STRATASCAN

Geophysical Survey Report

Church Street, Kingsteignton, Devon

Exeter Archaeology

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J2194

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1 SUMMARY OF RESULTS

A gradiometer survey was carried out in an area of grassland south of Church Street, Kingsteignton. The survey has been of limited success due to the large amounts of magnetic debris situated within the survey area. Weak evidence for four negative linear anomalies can be seen in the northeast of the survey area. These anomalies may represent structural debris or ground disturbance of possible archaeological origin. The presence of any possible archaeological anomalies has been obscured by the dominant presence of magnetic debris across the survey area.

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 being carried out by Exeter Archaeology.

2.2 Site location

The site is located on Church Street, Kingsteignton, Devon at OS ref. SX 870 728.

2.3 Description of site

The survey area is approximately 0.52ha of land of which formed part of a smallholding until recently. The majority of the survey area has been used as a storage area for vehicles. The landowner stated that vehicles have been stored within the survey area for approximately 40 years. Although a number of the vehicles were moved prior to the start of the survey a large amount of metallic debris remained. A small orchard is situated in the south of the survey area.

2.4 Geology and soils

The underlying geology is Upper Greensand and Gault (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Wallasea 1 soils which are pel-alluvial gley soils. These consist of marine alluvium (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 Site history and archaeological potential

Although there is no known archaeology within the survey area, its position close to the church and its close proximity to the Saxon core of the town suggests the potential for archaeological remains. Roman artefacts have also been found within the general area.

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 August 2006. Weather conditions during the survey were fair and dry.

3.2 Grid locations

The location of the survey grids has been plotted in Figure 2 together with the referencing information. Grids were referenced to OS coordinates using a Leica system 500 DGPS and set out using a Leica 705auto Total Station.

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 have been removed in an attempt to reveal 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

The geophysical survey was of limited success due to the high levels of magnetic debris situated within the survey area. Although the majority of vehicles were removed from the survey area, the long term use of the area as a store for vehicles has deposited metallic material within the soil.

Two large areas of strong magnetic debris are situated along the western and central parts of the survey area (**1** and **2**). Both of these anomalies are likely to be caused by metallic debris of modern origin. Anomaly **2** may also be caused by the demolition of a building shown on the base mapping that no longer exists.

Smaller areas of magnetic debris are situated across the survey area. These area anomalies may represent areas of ground disturbance or ferrous debris. Discrete positive anomalies with associated negative returns identified across the survey area represent near surface ferrous objects.

Areas of magnetic disturbance can also be seen along the edges of the survey area. These are associated with the nearby field boundaries (**3** and **4**).

An area of magnetic variation has been identified in the south of the survey area (**5**). This anomaly appears is in close proximity to a tree and is likely to be associated with the orchard.

A series of faint negative linear anomalies have been identified in the north east of the survey area (**6**). The linear anomalies may represent weak evidence for structural debris or ground disturbance. The presence of any possible archaeological anomalies has been obscured by the high amplitude response generated by the magnetic debris spread across the majority of the survey area. Further investigation would be needed to assess the presence of archaeological activity.

5 CONCLUSION

Weak evidence for a number of negative linear anomalies has been identified within the northeast corner of the survey area. These anomalies may indicate structural debris or localised ground disturbance of possible archaeological origin. The geophysical survey was of limited success due to the high levels of magnetic debris situated within the survey area. Although the majority of vehicles were removed from the survey area, the long term use of the area as a store for vehicles has deposited amounts of metallic material within the soil. The presence of any possible archaeological anomalies have been obscured by the dominate presence of magnetic debris across the survey area.

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.