MARFIELD QUARRY EXTENSION
MASHAM
NORTH YORKSHIRE

GEOPHYSICAL SURVEY

Work undertaken for
SLR CONSULTING

May 2009

Report produced by
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National Grid Reference: **SE 213 818**

APS Report No: **47/09**

ARCHAEOLOGICAL
PROJECT
SERVICES

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1. SUMMARY

Geophysical survey was undertaken within the area of the proposed Marfield Quarry extension at Masham, North Yorkshire. Detailed gradiometer survey was undertaken over an area of 12ha comprising 50% of the available arable land at the site.

The site lies in close proximity to areas of significant late Iron Age and Roman settlement. However, few clearly archaeological features were noted. Two linear/curvilinear features can be seen along the northern boundary, but most of the variation within the survey data is geological in origin, or due to modern agricultural activities on the site.

2. INTRODUCTION

2.1 Background

Archaeological Project Services was commissioned by SLR Consulting to undertake detailed gradiometer survey within the area of a proposed extension to the Marfield Quarry at Masham in North Yorkshire. Survey was undertaken within all available arable fields, initially comprising 9.5ha with additional areas targeted to bring the total to 12ha, 50% of the available areas.

2.2 Topography and Geology

Masham lies in the valley of the River Ure, some 15km northwest of Ripon in the Harrogate district of North Yorkshire. The proposed quarry extension area lies 1.5km northwest of the village comprising a block of land south of Mile House Farm between the Leyburn Road and Swinney Beck centred on SE 213 818 (Fig. 1).

The site lies between c. 90m and 100m O.D., gently sloping or fairly level in the west and north, with steeper gradients into a small valley on the eastern side.

The geology of the site comprises glacial diamicton or till over a solid geology of Libishaw Sandstone (BGS Sheet 51 Masham) resulting in generally sandy/pebbly and free draining ploughsoils.

3. AIMS

The aim of the survey was to locate any features of possible archaeological significance in the proposed extension area in order to contribute to the management of the potential archaeological resource of the site.

4. METHODS

The fieldwork was carried out in two phases with initial blocks totalling 9.5ha undertaken between 23rd and 30th April 2009. On the basis of interim results additional survey of 2.5ha was commissioned. This was undertaken between 5th and 7th May 2009. Location and key to survey areas is shown in Figure 2. Weather and ground conditions during the survey were generally dry, with some rain during the second week. The ground was covered with variable, but low, cereal crop (excepting only the southernmost field of Area G6 which was bare of crop but recently harrowed). Crop height was not such as to hinder surveying.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTesla (nT) in

an overall field strength of 48,000nT can be accurately detected using this instrumentation.

The mapping of anomalies in a systematic manner allows an estimate of the type of material present beneath the surface. Strong magnetic anomalies will be generated by buried iron-based objects or by kilns or hearths. More subtle anomalies such as pits and ditches can be seen if they contain more humic material which is normally rich in magnetic iron oxides when compared with the subsoil (but this can be variable depending on the nature of the underlying deposits). Wall foundations can show as negative anomalies where the stone is less magnetic than the surrounding soil, or as stronger positive and negative anomalies if of brick, but are not always responsive to the technique.

Readings relate to the difference in localised magnetic anomalies compared with the general magnetic background. The Grad601-2 consists of two high stability fluxgate gradiometers suspended on a single frame. Each gradiometer has a 1m separation between the sensing elements so enhancing the response to weak anomalies.

Sampling interval and data capture
Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid. The Grad 601 has a typical depth of penetration of 0.5m to 1.0m although a greater range is possible where strongly magnetic objects have been buried in the site.

Readings are logged consecutively into the data logger which is downloaded daily either into a portable computer whilst on site or directly to the office computer. At the end of each job, data is transferred to the office for processing and presentation.

Processing and presentation of results
Processing is performed using specialist ArchaeoSurveyor software. 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 shows the basic processing carried out on all processed gradiometer data used in this report:

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

2. Despike (useful for display and allows further processing functions to be carried out more effectively by removing extreme data values)
Parameters: X radius = 1; Y radius = 1; Threshold = 3 std. dev.; Spike replacement = mean

3. Clip (excludes extreme values allowing better representation of detail in the mid range): -7 to 7nT for Areas G1, G2, G8; -5 to 5nT for Areas G3, G6, G7; and -3nT to 3nT for Areas G4, G5 .

