

Substrata

Archaeological Geophysical Surveyors

An archaeological gradiometer survey

Land at Middle Knapp Farm Sidmouth, Devon

NGR 314930 95680

Report: 111201
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Plate 1: looking east across the survey area	front cover
Historic Environment Service, Devon County Council	

Accompanying CD-ROM

Report	Adobe PDF format
Survey areas and grids	Adobe PDF format
Data files	grid files generated using DW Consulting ArcheoSurveyor2
Minimal processing data plots and metadata	Adobe PDF format
GIS project and shape files	ESRI standard
GIS classification schema	Adobe PDF format

1 Survey description and summary

Type of survey: twin-sensor fluxgate gradiometer

Date of survey: 23 November 2011

Area surveyed: 1.3ha

Lead surveyor: Ross Dean BSc MSc MA MifA

Client

Historic Environment Service, Devon County Council, County Hall, Exeter, Devon EX2 4QW

Site

Location: Land at Middle Knapp Farm

Parish: Sidmouth

District: East Devon

County: Devon

NGR: 314930 95680

Planning Application: DCC/3020/2010

OASIS number: substrat1-115619

Survey purpose

The survey was commissioned to fulfil a Devon County Council Historic Environment Service requirement for a geophysical survey (Reed, 2011) in response to the above planning application. The survey was designed to evaluate the survival of below-ground archaeological deposits across the proposed development site, the results of which will allow the nature, extent and date of any surviving archaeological deposits within the application area to be understood and an appropriate planning decision made by the local planning authority.

Survey aims

1. identify and accurately record the location of any magnetic anomalies that may be related to archaeological deposits, structures or artefacts within the survey area
2. within the limits of the techniques and dataset, archaeologically characterise any such anomalies or patterns of anomalies
3. produce a summary based on the survey that is sufficiently detailed to inform any subsequent archaeological investigation about the location and possible archaeological character of the recorded anomalies

Results Summary

The magnetic contrast across the survey area was low but sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Four potential archaeological features were recorded as shown in figure 1.

Standards

The standards used to complete this survey are defined by the Institute for Archaeologists (2011). The codes of approved practice that were followed are those of the Institute for Archaeologists (2008 and 2009) and Schmidt (2002). The document text was written using the house style of the Institute for Archaeologists (Institute for Archaeologists, undated).

2 Site description

Landscape

The survey area comprised part of one large field with hedged boundaries to the north, south and west. The field is positioned on relatively high ground between 240 and 245m OD on a north-south trending spur (figure 4).

Land use

The field was under grass pasture at the time of the survey.

Geology

The site is located on a solid geology of Cretaceous limestone, mudstone and sandstone of the Gault and Upper Greensand formations (British Geological Survey, undated).

Soils

The soils in the survey area are defined as paleo-argillic stagnogly soils of the Dunkeswell association (Soil Survey of England and Wales, 1983):

- 0 - 25cm: dark grayish brown, slightly mottled, slightly stony silt loam or silty clay loam
- 25 - 45cm: pale brown, mottled, slightly or moderately stony silty clay loam; weak fine angular blocky structure
- 45 - 100cm: Red, mottled, , slightly stony clay; strong fine angular blocky structure (Findley et al, 1983: 226).

Known archaeological sites in the survey area

There are no known archaeological site within the survey area. A number of scheduled monuments and archaeological sites exist in unimproved land to the north of the site (Devon County Council, 2011).

Historical Landscape Characterisation

Modern enclosures adapting post-medieval fields; modern enclosures that have been created by adapting earlier fields of probable post-medieval date (Devon County Council, undated).

2. Results and discussion

The survey was designed to record magnetic anomalies. The anomalies themselves cannot be regarded as actual archaeological features and the widths of the anomalies shown do not represent the width of any associated archaeological features. The analysis presented below attempts to identify and characterise anomalies and anomaly groups that may pertain to archaeological deposits and structures. A detailed analysis of the data is provided in the attribute tables of the GIS project on the accompanying CD-ROM. The reader is referred to section 3.

