STRATASCAN

Geophysical Survey Report

Land Southwest of Bicester, Oxon

for

Terence O' Rourke Ltd

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J2104

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Land Southwest of Bicester, Oxon

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1 SUMMARY OF RESULTS

The gradiometer survey undertaken on the land southwest of Bicester has been successful in locating a number of anomalies of possible archaeological potential. Two ring ditches associated with round barrows have been located in the centre of the site. A number of substantial ditches run across the survey area and evidence for possible pits can be seen in all areas of the site.

2 INTRODUCTION

2.1 Background synopsis

Stratascan were commissioned by Terence O' Rourke to undertake a geophysical survey of an area outlined for mixed-use development by Cherwell District Council.

2.2 Site location

The site is located on the land southwest of Bicester at OS ref. SP 571 220.

2.3 Description of site

The survey area consists of approximately 55.8ha of gently undulating agricultural land currently used for pasture. Obstructions include roads, copses and springs.

2.4 Geology and soils

The underlying geology is Oxford Clay and Kellaway Beds (British Geological Survey South Sheet, Fourth Edition Solid, 2001). The overlying soils are known as Whickham 2 soils which are a type of drift over Jurassic and Cretaceous clay or mudstone. These consist of slowly permeable seasonally waterlogged fine loamy over clayey, fine silty over clayey and clayey soils. Small areas of slowly permeable calcareous soils may occur on steeper slopes (Soil Survey of England and Wales, Sheet 6 South East England).

2.5 Site history and archaeological potential

A geophysical survey undertaken by Stratascan immediately to the east of the current survey area in 1997 (J1258) identified a complex of linear ditches and a number of discrete features believed to be Romano- British in origin.

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 19 days from 9th January 2006. Weather conditions during the survey were cold and dry.

3.2 Grid locations

The survey grid was based upon the Ordnance Survey National Grid, see Figure 1. The referencing and alignment of grids was achieved using a Leica TS 705auto Total Station in conjunction with a Leica GS50 Global Positioning System using OS co-ordinate reference points derived from digital base mapping.

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 (Figures 2, 7, 12 and 17) and trace plots (Figures 3, 4, 8, 9, 13, 14, 18 and 19), together with a greyscale plot of the processed data (Figures 5, 10, 15 and 20). Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawings for the site (Figures 6, 11, 16 and 21).

4 RESULTS

The survey has been subdivided into four areas for ease of interpretation and presentation. All four survey areas are dominated by the presence of positive linear anomalies representing agricultural marks.

4.1 Northwest Area (*Figures 2-6*)

A number of positive linear anomalies indicating cut features of possible archaeological origin are evident within this survey area. A positive, rectilinear anomaly (Anomaly **1**) can be noted to the east of this survey area. This may be of archaeological origin however further investigation is required in order to ascertain the nature of the feature. The positive area anomalies in close proximity to Anomaly **1** may represent large pits.

A number of discrete positive anomalies (**2**) are clustered in the east of this area, with a further cluster observed at the western limits of the survey. These features have been interpreted as possible pits and may be of archaeological origin.

Positive linear anomalies representing agricultural marks dominate this area of the survey. The majority of these marks run from the northeast to southwest, however a number run northwest to southeast in the western limits of the survey area. The reverse 'S' shape and the distance between the furrows may suggest that these anomalies represent the presence of ridge and furrow. Other evidence of agricultural activity can be noted in the northwest of the survey area in the form of possible land drains. A former field boundary (**3**) is evident in the form of a positive linear anomaly running approximately east to west through the centre of this survey area.

Four bipolar anomalies representing buried ferrous objects are evident in this area.

4.2 Northeast Area (*Figures 7-11*)

The northern edge of this area shows evidence of ground disturbance (**4**) taking place on a large scale. Positive and negative linear anomalies (**5** and **18**) in these northern fields suggest the presence of banks and ditches. The areas of magnetic disturbance provide further evidence of activity on site. Further investigation is required in order to fully understand the origin of this feature.

