STRATASCAN

Geophysical Survey Report

Ridgeway National Trail, Swindon

for

Swindon Borough Council

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REGISTERED IFA ORGANISATION

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LIST OF FIGURES

1 SUMMARY OF RESULTS

Various positive and negative linear features have been identified that may be produced by buried embankments and cut features of archaeological origin.
There are also numerous clusters and linear arrangements of discrete positive and negative responses which may be associated with archaeology.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Swindon Borough Council to undertake a geophysical survey of an area of Ridgeway National Trail outlined for restoration. This survey also forms part of an ongoing archaeological investigation.

2.2 Site location

The site is located on the eastern side of Barbury Castle Country Park, Swindon, at OS ref. SU 144 763.

2.3 Description of site

The survey area is approximately 0.75ha of rough grassland as can be seen in the photograph below taken from the western edge of the site.

2.4 Geology and soils

The underlying geology is Chalk, including Red Chalk (British Geological Survey South Sheet, Third Edition Solid, 1979). The overlying soils are known as Icknield soils and are humic rendzinas. These consist of shallow, mostly humose, well-drained calcareous soils (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

The area surrounding the survey site is a prehistoric landscape near to the Iron Age Hill Fort of Barbury Castle with several barrows located nearby. There is significant archaeological potential within this area due to the close proximity of this prehistoric activity.

2.6 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.

2.7 Survey methods

Detailed magnetic survey (gradiometry) was used as an efficient and effective method of locating archaeological anomalies. More information regarding this technique is included in the Methodology section below.

3 METHODOLOGY

3.1 Date of fieldwork

The fieldwork was carried out over one day on the 1st April 2005. Weather conditions during the survey were fine.

3.2 Grid locations

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 using a Leica GPS 500 to the Ordnance Survey National Grid.

3.3 Survey equipment

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. 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 increasing the sensitivity to small changes in the Earths magnetic field.

3.4

Sampling interval, depth of scan, resolution and data capture

3.4.1 *Sampling interval*

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*

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*

The readings are logged consecutively into the data logger, which in turn is down-loaded daily 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*

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 gradiometer data used in this report:

1. *Despike* (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)

   Geoplot parameters:
   X radius = 1, y radius = 1, threshold = 3 std. dev.
   Spike replacement = mean

2. *Zero mean grid* (sets the background mean of each grid to zero and is useful for removing grid edge discontinuities)

Geoplot parameters:
Threshold = 0.25 std. dev.

3. *Zero mean traverse* (sets the background mean of each traverse within a grid to zero and is useful for removing striping effects)

Geoplot parameters:
Least mean square fit = off

3.5.2 Presentation of results and interpretation

The presentation of the data for each site involves a print-out of the raw data both as greyscale (Figure 3) and trace plots (Figure 4 and 5), together with a greyscale 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 7).

4 RESULTS

An area of positive magnetic response and two weak linear positive anomalies have been identified within the survey area and are highlighted in red in Figure 7. Buried embankments often produce positive anomalies such as these. It is possible that these features are of archaeological origin.

Three relatively clear negative linear areas have been picked up in the data and are hatched in blue in Figure 7. This type of anomaly is often caused by a cut feature that has been filled in and buried since its creation. It is likely that these features are of archaeological significance.

Two linear anomalies are present in the centre of the survey area that consist of an alignment of positive and negative anomalies. These may be caused by a linear arrangement of discrete objects or remains and there is a weak possibility that these are of archaeological origin. There are also several areas that are composed of positive anomalies with associated negative responses. These also have a weak archaeological potential although it is likely that they are caused by modern magnetic debris.

A large amount of high magnitude noisy data was picked up to the north of the survey area, along the field boundary. This has been hatched in yellow in Figure 7. The source of this noise is likely to be a service, as there is a manhole situated in the northeast corner of the survey area. Modern magnetic debris may also contribute to the noise, possibly associated with agricultural processes in the adjacent field.

5 CONCLUSION

Some linear anomalies have been highlighted within the survey area. Those of most interest are the strong negative linear areas that are relatively strong in comparison to the other anomalies. It is possible that these anomalies are responses to cut features, possibly of archaeological origin.

Positive linear anomalies have also been identified although these are relatively low amplitude features. These may be the result of buried embankments and could be of archaeological significance.

Discrete positive and negative anomalies in linear arrangements and clusters have been highlighted. There is a weak possibility that these are of archaeological origin, however it is also possible that they could be caused by a more modern source.

APPENDIX A – Basic principles of magnetic survey

Detailed magnetic survey can be used to effectively define areas of past human activity by mapping spatial variation and contrast in the magnetic properties of soil, subsoil and bedrock.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in *magnetic susceptibility* and permanently magnetised *thermoremnant* material.

Magnetic susceptibility relates to the induced magnetism of a material when in the presence of a magnetic field. This magnetism can be considered as effectively permanent as it exists within the Earth's magnetic field. Magnetic susceptibility can become enhanced due to burning and complex biological or fermentation processes.

Thermoremnance is a permanent magnetism acquired by iron minerals that, after heating to a specific temperature known as the Curie Point, are effectively demagnetised followed by re-magnetisation by the Earth's magnetic field on cooling. Thermoremnant archaeological features can include hearths and kilns and material such as brick and tile may be magnetised through the same process.

Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement allowing assessment and characterisation of subsurface features. Material such as subsoil and non-magnetic bedrock used to create former earthworks and walls may be mapped as areas of lower enhancement compared to surrounding soils.

Magnetic survey is carried out using a fluxgate gradiometer which is a passive instrument consisting of two sensors mounted vertically either 0.5 or 1m apart. The instrument is carried about 30cm above the ground surface and the top sensor measures the Earth's magnetic field whilst the lower sensor measures the same field but is also more affected by any localised buried field. The difference between the two sensors will relate to the strength of a magnetic field created by a buried feature, if no field is present the difference will be close to zero as the magnetic field measured by both sensors will be the same.

Factors affecting the magnetic survey may include soil type, local geology, previous human activity, disturbance from modern services etc.