STRATASCAN

Geophysical Survey Report

Ashby Parva – Northern area
Leicestershire

for

University of Leicester Archaeological Services

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J1917

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1 SUMMARY OF RESULTS

A magnetic susceptibility survey was carried out near Ashby Parva, Leicestershire, over approximately 6.8ha over agricultural ground. It has located areas of low, moderate and high susceptibility. Two areas of detail magnetometry were carried out, targeting moderate to high areas of magnetic enhancement.

The majority of anomalies found within the detailed magnetometry survey were weak magnitude responses mainly associated with previous agricultural activity, including plough marks (possibly ridge and furrow) and a possible previous field boundary. Little evidence of archaeological activity had been identified within the geophysical survey, although a small number of positive anomalies may be of archaeological origin.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by University of Leicester Archaeological Services to undertake a geophysical survey of an area outlined for a quarry extension. Stratascan previously surveyed an area of 30ha in May 2004 (J1864), lying southeast of the present survey area.

2.2 Site location

The site is located northeast of Ashby Parva, Leicestershire, and is centred approximately at OS ref. SP 534 889.

2.3 Description of site

The survey area covered approximately 6.8ha of agricultural land. The underlying geology is Lower Lias with overlying glacial sands and gravel (British Geological Survey South Sheet, Forth Edition Solid, 2001, Institute of Geological Sciences South Sheet, First Edition Quarternary, 1977). The overlying soils are known as Beccles 3 soils which are typical stagnogley soils. These consist of slowly permeable seasonally waterlogged fine loamy over clayey soils with only slight waterlogging (Soil Survey of England and Wales, Sheet 3 Midland and Western England).

2.4 Site history and archaeological potential

No specific details of the site history or archaeological potential were made available to stratascan. The survey carried out in May 2004 (J1894), situated southeast of the present survey area revealed evidence for former ridge and furrow agricultural systems across the site.

2.5 Survey objectives

The objective of the survey was to locate any features of possible archaeological origin in order that they may be assessed prior to extension of the adjacent quarry.

2.6 Survey methods

The reconnaissance technique of magnetic susceptibility was employed over the whole of the survey area. From this two areas of enhancement were targeted with detailed magnetometer survey together with an area of low enhancement to test 'blank' areas. More information regarding these techniques is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 3 days from 16/9/04 to 19/9/04 when the weather was wet.

3.2 Grid locations

The location of the survey grids has been plotted in Figures 2 and 4.

3.3 Description of techniques and equipment configurations

3.3.1 Magnetic Susceptibility

Alteration of iron minerals in topsoil through biological activity and burning can enhance the magnetic susceptibility (MS) of that soil. Measuring the MS of a soil can therefore give a measure of past human activity and can be used to target the more intensive and higher resolution techniques of Magnetometry and Resistivity. Measurements of MS were carried out using a field coil which provides a rapid scan and has the benefit of allowing "insitu" readings to be taken.

The equipment used on this contract was an MS2 Magnetic Susceptibility meter manufactured by Bartington Instruments Ltd. A field coil known as an MS2D was used to take field readings. This assessed the top 200mm or so of topsoil. To overcome the problem of ground contact all readings were taken 4 or 5 times and an average taken. All obvious localised "spikes" were ignored.

3.3.2 Magnetometer

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each sensor has a 1m separation between the sensing elements giving a strong response to deep anomalies.

3.4 Sampling interval, depth of scan, resolution and data capture

3.4.1 Sampling interval

Magnetic susceptibility
The magnetic susceptibility survey was carried out on a 20 m grid with readings being taken at the node points.

Magnetometer
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

3.4.2 Depth of scan and resolution

Magnetic Susceptibility
The MS2D coil assesses the average MS of the soil within a hemisphere of radius 200mm. This equates to a volume of some $0.016m^3$ and maximum depth of 200mm. As readings are only at 20m centres this results in a very coarse resolution but adequate to pick up trends in MS variations.

Magnetometer
The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. The collection of data at 0.5m centres provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

Magnetic susceptibility
The readings are logged manually on site, and then transferred to the office where they are entered into a computer and grey scale plots are produced.

