

GEOPHYSICAL SURVEY REPORT

STRATASCAN™



Project name:
Land off Snowbery Lane, Melksham, Wiltshire

Client:
CgMs Consulting Ltd.

March 2014

Job ref:
J6506

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Techniques:

**Detailed magnetic survey –
Gradiometry**

Survey date:

3rd – 7th March 2014

Site centred at:

ST 913 630

Post code:

SN12 6UN

Field team:

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1 SUMMARY OF RESULTS

A detailed gradiometry survey was conducted over approximately 19 hectares of agricultural land. A number of features of archaeological interest have been identified within the survey area. These include a concentrated area of ditches, enclosures, and pitting possibly related to historic settlement activity. Extensive ridge-and-furrow is also present across the site. Possible footpaths linked to features on historic mapping have also been identified.

Other anomalies identified are likely modern or natural in origin including ploughing, land drains, ferrous objects in the topsoil and magnetic disturbance relating to field boundaries and fences.

2 INTRODUCTION

2.1 *Background synopsis*

Stratascan 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 Consulting Ltd.

2.2 *Site location*

The site is located to the west of Melksham at ST 913 630. The survey area sits to the east of the town of Melksham itself, east of Snowbery Lane and with Hawthorn Lane as its northern boundary.

2.3 *Description of site*

The survey area is 19 hectares of agricultural land currently under pasture. The topography is flat overall and some small obstructions were present on site in the form of telegraph poles, animal feeding troughs and farm machinery.

2.4 *Geology and soils*

The underlying geology is Oxford Clay Formation - Mudstone. Sedimentary Bedrock formed approximately 156 to 165 million years ago in the Jurassic Period (British Geological Survey website). The drift geology is Head - Clay And Silt. Superficial Deposits formed up to 3 million years ago in the Quaternary Period (British Geological Survey website).

The overlying soils are known as Wickham 2 which are typical stagnogley soils. These consist of slowly permeable seasonally waterlogged fine and clayey soils (Soil Survey of England and Wales, Sheet 5 South West England).

2.5 **Site history and archaeological potential**

The following is taken from the Desk-based Assessment provided by CgMs Consulting Ltd (Bourn 2013):

"There are no prehistoric remains recorded within the site or the wider study area on the Wiltshire HER.

The development site immediately to the north of the study site has been the subject of a series of archaeological investigations (EWI7047-50). The only prehistoric remains that these investigations revealed was an isolated Early Bronze Age pit containing the articulated limbs of a red deer and a flint arrowhead, which has been interpreted as being suggestive of a ritual deposit. There is no evidence for any associated Bronze Age occupation within the study area.

Due to the paucity of prehistoric remains recorded within the area, the study site is considered to have low potential for prehistoric remains, although the presence of isolated prehistoric finds and features cannot be entirely ruled out.

A cluster of Roman features and finds have been recorded c. 900m-1km to the north east of the study site. These comprise 7 coins (ST96SW300), a dense pottery scatter associated with two burnt areas and a pit (ST96SW306), 1st and 2nd century pottery (ST96SW307) and a ditch containing Roman pottery and animal bone (ST96SW308). These features and finds imply the presence of a settlement or farmstead.

The archaeological investigations immediately to the north of the study site revealed a single undated but suspected Roman burial but no other finds or features of Roman date.

Due to the presence of the burial and the possible settlement/farmstead in the wider study area, the evidence indicates some at least low level Roman activity/settlement in the general area. However, there is no evidence to suggest the presence of Roman remains specifically within the study site. Therefore, the study site is considered to have low potential for Roman remains, although the presence of isolated Roman finds/features cannot be ruled out entirely.

There are no Saxon remains recorded within the study site or area. The site lies away from the core of nearby historic settlements that may have had Saxon origins (i.e. Melksham). Therefore, the study site is considered to have low potential for Saxon remains.

