STRATASCAN

Geophysical Survey Report

Monkleigh, North Devon

for

Exeter Archaeology

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J2219

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1 SUMMARY OF RESULTS

A geophysical survey was carried out over an area of 0.7ha in the village of Monkleigh, North Devon. The survey has identified weak evidence for anomalies of archaeological origin. Two linear cut features have been identified with Area 2. A number of positive area anomalies may represent cut features or ground disturbance within Area 1. The presence of two modern services and areas of strong magnetic debris and disturbance have obstructed the identification of faint anomalies that may relate to archaeological activity and has made the interpretation of the gradiometer anomalies difficult.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Exeter Archaeology to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation carried out by Exeter Archaeology.

2.2 Site location

The site is located in the village of Monkleigh, North Devon at OS ref. SS 457 207.

2.3 Description of site

The survey area consists of approximately 0.7ha of agricultural pasture. The survey area comprises of two areas situated either side of the road. Area 1 is situated to the west of the road and is also bounded by a road to the north. Area 2 is situated to the east of the road; the survey area was obstructed by the presence of an earthen mound and overgrown vegetation.

2.4 Geology and soils

The underlying geology is Upper and Lower Westphalian (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Neath soils which are typical brown earths. These consist of well drained fine loamy soils over rock (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

No specific details were available to Stratascan.

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 on the 9th of September 2006. Weather conditions during the survey were sunny and clear.

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 to suitable topographic features around the perimeter of the site.

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 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

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

In addition the following processing has been carried out to further enhance the data: Extreme data values were removed from the survey in an attempt to identify faint anomalies of possible archaeological origin.

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

Weak evidence for possible archaeological activity can be seen within both survey areas. However the presence of large areas of magnetic debris and disturbance from nearby buildings, modern ground disturbance and services has obscured the presence of faint anomalies. This has made it difficult to identify anomalies of possible archaeological origin which are often weak in nature.

Two probable services have been identified as bipolar linear anomalies situated within Area 1 (**13** and **14**). These services also have an associated area of magnetic disturbance.

Two positive linear anomalies have been identified within Area 2 (**1** and **2**). Anomaly **1** may represent a ditch feature, possibly associated with a previous field boundary, extending from the line of the St Georges Church boundary. However, this linear anomaly may also represent a trench cut associated with a possible service, as the linear anomaly is surrounded by areas of magnetic responses, possibly indicating areas of ground disturbance. Anomaly **2** may represent a further cut feature of possible archaeological origin.

A number of positive area anomalies have been identified within both survey areas (**3-10**). These area anomalies may represent weak evidence for cut features or ground disturbance of archaeological origin. Anomalies **4** and **7** are orthogonal to one another and may indicate the presence of right-angled cut features. Anomalies **8**, **9** and **10** may represent weak evidence for a curvilinear anomaly. Anomaly **11** may indicate a discrete cut feature of possible archaeological origin.

A large positive area anomaly (**12**) can also be seen running parallel to the service anomaly **13**. This area anomaly may represent a possible cut feature or area of ground disturbance that may relate to the nearby service installation.

A number of discrete positive anomalies with associated negative returns can be seen within both survey areas. These anomalies may represent near surface ferrous objects.

A large area of positive response is situated in the south of Area 1. This area anomaly is likely to be associated with the nearby building. Areas of magnetic debris and disturbance can be seen within Areas 1 and 2. These anomalies are associated with nearby buildings, field boundaries and ground disturbance of modern origin. The presence of these strong magnetic anomalies may have obscured the presence of faint anomalies of possible archaeological origin.

5 CONCLUSION AND RECOMMENDATIONS

Weak evidence for possible archaeological activity has been identified within both survey areas. Two linear cut features have been identified within Area 2. Anomaly **1** may be associated with a previous field boundary or ditch but may also represent a service trench. Areas of positive response may represent cut features or ground disturbance representing weak evidence for archaeological activity. The large areas of magnetic debris and disturbance situated within the survey areas may have obscured the presence of faint archaeological anomalies and has made it difficult to identify the extents of the weak positive anomalies seen within the data. Further investigation will be needed to assess the full archaeological potential of the area and the nature of the identified gradiometer anomalies.

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.