GEOPHYSICAL SURVEY REPORT

Doddington Road, Wollaston, Northamptonshire

Client

CgMs Heritage (part of RPS)

Survey Report

14595

Date

March 2019
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2. SURVEY TECHNIQUE

Detailed magnetic survey (magnetometry) was chosen as the most efficient and effective method of locating the type of archaeological anomalies which might be expected at this site.

Bartington Grad 601-2 Traverse Interval 1.0m Sample Interval 0.25m
SUMMARY OF RESULTS

3.1 A detailed magnetometer survey was conducted over approximately 2.5 ha at Doddington Road, Wollaston, Northamptonshire. No definite archaeological anomalies have been identified. An old footpath has been detected, along with evidence of ridge and furrow and natural magnetic responses.

INTRODUCTION

4.1 Background synopsis

SUMO Geophysics Ltd were commissioned to undertake a geophysical survey of an area outlined for development. This survey forms part of an archaeological investigation being undertaken by CgMs Heritage (part of RPS).

4.2 Site details

- **NGR / Postcode**: SP 897 633 / NN29 7PR
- **Location**: The site is situated on land adjacent to the rear of the Recycling Centre, off Doddington Road, approximately 1km west of the centre of Wollaston, Northamptonshire.
- **HER**: Northamptonshire
- **District**: Wellingborough
- **Parish**: Wollaston CP
- **Topography**: Generally flat
- **Current Land Use**: Pasture - horse grazing
- **Soils**: Soilscape 8; slightly acid loamy and clayey soils with impeded drainage (CU 2019).
- **Archaeology**: Within a 750m radius of the site a number of findspots and sites of archaeological interest are recorded on the Northamptonshire Historic Environment Record (NHER). These include Palaeolithic artefacts, later prehistoric flint tools, Bronze Age field boundaries and later Bronze Age/Early Iron Age co-axial pit alignments, pottery and undated hut circles. Romano-British activity, including evidence of a kiln site, villa and settlement are also recorded within the wider area. To the south-east of the site, medieval and post-medieval settlement evidence are recorded, and sunken feature buildings were revealed during excavations. No archaeological investigations have taken place within the site itself, though it has been identified as an area containing remnant ridge and furrow (CAU 2014).
- **Survey Methods**: Magnetometer survey (fluxgate gradiometer)
- **Study Area**: 2.5 ha

4.3 Aims and Objectives

To locate and characterise any anomalies of possible archaeological interest within the study area.
5 RESULTS

5.1 Probable / Possible Archaeology

5.1.1 No magnetic responses have been recorded that could be interpreted as being of archaeological interest.

5.2 Former Footpath

5.2.1 A very weak curvilinear trend has been detected running parallel to the north-eastern boundary of the site. This corresponds with the course of a former footpath, visible on historic mapping from 1885 to 1975.

5.3 Agricultural – Ridge and Furrow

5.3.1 Negative linear trends aligned northeast-southwest in the south of the site are indicative of former ridge and furrow cultivation and corresponds with the information provided in the desk-based assessment for remnant ridge and furrow to exist on the site (CAU 2014).

5.4 Natural / Geological / Pedological / Topographic

5.4.1 A number of sinuous bands of enhanced magnetic response and discrete anomalies are visible across the site. These are likely to be of natural origin and reflect localised variations in the underlying geology or superficial alluvial deposits.

5.5 Ferrous / Magnetic Disturbance

5.5.1 Ferrous responses close to boundaries are due to adjacent fences and gates. Smaller scale ferrous anomalies (“iron spikes”) are present throughout the data and are characteristic of small pieces of ferrous debris (or brick / tile) in the topsoil; they are commonly assigned a modern origin. Only the most prominent of these are highlighted on the interpretation diagram.

6 DATA APPRAISAL & CONFIDENCE ASSESSMENT

6.1 Historic England guidelines (EH 2008) Table 4 states that the average magnetic response on mudstone is variable. The results from this survey indicate the presence of ploughed out ridge and furrow; there is no a priori reason why the technique would not have detected archaeological features, if present.