There are no medieval remains recorded within the study site. The study site lies to the east of the medieval core of Melksham (ST96SW450, ST96SW472 & ST96SW475). It would have been within the agricultural holdings of the town throughout the period. The Clackers Brook archaeological investigations to the north of the study site demonstrated that the area had been unoccupied and unexploited until the 12th or 13th century. The investigations recorded three zones of medieval activity: a

possible small 12th century farmstead to the south of Snarlton Lane adjacent to Clackers Brook and two areas industrial activity (iron production).

Earthworks of probable medieval date have been recorded to the north of the study site, again focussed on Snarlton Lane (ST96SW476).

A series cropmarks of medieval occupation have been recorded focussed on Snarlton Lane c. 500m-1km to the east of the study site (ST96SW452). Further areas of medieval occupation have been recorded at Love Farm c. 1km to the south east of the study site (ST96SW459) and Woolmere Farm c. 500m to the south of the study site (ST96SW460).

The pattern of medieval remains recorded within the study site indicates that medieval occupation was focussed in the historic core of Melksham and on Snarlton Lane to the north of the study and medieval farmsteads to the south of the site. The industrial activity identified is next to Clackers Brook (good water source) and close to Snarlton Lane. The study site lies away from these foci of occupation and activity. The study site would have been within agricultural fields at the time and therefore, it is considered to have low potential for domestic and industrial remains but it may contain the remains of medieval agricultural activity (i.e. ridge and furrow).

There are a number of post-medieval features recorded on the Wiltshire HER which have no bearing on the study site. In summary these are: Bowerhill RAF camp (ST96SW526); former cloth drying oven (ST96SW528); a rope and twine factory (ST96SW537); a Quaker burial ground (ST96SW542) and the Wiltshire and Berkshire Canal (ST96NE539).

The earliest map that depicts the site at a reasonable and reliable scale is a George Oakley's Map of Melksham dated 1835-6 which depicts the site as comprising of a number of fields. The site remained unchanged on the Melksham Tithe Map (1850). The first edition OS map (1888) also depicts the site as comprising a number of fields. The site has remained essentially unchanged up to the present day."

2.6 Survey objectives

The objective of the survey was to locate any features of possible archaeological origin in order that they may be assessed prior to development.

2.7 Survey methods

This report and all fieldwork have been conducted in accordance with both the English Heritage guidelines outlined in the document: *Geophysical Survey in Archaeological Field Evaluation, 2008* and with the Institute for Archaeologists document *Standard and Guidance for Archaeological Geophysical Survey*.

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 and in Appendix A.

2.8 *Processing, presentation and interpretation of results*

2.8.1 *Processing*

Processing is performed using specialist 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. 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 minimally processed gradiometer data used in this report:

1. *Destripe* (Removes striping effects caused by zero-point discrepancies between different sensors and walking directions)
2. *Destagger* (Removes zigzag effects caused by inconsistent walking speeds on sloping, uneven or overgrown terrain)

2.8.2 *Presentation of results and interpretation*

The presentation of the data for each site involves a print-out of the minimally processed data both as a greyscale plot and a colour plot showing extreme magnetic values, together with a greyscale plot of the processed data. Magnetic anomalies have been identified and plotted onto the 'Abstraction and Interpretation of Anomalies' drawing for the site.

3 **RESULTS**

The detailed magnetic gradiometer survey conducted at Melksham has identified a number of anomalies that have been characterised as being of a *probable* archaeological origin.

The difference between *probable* and *possible* archaeological origin is a confidence rating. Features identified within the dataset that form recognisable archaeological patterns or seem to be related to a deliberate historical act have been interpreted as being of a probable archaeological origin.

Features of possible archaeological origin tend to be more amorphous anomalies which may have similar magnetic attributes in terms of strength or polarity but are difficult to classify as being archaeological or natural.

The following list of numbered anomalies refers to numerical labels on the interpretation plots.

3.1 **Probable Archaeology**

- 1 A concentrated area of positive linear, curvi-linear and point anomalies, indicative of cut features of archaeological origin. These represent ditches, enclosures and pits related to possible settlement activity.
- 2 Widely spaced parallel linear anomalies, probably related to ridge-and-furrow.

