Geophysical Survey Report

Wickham Bushes, Bracknell, Berkshire

for
Thames Valley Archaeological Services

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J1957

K T Donaldson
Geophysical Survey Report
Wickham Bushes, Bracknell, Berkshire

Client: Thames Valley Archaeological Services (TVAS)

Stratascan Job No: J1957

Techniques: Detailed magnetic survey (gradiometry)
Detailed resistance survey

National Grid Ref: SU 866 649

Field Team: David Elks, Alex Pimlow

Project Manager: David Sabin

Report written by: Kerry Donaldson

CAD illustration by: Kerry Donaldson

Checked by: David Sabin
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1 SUMMARY OF RESULTS

Detailed magnetic and resistance surveys were conducted over the site of the Roman town at Wickham Bushes near Bracknell in Berkshire. The detailed magnetic survey results show several low magnitude positive area and linear anomalies that may relate to cut features. Areas of weak magnetic debris also indicate that thermoremnant material is also located within the site. There is a correlation between several of the magnetic anomalies and a “U” shaped area of relatively low resistance which may represent a cut feature with an archaeological origin. Generally the resistance survey had very high values with lower resistance in the north and east which may be due to the underlying geology and drift deposits. The geology, soils and previous land use may also be responsible for the very low levels of magnetic enhancement within the site.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Thames Valley Archaeological Services to undertake a geophysical survey of the site of the Roman town of Wickham Bushes near Bracknell.

2.2 Site location

The site is located within the Windsor Forest at Wickham Bushes, south of Bracknell, Berkshire at OS ref. SU 8658 6493.

2.3 Description of site

The survey area is 4500m² of heathland which has been recently cleared of plantation. The underlying geology is the Tertiary deposits of the Barton, Bracklesham and Bagshot Beds overlain by Sand and Gravel (British Geological Survey 1979, Institute of Geological Sciences 1977). The overlying soils are known as Southampton soils which are paleo-argillie podsols. These consist of well drained very acid, very flinty sandy soils with a bleached subsurface horizon. (Soil Survey of England and Wales 1983).

2.4 Site history and archaeological potential

The site of the Roman town of Wickham Bushes is located approximately 600m south of the Iron Age Hillfort of Caesar’s Camp and approximately 400m north of the Roman road from London to Silchester. A geophysical survey of Caesar’s Camp in 1995 located a small number of pit like responses, the sparsity and low magnitude of the anomalies may have been due to the acidic environment caused by pedology and pine needle litter (Linford 1995). There is therefore a potential of locating geophysical anomalies with an archaeological origin within the site although the underlying geology and soils may be an affecting factor within the results.

2.5 Survey objectives

The objective of the survey was to locate any anomalies that may be of archaeological significance so that they may be assessed.
2.6 Survey methods

Detailed magnetometry and resistivity surveys were carried out across the site in order to assess the area with complementary techniques. More information regarding these techniques is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out on the 14th of December 2004 when the weather was dry.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Two areas were selected for survey either side of a forest ride, centred on the site of the Roman town.

Two baselines were set out using a Leica GS50 differential GPS. The GS50 receives correction signals from land based beacons resulting in sub-metre accuracies.

Plate 1 Looking north along baseline

3.3 Description of techniques and equipment configurations

3.3.1 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 dual FM256 Fluxgate Gradiometers, manufactured by Geoscan Research. The gradiometers are suspended on a frame CF6. One gradiometer acts as a master trigger that controls the second slave gradiometer. The instruments each consist of two fluxgates mounted 0.5m vertically apart, and 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.

### 3.3.2 Resistance Meter

This method relies on the relative inability of soils (and objects within the soil) to conduct an electrical current, which is passed through them. As resistivity is linked to moisture content, and therefore porosity, hard dense features such as rock will give a relatively high resistivity response, while features such as a ditch which retains moisture give a relatively low response.

The resistance meter used was an RM15 manufactured by Geoscan Research incorporating a mobile Twin Probe Array. The Twin Probes are separated by 0.5m and the associated remote probes were positioned approximately 15m outside the grid. The instrument uses an automatic data logger, which permits the data to be recorded as the survey progresses for later downloading to a computer for processing and presentation.

Though the values being logged are actually resistances in ohms they are directly proportional to resistivity (ohm-metres) as the same probe configuration was used through-out.

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

#### 3.4.1 Sampling interval

**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.

**Resistivity**
Readings were taken at 1.0m centres along traverses 1.0m apart. This equates to 900 sampling points in a full 30m x 30m grid. All traverses were surveyed in a “zigzag” mode.
3.4.2 Depth of scan and resolution

Magnetometer
The FM256 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.

Resistivity
The 0.5m probe spacing of a twin probe array has a typical depth of penetration of 0.5m to 1.0m. The collection of data at 1m centres with a 0.5m probe spacing provides an appropriate methodology balancing cost and time with resolution.

3.4.3 Data capture

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

Resistivity
The readings are logged consecutively into the data logger which in turn is daily downloaded 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

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
Resistivity

The processing was carried out using specialist software known as Geoplot 3 and involved the 'despiking' of high contact resistance readings and the passing of the data though a high pass filter. This has the effect of removing the larger variations in the data often associated with geological features. The nett effect is aimed at enhancing the archaeological or man-made anomalies contained in the data.

The following schedule shows the processing carried out on the processed resistance plots.

| Despike       | X radius = 1  |
|               | Y radius = 1  |
| Spike replacement |

| High pass filter | X radius = 10 |
|                 | Y radius = 10 |
| Weighting = Gaussian |

3.5.2 Presentation of results and interpretation

Magnetometer

The presentation of the data for the site involves a print-out of the raw data both as grey scale (Figure 3) and trace plots (Figure 4 and 5), together with a grey scale plot of the processed data (Figure 6). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 9).

