STRATASCAN

Geophysical Survey Report

Middleton and Oakgrove, Milton Keynes, Buckinghamshire

for

Birmingham Archaeology

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J1895

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LIST OF FIGURES

1 SUMMARY OF RESULTS

A magnetic susceptibility survey was carried out over approximately 7ha at Middleton and Oakgrove near Milton Keynes in Buckinghamshire. Although poor surveying conditions caused by scrub growth affected surveying progress, areas of magnetic enhancement were located in Area A to the east of the site. Subsequent detailed magnetic survey within Area A and Area C in the west of the site located geophysical anomalies, however they cannot be defined as characteristically archaeological and they are likely to be responses to modern objects and features within the site.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Birmingham Archaeology to undertake a geophysical survey of an area outlined as the Oakgrove Millenium Community Development which will involve the construction of 1700 homes and associated infrastructure.

2.2 Site location

The site is located near to Milton Keynes village, Buckinghamshire and approximately centred on OS ref. SP 880 387.

2.3 Description of site

The survey was located over three areas (Areas A, B and C) which cover approximately 7.4ha of uncultivated, relatively flat land covered with long grass and scrub. The underlying geology is Oxford Clay with drift deposits of alluvium and river terrace gravels (British Geological Survey 2001 and 1977). The overlying soils are known as Bishampton 2 soils which are stagnogleyic argillic brown earths. These consist of deep fine loamy and fine loamy over clayey soils with slowly permeable subsoils and slight seasonal waterlogging associated with similar slowly permeable seasonally waterlogged soils (Soil Survey of England and Wales 1983).

2.4 Site history and archaeological potential

The site was used for agriculture until the 1960s when the land became a quarry and was subsequently used as a landfill site. Evidence for ridge and furrow can be seen on aerial photographs of the area prior to quarrying. Excavations during quarrying operations revealed evidence of occupation from the prehistoric to the Saxon periods (Nichol, 2003). The survey areas located close to the site boundaries and have been identified as areas with archaeological potential. However scrub growth, landfill vent pipes and soil dumps make surveying conditions difficult and can affect data collected in the field.

2.5 Survey objectives

The objective of the survey was to locate any features of possible archaeological significance in order that they may be assessed prior to development.

2.6 Survey methods

The reconnaissance technique of magnetic susceptibility was employed over the whole of the three survey areas where scrub growth did not restrict access. From this two areas of enhancement were targeted with detailed magnetometer survey together with an area of low enhancement to act as a control. 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 four days from 7th to the 12th July 2004 when the weather was dry.

3.2 Grid locations

The location of the survey grids for the magnetic susceptibility survey Areas A & B has been plotted in Figure 2 at a scale of 1:2000. Referencing for the magnetic susceptibility and detailed magnetometry surveys has been plotted in Figures 3, 5 and 11 for Area A and Figure 16 for Area B. The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were set out using a Leica 705auto Total Station and referenced to suitable topographic features around the perimeter of the site.

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. 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 Grad601-2 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 0.25m 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 (eg Figure 4).

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

4 RESULTS

4.1 Magnetic susceptibility

The magnetic susceptibility survey showed that Area A has moderate to relatively high levels of magnetic enhancement within the centre and southern half of the survey area, with lower levels in the northwest (Figure 4). Area B showed a mix of levels of low, moderate and higher magnetic enhancement with the highest levels of enhancement closest to roads and footpaths (Figure 17). Area C has relatively low levels of magnetic enhancement throughout the survey area (Figure 19).

Two areas of relatively high magnetic enhancement were selected from Area A for detailed magnetic survey, and one in Area C with low enhancement to act as a control. Surveying conditions were not favourable in Area B and no detailed magnetic survey was carried out. Surveying conditions were affected by unrestricted scrub growth in many places. Dumped soil is evident in many parts of the survey areas, this may have been spread across the site and vent pipes from the landfill site are also situated within the survey areas suggesting the landfill extends into them. It is therefore likely that modern use and activity on the site may have destroyed or obscured any possible archaeological features.

4.2 Detailed magnetometry

Detailed magnetometry survey was carried out over two areas within Area A where magnetic enhancement was relatively high. Although the magnetic survey located some geophysical anomalies within the site these cannot be defined as characteristically archaeological features. It is likely that modern activity has affected the site and the presence of features relating to landfill operations suggest that the landfill area may cover all or part of the areas surveyed. Anomalies can be categorised as positive linear anomalies, possible negative linear anomalies, discrete low magnitude positive anomalies, strong discrete positive anomalies with negative returns, and areas of magnetic debris and disturbance.

Area A (Figures 5-11)

Several positive and negative linear anomalies (1) in the southern part of the survey area appear in the form of a possible rectilinear anomaly. Several discrete dipolar anomalies (2) can also be seen close to and amongst (1) suggesting an association. The origin of this group of anomalies is not certain, although they are likely to be modern, and it is possible that they may have some association with the methane vent pipe (3) that is indicated by the dipolar anomaly and its surrounding magnetic disturbance.

A series of very low magnitude positive linear anomalies (4) are located across the survey area and oriented approximately north – south and may have been caused by mechanical vehicles on the site.

Several areas of magnetic disturbance (5) can be seen close to the survey edges and are likely to be responses to adjacent vent pipes and other ferrous objects. The presence of ferrous objects in the topsoil is indicated by several strong discrete positive anomalies with negative returns (6) across the site.

Area A1 (Figures 11-15)

Two positive linear anomalies are located towards the centre and a positive curvilinear anomaly is located towards the northern corner of the survey area. These anomalies are of low magnitude and it is impossible to be certain of there origin.

A discrete positive area anomaly can be seen near the western corner of the survey area. It is difficult to be certain of the origin of this anomaly, because of its form it is possible that it is a response to the magnetically enhanced fill of pit although the strength of the anomaly may suggest it is a response to a ferrous object. Several other bipolar anomalies with differing strengths can be seen across the site. It is likely that these are responses to ferrous objects in the topsoil with the weaker bipolar responses indicating ferrous objects buried at depth.

Area C (Figures 20-25)

A linear area of magnetic disturbance can be seen across the survey area oriented from the northeast corner towards the southwest corner and possibly indicates the presence of a modern service or cable. An area of magnetic debris can be seen to lead towards this anomaly from the northwest and may be a response to the thermoremnant material used in the construction of a pipe which has been subsequently destroyed and scattered or to material used to backfill the trench. It is also possible that these anomalies relate to the metalled surface of a former road or trackway which has slag or other thermoremnant material used in its construction.

An area of magnetic disturbance along the southern edge of the survey area is a response to ferrous material used in the construction of the adjacent fenceline. The presence of ferrous objects likely to be modern in origin are indicated by several discrete bipolar anomalies across the survey area.

5 CONCLUSION

A magnetic susceptibility survey carried out over three areas, A, B and C, revealed areas of moderate to relatively high enhancement in Area A. Detailed magnetometry carried out in two areas within Area A and C located a number of geophysical anomalies although they are not characteristically archaeological. Modern land use including vent pipes from the landfill and scrub growth have affected survey. Magnetic susceptibility survey in Area B showed a mix of relative enhancements with no distinct areas within the site. It is possible that modern activity has destroyed or obscured any archaeological features that may have been present on the site.

6 REFERENCES

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