5. RESULTS

The presentation of the data for the site involves a print-out of the raw data as greyscale and trace plots (Figs 3-12), together with a greyscale plot of the

processed data (Figs 13, 15, 17, 19, 21, 22, 25). Magnetic anomalies have been identified and plotted onto interpretative drawings (Figs 14, 16, 18, 20, 23, 24, 26) and are described by Areas below.

Area G1, G2, G8 (Figs 13, 14)

Geological responses

Background responses owing to variations in the underlying natural dominate the southern part of these plots. These are evident as amorphous positive and negative responses, sometimes approximating to a linear form but diffuse and ill-defined. Two areas (**A**, **B**) are noted as having more coherent form and a possible archaeological origin, but the 'halo' effect observed at B especially is atypical of an archaeological response.

Positive linear anomalies of probable archaeological origin

Linear anomaly (**C**) perhaps represents a former boundary, although it is not seen to continue to the northwest. The adjacent negative response may represent remnants of a bank. The stronger response here may indicate incorporation of material from the adjacent kilns/hearths (D, E) (see below).

Discrete positive anomalies

Discrete positive responses are difficult to interpret owing to the variability of the natural background which gives rise to responses as strong as some possible archaeological features. None have been highlighted as of possible archaeological origin.

Strong bipolar responses

Two strong bipolar responses (**D**, **E**) are notable in the eastern half of this area with readings in the region of +/-100nT. These would be consistent with the presence of a kiln or hearth.

Agricultural features

A general northwest-southeast trend can be observed in the northern part of the survey here. However, these are not coherent enough to suggest remnants of furrows and/or ridges. They perhaps just represent just an effect of modern ploughing on this alignment.

Iron spikes (discrete bipolar anomalies)

Iron items within the topsoil/ploughsoil give a distinctive localised bipolar (strong negative and positive) response. Such items usually derive from relatively recent agricultural use of the land – broken or discarded pieces of agricultural machinery etc. These are fairly widely distributed across the survey area.

Modern disturbance

Elevated positive and negative readings are noted adjacent to the site of barn S2. Further localised bipolar responses in the southern half of the field may indicate recent magnetic debris but these are not much different in scale to the natural variations.

Area G3 (Figs 15, 16)

Geological responses

Background responses owing to variations in the underlying natural are less notable, forming amorphous positive responses.

Agricultural features

A general northwest-southeast trend can be observed but these are not coherent enough to suggest remnants of furrows and/or ridges. They may represent an effect of modern ploughing on this alignment.

Iron spikes (discrete bipolar anomalies)

These are fairly widely distributed across the survey area.

Area G4 (Figs 17, 18)

Positive area anomalies – possible pits

Background responses are much more even. Localised positive area anomalies here (**F**, **G**, **H**) might represent infilled

pits.

Agricultural features
A pattern of northwest-southeast parallel positive and negative linear anomalies probably represents remnant ridge and furrow with a spacing of 4-5m. These lie slightly athwart the modern direction of ploughing (which is more or less parallel to the southwestern boundary and some effects of which can be seen within the plot). The responses are generally absent towards the brow of the slope where truncation is likely to have been greater.

Iron spikes (discrete bipolar anomalies)
These are fairly widely distributed across the survey area.

Area G5 (Figs 19, 20)
Positive area anomalies – possible pits
Background responses are again relatively even although there are some patch amorphous responses. Localised positive area anomalies here might represent infilled pits.

Positive linear anomalies
A positive linear anomaly (**F**) runs southeast-northwest across the area, weakening towards the northwest, but still faintly evident.

Negative linear anomalies
A negative linear anomaly (**G**) runs southeast-northwest across the area a little way to the north of (F), also weakening, but faintly evident, towards the northwest. The response would be consistent with a slight bank or ridge. A headland within the ridge and furrow field system (see below) might be suggested, but if so it had been superseded for some of the ridges clearly run over it. A faint positive anomaly along the southern side perhaps represents an associated ditch or hollow.