A large positive linear anomaly (**6**) runs diagonally through the centre of this area. This feature cuts the former field boundary but may be cut by a modern service. Further investigation of this anomaly may shed light of the dating sequence of the ditch, the former field boundary and the modern service. Other positive linear anomalies (**7**) representing cut features of possible archaeological origin can also be noted in this survey area. An isolated negative linear anomaly with a north to south alignment (**8**) in the centre of this area may indicate the presence of a former earthen bank.

A large number of discrete positive anomalies are evident across this survey area (**9**). These features may be of archaeological origin and have been interpreted as possible pits.

The former field boundary evident in the North-Western Area of the site (**3**) continues with the same alignment in this section of the survey area.

A large number of bipolar anomalies (**10**) representing buried ferrous objects can be noted in this area with a concentration in the northern limits of the survey. Agricultural marks can also be noted in this survey area.

4.3 Central Area (Figures 12-16)

Two clear positive circular features are evident in this area (**11**). These anomalies represent the ditches of round barrows typical of the Bronze Age. Another, more subtle circular feature (**12**) is discernable to the south and west of these barrows. This feature may indicate the presence of another barrow that has been ploughed out through time. To the east of the two barrows (**11**) positive curvilinear anomalies can be noted (**13**). The localised disturbance in this area prevents us from interpreting this feature as a barrow. Further investigation is required in order to ascertain the nature of this feature.

A number of other positive linear anomalies of possible archaeological origin can be noted in this area. One runs approximately north to south in close proximity to the round barrows (**14**). Further investigation into this cut feature may determine as to whether or not it is contemporary with the Bronze Age barrows. Two orientations of agricultural markings can also be observed. The fact that these agricultural marks run parallel to the present field boundaries suggests that they are contemporary with or later than the division of the land.

4.4 Southern Area (*Figures 17-21*)

A set of parallel positive linear anomalies (**15**) is evident to the north of this area. These linear anomalies are cut by the more recent agricultural marks, however the origin of these cut features remains unknown.

A small number of discrete positive anomalies (**16**) can be noted in this area. These have been interpreted as possible pits and may be of archaeological origin.

A large number of bipolar anomalies (**17**) are evident throughout this survey area. These magnetic spikes indicate the presence of buried ferrous objects. The long, narrow area of magnetic debris is caused by the debris being spread across the field through plough action. A possible land drain runs around the southern perimeter of this survey area.

5 CONCLUSION

The geophysical survey undertaken on the land southwest of Bicester has been successful in locating a number of anomalies, some of which have greater archaeological potential than others. The data from across the site is dominated by evidence of ridge and furrow. The positive linear anomalies caused by these agricultural activities vary in strength across the survey and therefore it is possible to identify the more subtle features in some areas. However, faint, subtle features of archaeological origin may be masked in areas where the agricultural marks are stronger.

Two positive circular anomalies are evident in the central area of the survey. These have been interpreted as being caused by the ring ditches commonly associated with the round barrows of the Bronze Age. To the south and west of these barrows is another circular feature. This feature is by no means as well defined as the round barrows. It is possible that this anomaly represents a ploughed out barrow, but further investigation would be required to verify this. To the east of the two round barrows (**11**) is another feature (**13**). The localised debris around these anomalies disguises the feature's shape. It is not uncommon for round barrows to be clustered in an area. Therefore it is possible that Anomaly **13** is another barrow or some other form of burial monument.

A substantial ditch runs across the survey area (**6**). It may be possible that the ditch forms a western boundary to the Bronze Age burial area. However, further investigation is required in order to ascertain as to whether or not the barrows are contemporary with Anomaly **6** or Anomaly **14**.

A great deal of ground disturbance has taken place to the northern limits of the site (**4**). Positive and negative linear anomalies in this area indicate the presence of former bank and ditch arrangements (**18**). The disturbance may be as a result of industrial activity or some other form of intrusive groundwork.

A set of parallel positive linear anomalies (**15**) evident in the southern part of the survey area may indicate some form of boundary ditches. Further investigation is required to decide how these tie in with the sequence of the site and to ascertain as to whether or not it is contemporary with the other large ditches (**6** and **14**).

Discrete positive anomalies are evident across the survey area with a concentration in northern and central areas (**2** and **9**). These anomalies have been interpreted as possible pits. The presence of other prehistoric activity on site increases the likelihood that some of these features are of archaeological origin.

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.