STRATASCAN

Geophysical Survey Report

Tottenham House, Savernake
Wiltshire

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J2053

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Tottenham House, Savernake

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Techniques: **Detailed magnetic survey (gradiometry)**
Resistivity (Trial)

National Grid Ref: **SU 250 639**

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1 SUMMARY OF RESULTS

The gradiometer survey undertaken at Tottenham House, Savernake, Wiltshire was successful in locating a number of features of archaeological potential, including positive linear anomalies representing possible ditches and discrete positive anomalies indicating the presence of possible pits or tree bowls.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Wessex Archaeology to undertake a geophysical survey of an area outlined for proposed development as a golf course.

2.2 Site location

The site is located at Tottenham House, Savernake at OS ref. SU250 639.

2.3 Description of site

The survey area consists approximately 4.86ha of rolling arable land.

The underlying geology is chalk, including red chalk, from the lower cretaceous period (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils are known as Batcome soils which are a type of plateau drift. These consist of deep fine loamy over clayey soils with slowly permeable sub soils and slight seasonal waterlogging (Soil Survey of England and Wales, Sheet 4 Eastern England).

2.4 Site history and archaeological potential

Former tree avenues and a walled kitchen garden are known to be on site. Plots showing the location of cropmarks within the area were provided by Wessex Archaeology.

2.5 Survey objectives

The objective of the survey was to locate any anomalies that may relate to previous tree avenues and the walled kitchen garden prior to development.

2.6 Survey methods

Detailed magnetometry and Resistivity were trialed in the walled garden and avenue areas of the site. The gradiometer survey results produced greater definition than those of the resistance meter. As a result the survey was completed using the gradiometer at 0.5m x 0.25m centres.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over 5 days on the 12th of October 2005 when the weather was variable.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information.

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 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.

3.3.2 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 0.5m apart. This equates to 7200 sampling points in a full 30m x 30m grid.

Resistivity
Readings were taken at 0.5m centres along traverses 0.5m apart. This equates to 3600 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 Grad 601 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 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.

Resistivity
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

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 survey involves a print-out of the raw data both as grey scale (Figures 4, 9 and 14) and trace plots (Figure 5, 6, 10, 11, 15 and 16), together with a grey scale plot of the processed data (Figure 7, 12 and 17). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site (Figure 8, 13, 18).

Resistance
A grey scale plot of the processed Resistivity trial data can be seen in Figure 3.

4 RESULTS

4.1 Trials

Resistivity and magnetometry techniques were trialed over the site. The gradiometer data produced greater definition than that of the resistance meter. The gradiometer trial was undertaken using 0.5m x 0.25m centres and was resampled to show the data at 1m x 0.25m. The results of this can be seen in Figure 19. It was decided, in co-operation with English Heritage, to complete the survey using the gradiometer with a sample and traverse interval of 0.25m x 0.5m in order to provide the best definition.

4.2 Walled Garden Area

The gradiometer survey undertaken in the walled garden area of Tottenham House produced a number of anomalies of possible archaeological potential (Figure 8). A large number of positive linear anomalies, possibly caused by ditches, are evident in this area. These features are probably related to the cropmarks as shown in the plans provided by Wessex Archaeology. A number of discrete positive anomalies are also evident in this area, which have been interpreted as possible pits and may be of archaeological origin.

Modern activity is represented in this area by a modern service running approximately north to south through the eastern edge of the survey area.

4.3 Avenue Area 1

The results in Avenue Area 1 are dominated by the presence of magnetic debris. The origin of this debris is uncertain. However, it may represent a demolished brick building or a site of minor industrial activity. Further investigation is required in order to ascertain the origin of these features. Positive linear anomalies are seen across the site that may represent ditch-like features, while the negative linear anomaly may provide evidence for a former bank or earthwork. A number of possible pits have been identified in this area in the form of discrete positive anomalies. A positive linear anomaly with a negative return may be caused by a modern service such as a ceramic drain.

4.4 Avenue Area 2

Positive linear anomalies and discrete positive anomalies dominate the results of Avenue Area 2. As with the other areas, the positive linear anomalies may represent former ditches. The discrete positive anomalies may represent possible pits. To the eastern edge of this survey area are a number of these possible pits that have an approximate east-west alignment. It is possible that these may represent the position of the trees in the former avenue. However, this may not be the case as the pits are very close to each other. Therefore, further investigation is required to identify the origin of these features.

An area of magnetic debris can be seen to the east of this survey area. This debris is related to some form of ground disturbance, the demolition of a building for example. The linear debris marked in orange on Figure 18 has been interpreted as possible land drains. Positive anomalies with associated negative responses are related to buried ferrous objects of possible modern origin.

5 CONCLUSION

The gradiometer survey undertaken at Tottenham House, Savernake was successful in locating a number of anomalies of possible archaeological origin. However, we cannot say with any certainty that we have located the position of the kitchen walled garden or the former tree avenue.

Due to the large amount of positive linear anomalies located in the walled garden area it is difficult to differentiate between linears representing the edge of the garden and those relating to earlier activity.

The areas over the suspected route of the tree avenue have produced less in the way of archaeological potential. A number of possible pits may indicate the location of the former trees; however further investigation is required in order to ascertain the nature of these anomalies. Areas of magnetic debris are also evident along parts of the avenue. These features may represent areas of demolition or small-scale industrial activity. Until further investigation has been carried out, the origin of these anomalies remains unknown.