7 CONCLUSION

7.1 The survey at Wollaston has not identified any anomalies of archaeological interest. Evidence of former ridge and furrow and an old footpath have been mapped, along with areas of natural magnetic variation and disturbance from nearby ferrous objects, such as fences.
8 REFERENCES


CAU 2014  Site F: Land adjacent and to the rear of the Recycling Centre, Doddington Road, Wollaston, Northamptonshire - An Archaeological Desk-Based Assessment. Cambridge Archaeological Unit; unpublished report.


Site Location Information

Title: Site Location Information

Client: CgMs Heritage (part of RPS)

Project: 14595 - Doddington Road, Wollaston, Northamptonshire

Scale: NOT TO SCALE

Survey Area

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Appendix A - Technical Information: Magnetometer Survey Method, Processing and Presentation

Standards & Guidance

This report and all fieldwork have been conducted in accordance with the latest guidance documents issued by Historic England (EH 2008) (then English Heritage), the Chartered Institute for Archaeologists (CIfA 2014) and the European Archaeological Council (EAC 2016).

Grid Positioning

For hand held gradiometers the location of the survey grids has been plotted together with the referencing information. Grids were set out using a Trimble R8 Real Time Kinematic (RTK) VRS Now GNSS GPS system.

An RTK GPS (Real-time Kinematic Global Positioning System) can locate a point on the ground to a far greater accuracy than a standard GPS unit. A standard GPS suffers from errors created by satellite orbit errors, clock errors and atmospheric interference, resulting in an accuracy of 5m-10m. An RTK system uses a single base station receiver and a number of mobile units. The base station rebroadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. This results in an accuracy of around 0.01m.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Instrument</th>
<th>Traverse Interval</th>
<th>Sample Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetometer</td>
<td>Bartington Grad 601-2</td>
<td>1m</td>
<td>0.25m</td>
</tr>
</tbody>
</table>

Instrumentation: **Bartington Grad 601-2**

Bartington instruments operate in a gradiometer configuration which comprises fluxgate sensors mounted vertically, set 1.0m apart. The fluxgate gradiometer suppresses any diurnal or regional effects. The instruments are carried, or cart mounted, with the bottom sensor approximately 0.1-0.3m from the ground surface. At each survey station, the difference in the magnetic field between the two fluxgates is measured in nanoTesla (nT). The sensitivity of the instrument can be adjusted; for most archaeological surveys the most sensitive range (0.1nT) is used. Generally, features up to 1m deep may be detected by this method, though strongly magnetic objects may be visible at greater depths. The Bartington instrument can collect two lines of data per traverse with gradiometer units mounted laterally with a separation of 1.0m. 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 site survey, data is transferred to the office for processing and presentation.

Data Processing

**Zero Mean Traverse**

This process sets the background mean of each traverse within each grid to zero. The operation removes striping effects and edge discontinuities over the whole of the data set.

**Step Correction (De-stagger)**

When gradiometer data are collected in ‘zig-zag’ fashion, stepping errors can sometimes arise. These occur because of a slight difference in the speed of walking on the forward and reverse traverses. The result is a staggered effect in the data, which is particularly noticeable on linear anomalies. This process corrects these errors.

Display

**Greyscale/Colourscale Plot**

This format divides a given range of readings into a set number of classes. Each class is represented by a specific shade of grey, the intensity increasing with value. All values above the given range are allocated the same shade (maximum intensity); similarly, all values below the given range are represented by the minimum intensity shade. Similar plots can be produced in colour, either using a wide range of colours or by selecting two or three colours to represent positive and negative values. The assigned range (plotting levels) can be adjusted to emphasise different anomalies in the data-set.
Presentation of results and interpretation

The presentation of the results includes a ‘minimally processed data’ and a ‘processed data’ greyscale plot. Magnetic anomalies are identified, interpreted and plotted onto the ‘Interpretation’ drawings.

