STRATASCAN

Geophysical Survey Report

Apple Lane, Topsham
Devon

for

John Moore Heritage Services

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J2154

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REGISTERED IFA ORGANISATION

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National Grid Ref:	**SX 962 913**

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1 SUMMARY OF RESULTS

A gradiometer survey was carried out at land southwest of Apple Lane, Topsham. A number of positive discrete and linear anomalies have been identified situated mainly in the northwest of the survey area. These anomalies may relate to cut features and pits of archaeological origin. Faint fragmented positive linear anomalies may represent weaker evidence for archaeological activity along with a large spread of magnetic debris, possibly indicating an area of ground disturbance.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by John Moore Heritage Services to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation undertaken by John Moore Heritage Services.

2.2 Site location

The site is located north of Topsham at OS ref. SX 962 913.

2.3 Description of site

The survey area is approximately 2.25ha of agricultural land currently left to pasture. Running along the eastern edge of the survey is a metal fence, beyond which there is a sand quarry. Obstructions in the survey area include a series of earth mounds in the southeast corner and overgrown vegetation along the northern edge of the survey area.

Plate 1: Looking northeast across survey area

2.4 Geology and soils

The underlying geology is Permian basal breccias, sandstones and mudstones (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Delamere soils which are Humo-ferric podzols. These consist of Permo-Triassic reddish sandstone (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 over 2 days from the 22nd-23rd May 2006 Weather conditions during the survey were wet and overcast.

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

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

Large areas of magnetic debris can be seen around the edges of the survey area. These area anomalies are caused by the nearby field boundaries and the metal fencing. Strong discrete positive anomalies with associated negative returns have also been identified across the survey area. These anomalies are often associated with near surface ferrous objects.

A spread of magnetic debris can be seen across the centre and southeast of the survey area. This area anomaly may represent an area of ground disturbance of unknown origin. A number of strong positive linear anomalies can be seen across the northwest of the survey. These anomalies may represent cut features of archaeological origin. A large number of faint disjointed positive linear anomalies may represent weaker evidence for cut features of archaeological origin; however these anomalies may also be indicative of an area of generalised ground disturbance.

Four discrete positive anomalies have been identified in the northwest corner of the survey area. Theses anomalies may indicate cut features, possibly pits, of archaeological origin.

5 CONCLUSION

A number of positive anomalies have been identified mainly in the northwest of the survey areas. These anomalies may relate to cut features and pits of archaeological origin. Faint fragmented positive linear anomalies may represent weaker evidence for archaeological activity along with a large spread of magnetic debris, possibly indicating an area of ground disturbance.

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.