Magnetometer
The readings are logged consecutively into the data logger which in turn is daily down- loaded into a portable computer whilst on site. At the end of each job, data is transferred to the office for processing and presentation.

3.5 Processing, presentation of results and interpretation

3.5.1 Processing

Magnetic susceptibility
No processing of the data has been undertaken.

Magnetometer
Processing is performed using specialist software known as *Geoplot 3.* This can emphasise various aspects contained within the data but which are often not easily seen in the raw data. Basic processing of the magnetic data involves 'flattening' the background levels with respect to adjacent traverses and adjacent grids. 'Despiking' is also performed to remove the anomalies resulting from small iron objects often found on agricultural land. Once the basic processing has flattened the background it is then possible to carry out further processing which may include low pass filtering to reduce 'noise' in the data and hence emphasise the archaeological or man-made anomalies.

The following schedule shows the basic processing carried out on all processed magnetometer data used in this report:

Zero mean grid	*Threshold = 0.25 std. dev.*
Zero mean traverse	*Last mean square fit = off*
Despike	*X radius = 1 Y radius = 1*
	Threshold = 3 std. dev.
	Spike replacement = mean

3.5.2 Presentation of results and interpretation

Magnetic susceptibility
The presentation of the data for this site involves a grey scale plot of the field measurements overlain onto a site plan (see Figure 3).

Magnetometer
The presentation of the data for each site involves a print-out of the raw data both as grey scale (Figure 5 and 10) and trace plots (Figure 6,7,11 and 12), together with a grey scale plot of the processed data (Figure 8 and 13). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 9, 14 and 15).

4 RESULTS

4.1 Magnetic susceptibility

Two areas of high magnetic susceptibility can be identified in the north central area of the southern field and south central area of the northern field. High levels of magnetic susceptibility have also been identified along the north eastern edge of the survey area; this is possibly caused by ground disturbance from the nearby quarry and close

proximity to overhead cables. From the results two areas were selected for detailed magnetometry, targeting moderate to relatively high magnetically enhanced areas.

4.2 Detailed magnetometry

The detailed magnetometry survey was carried out over 2ha and targeted two moderate to high areas of magnetic enhancement identified from the magnetic susceptibility survey.

Area 1 (*Figures 4-9*)

A series of positive linear anomalies orientated approximately north to south can be identified to the western side of the survey area. These anomalies are likely to represent former agricultural activity.

A number of strong discrete positive anomalies with negative returns can be seen scattered across the survey area; these are likely to be responses from near surface ferrous objects.

Two faint negative linear anomalies can be seen towards the northern part of the survey area in a north west to south east orientation. These may represent remains of earthworks, possibly associated with agricultural activity or may be archaeological in origin.

Towards the south of the survey area is a pair of positive and negative linear anomalies no more than twenty metres in length. It is uncertain what these anomalies represent.

An area of weak positive readings was identified approximately in the centre of the survey area and is of uncertain origin.

Area 2 (*Figures 10-14*)

A positive linear anomaly orientated approximately north to south can be seen running through the survey area, this is likely to be associated with previous agricultural activity and may indicate a previous field boundary. It may represent the former continuation of a boundary still existent to the south of the survey area.

A series of positive linear anomalies with an orientation of approximately east to west can be seen to east of the survey area. These are likely to be associated with previous agricultural activity.

Two areas of magnetic disturbance have been identified in the survey area; these are likely to be responses to modern ferrous material. The larger area could also be associated with the possible former field boundary.

A small number of strong discrete positive anomalies with negative returns can be seen scattered across the survey area; these are likely to be responses from near surface ferrous objects.

Towards the northern edge of the survey area, three faint positive linear anomalies have been identified. These may represent cut features of possible archaeological origin.

5 CONCLUSION

A magnetic susceptibility survey has located areas of low, moderate and high susceptibility. Two areas of detail magnetometry were carried out, targeting moderate to high areas of magnetic enhancement.

The majority of anomalies found within the detailed magnetometry survey were weak magnitude responses mainly associated with previous agricultural activity, including plough marks (possibly ridge and furrow) and a possible previous field boundary. Little archaeological activity has been identified in the geophysical survey, although a small series of positive linear anomalies have been identified in the northern part of survey area 2 and may be of archaeological origin.