. The transect interval was approximately 5m and the method involved using two gradiometers in tandem.

4.4.2 Few significant anomalies were noted during the scan and it was therefore decided to delimit the archaeological type anomalies identified on the boundary between Areas A and B.

4.5 The Detailed Magnetic Survey

4.5.1 One of the linear anomalies noted in Area A continued in Area B and turned sharply north-east. Within the area that is bounded by this ditch system there is a higher noise level. It is not clear if this distribution is random or anthropogenic. It is thought that much of the noise may be ferrous in origin.

4.5.2 Further to the east there is some suggestion for a second field boundary, parallel to the one described in section 4.6.1.

4.5.3 A concentrated area of ferrous disturbance can be seen at the eastern edge of the survey. It is assumed that this is likely to be due to a modern spread of fired material.

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5. Summary of Results

5.1 The results from both the gradiometer and resistance techniques have provided little evidence for the presumed archaeology at this site.

5.2 The gradiometer results have indicated that linear anomalies exist in both Area A and B. It is likely that they are the product of a former field system of unknown date.

5.3 Some elements of the cropmark 'enclosure' have been located, although the anomalies are very broken. This may be due to plough damage. The large 'pit' (A) that was noted on the aerial photograph has been located. However, similar anomalies have been noted elsewhere in Area A and they may all be the product of clay pockets in the limestone.

5.4 No conclusive evidence for the road has been found. Given that the physical structure of the road may be slight, it is possible that little remains to be detected using geophysical techniques.

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Geophysical Surveys of Bradford
22nd October 1992

TECHNICAL INFORMATION

The following is a description of the equipment and display formats used in **GEOPHYSICAL SURVEYS OF BRADFORD** reports. It should be emphasised that whilst all of the display options are regularly used, the diagrams produced in the final reports are the most suitable to illustrate the data from each site. The choice of diagrams results from the experience and knowledge of the staff of **GEOPHYSICAL SURVEYS OF BRADFORD**.

All survey reports are prepared and submitted on the basis that whilst they are based on a thorough survey of the site, no responsibility is accepted for any errors or omissions.

Magnetic readings are logged at 0.5m intervals along one axis in 1m traverses giving 800 readings per 20m x 20m grid, unless otherwise stated. Resistance readings are logged at 1m intervals giving 400 readings per 20m x 20m grid. The data are then transferred to portable computers and stored on 3.5" floppy discs. Field plots are produced on a portable Hewlett Packard Thinkjet. Further processing is carried out back at base on computers linked to appropriate printers and plotters.

Instrumentation

(a) Fluxgate Gradiometer - Geoscan FM36

This instrument comprises of two fluxgates mounted vertically apart, at a distance of 500mm. The gradiometer is carried by hand, with the bottom sensor approximately 100-300mm from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is conventionally measured in nanoTesla (nT) or gamma. The fluxgate gradiometer suppresses any diurnal or regional effects. Generally features up to one metre deep may be detected by this method.

(b) Resistance Meter - Geoscan RM4 or RM15

This measures the electrical resistance of the earth, using a system of four electrodes (two current and two potential.) Depending on the arrangement of these electrodes an exact measurement of a specific volume of earth may be acquired. This resistance value may then be used to calculate the earth resistivity. The "Twin Probe" arrangement involves the paring of electrodes (one current and one potential) with one pair remaining in a fixed position, whilst the other measures the resistance variations across a fixed grid. The resistance is measured in Ohms and the calculated resistivity is in Ohm-metres. The resistance method as used for area survey has a depth resolution of approximately 0.75m, although the nature of the overburden and underlying geology will cause variations in this generality. The technique can be adapted to sample greater depths of earth and can therefore be used to produce vertical "pseudo sections".

(c) Magnetic Susceptibility

Variations in the magnetic susceptibility of subsoils and topsoils occur naturally, but greater enhanced susceptibility can also be a product of increased human/anthropogenic activity. This phenomenon of susceptibility enhancement can therefore be used to provide information about the "level of archaeological activity" associated with a site. It can also be used in a predictive manner to ascertain the suitability of a site for a magnetic survey. The instrument employed for measuring this phenomenon is either a field coil or a laboratory based susceptibility bridge. For the latter 50g soil samples are collected in the field.

Display Options

The following is a description of the display options used. Unless specifically mentioned in the text, it may be assumed that no filtering or smoothing has been used to enhance the data. For any particular report a limited number of display modes may be used.

(a) X-Y Plot

This involves a line representation of the data. Each successive row of data is equally incremented in the Y axis, to produce a stacked profile effect. This display may incorporate a hidden-line removal algorithm, which blocks out lines behind the major peaks and can aid interpretation. Advantages of this type of display are that it allows the full range of the data to be viewed and shows the shape of the indiviual anomalies. Results are produced on a flatbed plotter.

(b) Dot-Density

In this display, minimum and maximum cut-off levels are chosen. Any value that is below the minimum cut-off value will appear white, whilst any value above the maximum cut-off value will appear black. Any value that lies between these two cut-off levels will have a specified number of dots depending on the relative position between the two levels. The focus of the display may be changed using different levels and a contrast factor (C.F.). Usually the C.F. = 1, producing a linear scale between the cut-off levels. Assessing a lower than normal reading involves the use of an inverse plot, This plot simply reverses the minimum and maximum values, resulting in the lower values being presented by more dots. In either representation, each reading is allocated a unique area dependent on its position on the survey grid, within which numbers of dots are randomly placed. The main limitation of this display method is that multiple plots have to be produced in order to view the whole range of the data. It is also difficult to gauge the true strength of any anomaly without looking at the raw data values. This display is much favoured for producing plans of sites, where positioning of the anomalies and features is important.

(c) Contour

This display joins data points of an equal value by a contour line. Displays are generated on the computer screen or plotted directly on a flat bed plotter / inkjet printer.

(d) 3-D Mesh

This display joins the data values in both the X and Y axis. The display may be changed by altering the horizontal viewing angle and the angle above the plane. The output may be either colour or black and white. A hidden line option is occasionally used (see (a) above).

(e) Grey-Scale

This format divides a given range of readings into a set number of classes. These classes have a predefined arrangement of dots or shade of grey, the intensity increasing with value. This gives an appearance of a toned or grey scale.

Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. While colour plots can look impressive and can be used to highlight certain anomalies, grey-scales tend to be more informative.