When interpreting the results, several factors are taken into consideration, including the nature of archaeological features being investigated and the local conditions at the site (geology, pedology, topography etc.). Anomalies are categorised by their potential origin. Where responses can be related to other existing evidence, the anomalies will be given specific categories, such as: Abbey Wall or Roman Road. Where the interpretation is based largely on the geophysical data, levels of confidence are implied, for example: Probable, or Possible Archaeology. The former is used for a confident interpretation, based on anomaly definition and/or other corroborative data such as cropmarks. Poor anomaly definition, a lack of clear patterns to the responses and an absence of other supporting data reduces confidence, hence the classification Possible.
Interpretation Categories

In certain circumstances (usually when there is corroborative evidence from desk-based or excavation data) very specific interpretations can be assigned to magnetic anomalies (for example, Roman Road, Wall, etc.) and where appropriate, such interpretations will be applied. The list below outlines the generic categories commonly used in the interpretation of the results.

**Archaeology / Probable Archaeology**

This term is used when the form, nature and pattern of the responses are clearly or very probably archaeological and/or if corroborative evidence is available. These anomalies, whilst considered anthropogenic, could be of any age.

**Possible Archaeology**

These anomalies exhibit either weak signal strength and/or poor definition, or form incomplete archaeological patterns, thereby reducing the level of confidence in the interpretation. Although the archaeological interpretation is favoured, they may be the result of variable soil depth, plough damage or even aliasing as a result of data collection orientation.

**Industrial / Burnt-Fired**

Strong magnetic anomalies that, due to their shape and form or the context in which they are found, suggest the presence of kilns, ovens, corn dryers, metal-working areas or hearths. It should be noted that in many instances modern ferrous material can produce similar magnetic anomalies.

**Former Field Boundary (probable & possible)**

Anomalies that correspond to former boundaries indicated on historic mapping, or which are clearly a continuation of existing land divisions. Possible denotes less confidence where the anomaly may not be shown on historic mapping but nevertheless the anomaly displays all the characteristics of a field boundary.

**Ridge & Furrow**

Parallel linear anomalies whose broad spacing suggests ridge and furrow cultivation. In some cases, the response may be the result of more recent agricultural activity.

**Agriculture (ploughing)**

Parallel linear anomalies or trends with a narrower spacing, sometimes aligned with existing boundaries, indicating more recent cultivation regimes.

**Land Drain**

Weakly magnetic linear anomalies, quite often appearing in series forming parallel and herringbone patterns. Smaller drains may lead and empty into larger diameter pipes, which in turn usually lead to local streams and ponds. These are indicative of clay fired land drains.

**Natural**

These responses form clear patterns in geographical zones where natural variations are known to produce significant magnetic distortions.

**Magnetic Disturbance**

Broad zones of strong dipolar anomalies, commonly found in places where modern ferrous or fired materials (e.g. brick rubble) are present.

**Service**

Magnetically strong anomalies, usually forming linear features are indicative of ferrous pipes/cables. Sometimes other materials (e.g. pvc) or the fill of the trench can cause weaker magnetic responses which can be identified from their uniform linearity.

**Ferrous**

This type of response is associated with ferrous material and may result from small items in the topsoil, larger buried objects such as pipes, or above ground features such as fence lines or pylons. Ferrous responses are usually regarded as modern. Individual burnt stones, fired bricks or igneous rocks can produce responses similar to ferrous material.

**Uncertain Origin**

Anomalies which stand out from the background magnetic variation, yet whose form and lack of patterning gives little clue as to their origin. Often the characteristics and distribution of the responses straddle the categories of Possible Archaeology / Natural or (in the case of linear responses) Possible Archaeology / Agriculture; occasionally they are simply of an unusual form.

Where appropriate some anomalies will be further classified according to their form (positive or negative) and relative strength and coherence (trend: weak and poorly defined).
Appendix B - Technical Information: Magnetic Theory

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. Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.1 nanoTeslas (nT) in an overall field strength of 48,000 (nT), can be accurately detected.

Weakly magnetic iron minerals are always present within the soil and areas of enhancement relate to increases in magnetic susceptibility and permanently magnetised thermoremanent 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.

Thermoremanence 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. Thermoremanent archaeological features can include hearths and kilns; 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 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 feature. The difference between the two sensors will relate to the strength of a magnetic field created by this 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 and disturbance from modern services.