3.2 **Possible Archaeology**

No possible archaeology has been identified within the survey area.

3.3 **Other Anomalies**

- 3 Curvi-linear anomalies likely related to footpaths visible on historic mapping of 1900.
- 4 Closely spaced parallel linear anomalies, probably related to agricultural activity such as ploughing.
- 5 Linear anomalies possibly related to land drains.
- 6 Areas of magnetic disturbance are the result of substantial nearby ferrous metal objects such as fences and underground services. These effects can mask weaker archaeological anomalies, but on this site have not affected a significant proportion of the area.
- 7 A number of magnetic 'spikes' (strong focussed values with associated antipolar response) indicate ferrous metal objects. These are likely to be modern rubbish.

4 **CONCLUSION**

A number of features of archaeological interest have been identified in the south west of the survey area. These are indicative of historic settlement activity indicating the presence of ditches, enclosures and pits.

Ridge-and-furrow ploughing is also present across the site, indicating the presence of medieval agricultural activity. In places, the ridge-and-furrow is visible on site in the form of earthworks. A number of curvi-linear anomalies visible in the south west and north east possibly relate to footpaths or trackways visible on historic mapping dating from 1900.

Other anomalies identified are likely modern or natural in origin including ploughing, land drains, ferrous objects in the topsoil and magnetic disturbance relating to field boundaries and fences.

Geophysical Survey Report

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5 REFERENCES

British Geological Survey South Sheet, 1977. *Geological Survey Ten Mile Map, South Sheet First Edition (Quaternary)*. Institute of Geological Sciences.

British Geological Survey, 2001. *Geological Survey Ten Mile Map, South Sheet, Fourth Edition (Solid)*. British Geological Society.

British Geological Survey, n.d., *website*:
(<http://www.bgs.ac.uk/opengeoscience/home.html?Accordion1=1#maps>) Geology of Britain viewer.

Soil Survey of England and Wales, 1983. *Soils of England and Wales, Sheet 5 South West England*.

English Heritage, 2008. *Geophysical Survey in Archaeological Field Evaluation*.

Bourn, R, 2013, *Desk-based Assessment: Land to the East of Spa Road, Melksham, Wiltshire*, CgMs Consulting Ltd.

Institute For Archaeologists. *Standard and Guidance for Archaeological Geophysical Survey*.
<http://www.archaeologists.net/sites/default/files/nodefiles/Geophysics2010.pdf>

APPENDIX A – METHODOLOGY & SURVEY EQUIPMENT

Grid locations

The location of the survey grids has been plotted 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 or a Leica Smart Rover RTK GPS.

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 re-broadcasts the phase of the carrier it measured, and the mobile units compare their own phase measurements with those they received from the base station. A SmartNet RTK GPS uses Ordnance Survey's network of over 100 fixed base stations to give an accuracy of around 0.01m.

Survey equipment and gradiometer configuration

Although the changes in the magnetic field resulting from differing features in the soil are usually weak, changes as small as 0.2 nanoTeslas (nT) in an overall field strength of 48,000nT, can be accurately detected using an appropriate instrument.

The mapping of the anomaly in a systematic manner will allow 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.

To illustrate this point, the cutting and subsequent silting or backfilling of a ditch may result in a larger volume of weakly magnetic material being accumulated in the trench compared to the undisturbed subsoil. A weak magnetic anomaly should therefore appear in plan along the line of the ditch.

The magnetic survey was carried out using a dual sensor Grad601-2 Magnetic Gradiometer manufactured by Bartington Instruments Ltd. The instrument consists of two fluxgates very accurately aligned to nullify the effects of the Earth's magnetic field. 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

Readings were taken at 0.25m centres along traverses 1m apart. This equates to 3600 sampling points in a full 30m x 30m grid.

Depth of scan and resolution

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m, though strongly magnetic objects may be visible at greater depths. The collection of data at 0.25m centres provides an optimum methodology for the task balancing cost and time with resolution.