Resistivity

The presentation of the data for the site involves a print-out of the raw data as a grey scale plot (Figure 7), together with a grey scale plot of the processed data (Figure 8). Anomalies have been identified and plotted onto the ‘Abstraction and Interpretation of Anomalies’ drawing (Figure 10). A smaller area of resistivity was carried out due to surveying conditions and time constraints.

4 RESULTS

Magnetometer

The results of the detailed magnetic survey show that levels of magnetic enhancement are generally very low. This may be due to the geology, pedology or even recent use of the site. It may be that the underlying very acidic podsol soils are iron deficient and that the plantation and subsequent removal of the trees has affected the ability of the environment to yield detectable magnetic anomalies. Similar low magnitude responses have also been seen in a geophysical survey of Caesar’s Camp conducted by English Heritage (Linford 1995).

In Area 1 several low magnitude positive area (1 and 2) and linear anomalies (3) can be seen primarily within the southern half of the survey area. The strength of these anomalies is generally less than 1nT and although they may be a response to the magnetically enhanced fill of cut features, levels of enhancement are relatively low.
Areas of magnetic debris can be seen in the south of Area 1 as anomalies (4 and 5). These anomalies are generally of a low magnitude which may indicate that they are a response to weakly magnetic thermoremmnant material. It is possible that this thermoremmnant material has been caused by areas of burning, however they may have been caused by spreads of debris associated with settlement such as burnt daub or pottery.

Several strong discrete dipolar anomalies (6) can be seen in Area 1 and it is likely that these are responses to ferrous objects within the topsoil. Two strong anomalies (7 & 8) are located within an area of magnetic debris and may indicate that thermoremmnant objects are associated with the spread, although these may be ferrous.

Area 2 contains three strong dipolar anomalies (9) that are likely to relate to ferrous objects. A low magnitude positive linear anomaly (10) can be seen in the southwest corner of the survey grid but is of uncertain origin.

Resistivity

The resistivity survey shows that there is a change in the relative resistance within the survey grids. Generally areas of high resistance can be seen in the southwest with relatively lower resistance areas in the northeast. It is possible that this change in response is due to the underlying geology or drift deposits and responses may therefore be to lenses of sands and gravels. However in the south of Area 1, adjacent to a general high resistance anomaly (11) is a “U” shaped area of lower resistance (12). This relatively low area shows a very close correlation with positive area anomaly (1) and the western area of magnetic debris (4) seen in the magnetometry results. The combination of these results therefore indicates that there is a possible “U” shaped cut feature with a magnetically enhanced and low resistance fill in the south of the site. It is possible that the high resistance anomaly (11) relates to structural remains, however the small scale of the survey and the anomalous response due to the general high resistance makes it difficult to confidently determine the origin.

Although the majority of the northern half of Area 1 is generally of a lower resistance, it is possible to abstract a distinct low resistance anomaly (13) that may relate to a cut feature close to the north-western corner of the survey grids. It is possible that this anomaly is a continuation of the western part of anomaly (12) located to the south.

In Area 2 the northern half of the grid is generally of a lower resistance to the southern half. Within this grid a fragmented area of relatively low resistance (14) can be seen extending from the northwest to the southeast. There is no correlation with the detailed magnetic survey and although this anomaly has a linear form it is difficult to be certain of its origin.

5 CONCLUSION

The detailed magnetic and resistance surveys show some correlation between anomalies. An area of magnetic debris and a positive area anomaly, identified within the magnetic survey, in the south of Area 1 correspond to a “U” shaped relatively low resistance area. It is possible that the anomalies located by the different techniques are a
response to the fill of a cut ditch like feature. Although modern burning or dumping may be responsible for areas of magnetic debris, it is possible that these generally low magnitude anomalies are responses to thermoremnant material associated with occupation of the site.

Levels of magnetic enhancement are generally low across the site. This does not necessarily indicate a lack of archaeological features, but it may be that the underlying acidic sandy soils have leached out the iron rich compounds which does not allow for magnetic enhancement of the subsequent fills of cut features.

The resistance survey showed a difference in resistance values within the grids with the north and northeast of the survey area of a generally lower resistance than the south and west which were very high. It is possible that the differing resistance may be a response to underlying geology or drift deposits of sand and gravels which coupled with the small scale of the survey has made characterisation of features difficult.

6 REFERENCES


Plotting parameters

-20nT/cm vertical displacement

(Positive values displace above the trace line.
Hidden values have not been plotted)
Plotting parameters
Area 1
Maximum +2nT (black)
Minimum -2nT (white)

Plotting parameters
Area 2
Maximum +2nT (black)
Minimum -2nT (white)
Area 1

Area 2

Plotting parameters
Area 1
Maximum -242.703 (black)
Minimum -228.413 (white)

Plotting parameters
Area 2
Maximum +177.280 (black)
Minimum -176.730 (white)

Project Title: GEOPHYSICAL SURVEY - WICKHAM BUSHES, BERKSHIRE
Subject: PLOT OF PROCESSED RESISTIVITY DATA

STRATASCAN
GEOPHYSICS FOR ARCHAEOLOGY
AND ENGINEERING
VINEYARD HOUSE
UPPER HOOK ROAD
UPTON UPON SEVERN
UK
T: +44 (0)1684 592266
F: +44 (0)1684 594142
E: info@stratascan.co.uk
www.stratascan.co.uk