Agricultural features
Remnant ridge and furrow within the field is strongly represented within the survey mirroring the extant curving field boundaries with a spacing of c. 4m. Positive linear anomalies will represent infilled furrows; negative anomalies perhaps some remnant of ridges (although nothing is visible within the field to the naked eye). The responses are generally absent over the highest part of the field where truncation is likely to have been greater.

At the northern end of the field, towards the base of slope, further short length of ridge and furrow is evident. These are much more widely spaced at 7.3m to 8.9m apart and on a quite different alignment. It may be that these belong to a different element of the medieval field layout.

Iron spikes (discrete bipolar anomalies)
These are fairly widely distributed across the survey area.

Areas G6, G7 (Figs 21-24)
Geological responses
Background responses owing to variations in the underlying natural are again very evident along the western part of the survey area. Most striking is the wide sinuous anomaly (**H**), 6m-10m in width, showing as a positive anomaly, again with a 'halo' effect of negative readings along parts of its course. Although no surface landscape feature is evident, its sinuous nature and termination at the edge of the current course of the Swinney Brook suggests a channel form. A number of further amorphous positive and negative responses run into this, sometimes approximating to a linear form but generally diffuse and ill-defined and probably also of geological origin. Two areas (**I**, **J**) are noted as having more coherent form and a possible archaeological origin (and see below).

Positive linear anomalies of probable archaeological origin
Linear anomaly (**K**) runs roughly north-south through the centre of Area G6. It is sharply defined and strongly positive seeming to terminate just past feature H, but apparently continuing at right angle as a much weaker response to join with the possible linear features J.

Discrete positive anomalies
Discrete positive responses are difficult to interpret owing to the variability of the natural background which gives rise to responses almost as strong as some possible archaeological features. One or two have been highlighted as of possible archaeological origin, but others at the field margins may just relate to disturbance along the hedgerow.

Strong bipolar responses
Bipolar response (**M**) in Area G7 is not as marked as D and E above, with positive readings of +38nT but negative values less extreme. The presence of a hearth or area of burning might account for this.

Agricultural features
A general underlying trend can be observed in the surveys here: southwest-northeast in the northern three fields and northwest-southeast in the southern two. These would reflect the pattern of medieval ploughing inferred from the field layout, however, they are not coherent enough to suggest remnants of furrows and/or ridges. Modern ploughing continues on much the same alignments and may well be the cause of these trends.

Negative linear anomalies
Negative anomaly (**L**) probably also relates to current agricultural use of the land, mirroring the western field boundary. Similar responses further south are clearly related to the edge of ploughing (and have been included in the 'recent magnetic disturbance' marking the extent of the track at the western edge of the field).

Iron spikes (discrete bipolar anomalies)
These are fairly widely distributed across the survey area.

6. DISCUSSION

Magnetic survey was successful with a good range of responses evident in the surveyed data. However, the variable nature of the natural background, especially in the west of the site, makes interpretation difficult with possible discrete features difficult to separate from the natural variations which can be as strong or stronger.

This is particularly evident in the southwest of the site where most of the rather diffuse and ill-defined responses appear to relate to a sinuous channel form. One linear feature clearly crosses this however and others on a similar alignment here may also be of archaeological origin. These linear features and possible enclosures are on differing alignments to the medieval and post-medieval field patterns and, if archaeological in origin, would be of earlier date.

Two strong bipolar features in the northwest of the site give responses consistent with the presence of a kiln or hearth, although no surface evidence was observed which would support interpretation as a kiln. These lie close to mapped early structures (one still extant) and boundaries and may not be early in date.

7. ACKNOWLEDGEMENTS

Archaeological Project Services wishes to acknowledge the assistance of Gavin

Kinsley of SLR who commissioned the project and liaised with landowners over access. Tom Lane edited the report.

8. PERSONNEL

Project coordinator: Steve Malone
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Survey processing and reporting: Steve Malone

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10. ABBREVIATIONS

APS	Archaeological Project Services
BGS	British Geological Survey
EH	English Heritage
IFA	Institute of Field Archaeologists
OS	Ordnance Survey