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 site survey, data is transferred to the office for processing and presentation.

APPENDIX B – 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 *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 and material such as brick and tile may be magnetised through the same process.

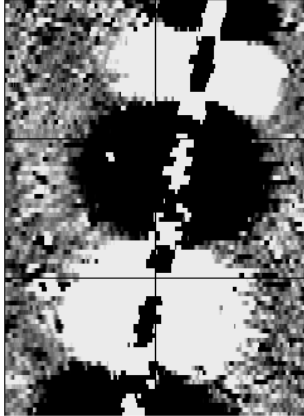
Silting and deliberate infilling of ditches and pits with magnetically enhanced soil creates a relative contrast against the much lower levels of magnetism within the subsoil into which the feature is cut. Systematic mapping of magnetic anomalies will produce linear and discrete areas of enhancement 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 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.

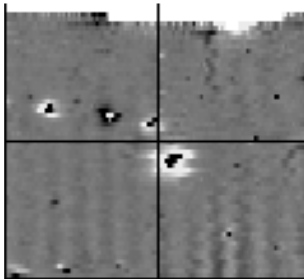
APPENDIX C – GLOSSARY OF MAGNETIC ANOMALIES

Bipolar



A bipolar anomaly is one that is composed of both a positive response and a negative response. It can be made up of any number of positive responses and negative responses. For example a pipeline consisting of alternating positive and negative anomalies is said to be bipolar. See also dipolar which has only one area of each polarity. The interpretation of the anomaly will depend on the magnitude of the magnetic field strength. A weak response may be caused by a clay field drain while a strong response will probably be caused by a metallic service.

Dipolar

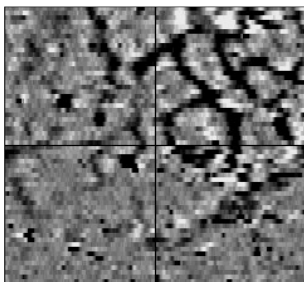


This consists of a single positive anomaly with an associated negative response. There should be no separation between the two polarities of response. These responses will be created by a single feature. The interpretation of the anomaly will depend on the magnitude of the magnetic measurements. A very strong anomaly is likely to be caused by a ferrous object.

Positive anomaly with associated negative response

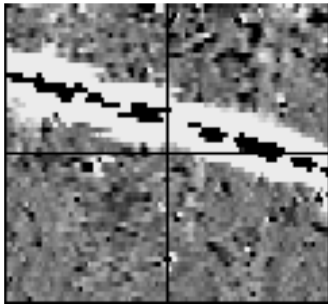
See bipolar and dipolar.

Positive linear



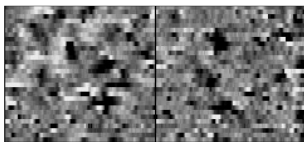
A linear response which is entirely positive in polarity. These are usually related to in-filled cut features where the fill material is magnetically enhanced compared to the surrounding matrix. They can be caused by ditches of an archaeological origin, but also former field boundaries, ploughing activity and some may even have a natural origin.

Positive linear anomaly with associated negative response



A positive linear anomaly which has a negative anomaly located adjacently. This will be caused by a single feature. In the example shown this is likely to be a single length of wire/cable probably relating to a modern service. Magnetically weaker responses may relate to earthwork style features and field boundaries.

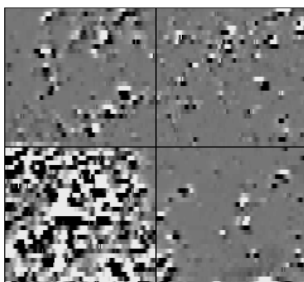
Positive point/area



depressions in the ground.

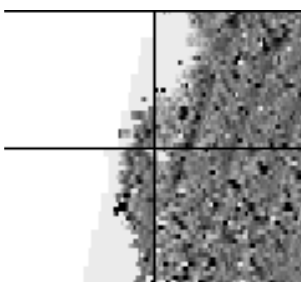
These are generally spatially small responses, perhaps covering just 3 or 4 reading nodes. They are entirely positive in polarity. Similar to positive linear anomalies they are generally caused by in-filled cut features. These include pits of an archaeological origin, possible tree bowls or other naturally occurring

Magnetic debris



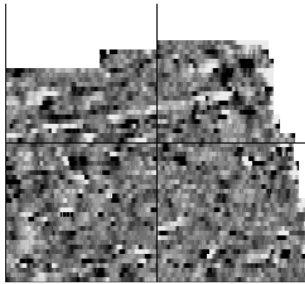
Magnetic debris consists of numerous dipolar responses spread over an area. If the amplitude of response is low ($\pm 3\text{nT}$) then the origin is likely to represent general ground disturbance with no clear cause, it may be related to something as simple as an area of dug or mixed earth. A stronger anomaly ($\pm 250\text{nT}$) is more indicative of a spread of ferrous debris. Moderately strong anomalies may be the result of a spread of thermoremanent material such as bricks or ash.

Magnetic disturbance



Magnetic disturbance is high amplitude and can be composed of either a bipolar anomaly, or a single polarity response. It is essentially associated with magnetic interference from modern ferrous structures such as fencing, vehicles or buildings, and as a result is commonly found around the perimeter of a site near to boundary fences.

Negative linear

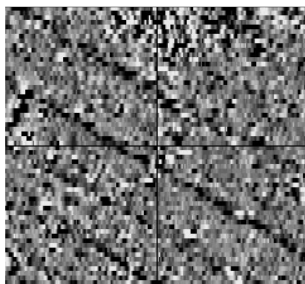


A linear response which is entirely negative in polarity. These are generally caused by earthen banks where material with a lower magnetic magnitude relative the background top soil is built up. See also ploughing activity.

Negative point/area

Opposite to positive point anomalies these responses may be caused by raised areas or earthen banks. These could be of an archaeological origin or may have a natural origin.

Ploughing activity



Ploughing activity can often be visualised by a series of parallel linear anomalies. These can be of either positive polarity or negative polarity depending on site specifics. It can be difficult to distinguish between ancient ploughing and more modern ploughing, clues such as the separation of each linear, straightness, strength of response and cross cutting relationships can be used to aid this, although none of these can be guaranteed to differentiate between different phases of activity.

Polarity

Term used to describe the measurement of the magnetic response. An anomaly can have a positive polarity (values above 0nT) and/or a negative polarity (values below 0nT).

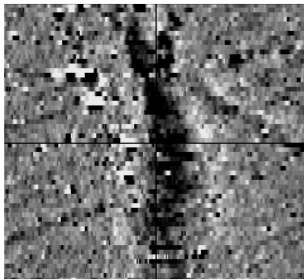
Strength of response

The amplitude of a magnetic response is an important factor in assigning an interpretation to a particular anomaly. For example a positive anomaly covering a 10m² area may have values up to around 3000nT, in which case it is likely to be caused by modern magnetic interference. However, the same size and shaped anomaly but with values up to only 4nT may have a natural origin. Colour plots are used to show the amplitude of response.

Thermoremanent response

A feature which has been subject to heat may result in it acquiring a magnetic field. This can be anything up to approximately +/-100 nT in value. These features include clay fired drains, brick, bonfires, kilns, hearths and even pottery. If the heat application has occurred in situ (e.g. a kiln) then the response is likely to be bipolar compared to if the heated objects have been disturbed and moved relative to each other, in which case they are more likely to take an irregular form and may display a debris style response (e.g. ash).

Weak background variations



Weakly magnetic wide scale variations within the data can sometimes be seen within sites. These usually have no specific structure but can often appear curvy and sinuous in form. They are likely to be the result of natural features, such as soil creep, dried up (or seasonal) streams. They can also be caused by changes in the underlying geology or soil type which may contain unpredictable distributions of magnetic minerals, and are usually apparent in several locations across a site.

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