Results

The magnetic contrast across the survey area was low but sufficient to be able to differentiate between anomalies representing possible archaeological features and background magnetic responses.

Four potential archaeological features were recorded as shown in figure 1.

Discussion

The results are discussed with reference to the magnetic anomaly groups shown in figure 1.

1. A magnetically positive anomaly group; a possible curvilinear archaeological feature but more likely to be a coincidentally curvilinear group of anomalies caused by natural sub-surface variations combined with remnant ploughing disturbance. Nevertheless, their apparent shape requires that they be considered as representing potential archaeology.
2. A group of magnetically positive anomalies that may represent large postholes or pits; they have been highlighted because of their proximity to anomaly group 3 rather than because of their individual significance. Similar anomalies occur at random elsewhere in the survey data without being in apparent archaeologically significant patterns.
3. A relatively large magnetically positive anomaly pattern at the edge of the survey area; this pattern stands out in the data and could reflect an archaeological deposit.
4. A magnetically negative anomaly that may represent stony material and stands out in the data set; this may be archaeologically significant.

All of the above are, at best, only possibly archaeologically significant. Bearing in mind the shallow nature of the surface deposits at the site, the author is reasonably confident that any archaeology significant features or deposits cut into the bedrock would show up in such a data set. Relatively shallow features intruding only into the subsoil to a depth of, say, 10 to 20cm may, however, be masked by the relatively low magnetic contrast between the soils and the underlying geology.

The interpretation plot shows strong magnetic responses that are almost certainly the result of subsurface ferrous material. These are recorded only where they could influence an interpretation of the nearby data and no other archaeological significance is implied. The same is true of the parallel linear trends plotted; these anomaly groups are likely to represent past ploughing or similar disturbance of surface and sub-surface deposits.

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Legend

— survey area

potential archaeology

possible archaeology, positive anomaly

possible archaeology, negative anomaly

ferrous response (2, 4)

possible archaeology, repeated parallels (2)

17 anomaly group

Notes:

1. All interpretations are provisional and represent potential archaeological deposits.
2. Representative of trends; only anomalies relevant to potential archaeology are recorded.
3. Anomalies likely to represent very recent ground disturbance are not highlighted.
4. Filled circles used to define anomalies are symbols and do not indicate possible circular archaeological features unless specifically indicated in the text.

0 12.5 25 50 Meters

Figure 1: survey interpretation

3 Disclaimer and copyright

The description and discussion of the results presented in this report are the authors, based on his interpretation of the survey data. Every effort has been made to provide accurate descriptions and interpretations of the geophysical data set. The nature of archaeological geophysical surveying is such that interpretations based on geophysical data, while informative, can only be provisional. It must be presumed that more archaeological features will be evaluated than those specified in this report. Geophysical surveys are a cost-effective early step in the multi-phase process that is archaeology.

Ross Dean, trading as Substrata, will assign copyright to the client upon written request but retains the right to be identified as the author of all project documentation and reports as defined in the Copyright, Designs and Patents Act 1988 (Chapter IV, s.79).

4 Acknowledgements

Substrata would like to thank Stephen Reed of Devon County Council Historic Environment Service for commissioning us to complete this survey.

5 References

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Appendix 1 Supporting plots

General Guidance

The anomalies represented in the survey plots provided in this appendix are magnetic anomalies. The apparent size of such anomalies and anomaly patterns are unlikely to correspond exactly with the dimensions of any associated archaeological features.

A rough rule for interpreting magnetic anomalies is that the width of an anomaly at half its maximum reading is equal to the width of the buried feature, or its depth if this is greater (Clark, 2000: 83). Caution must be applied when using this rule as it depends on the anomalies being clearly identifiable and distinct from adjacent anomalies. In northern latitudes the position of the maximum of a magnetic anomaly will be displaced slightly to the south of any associated physical feature.

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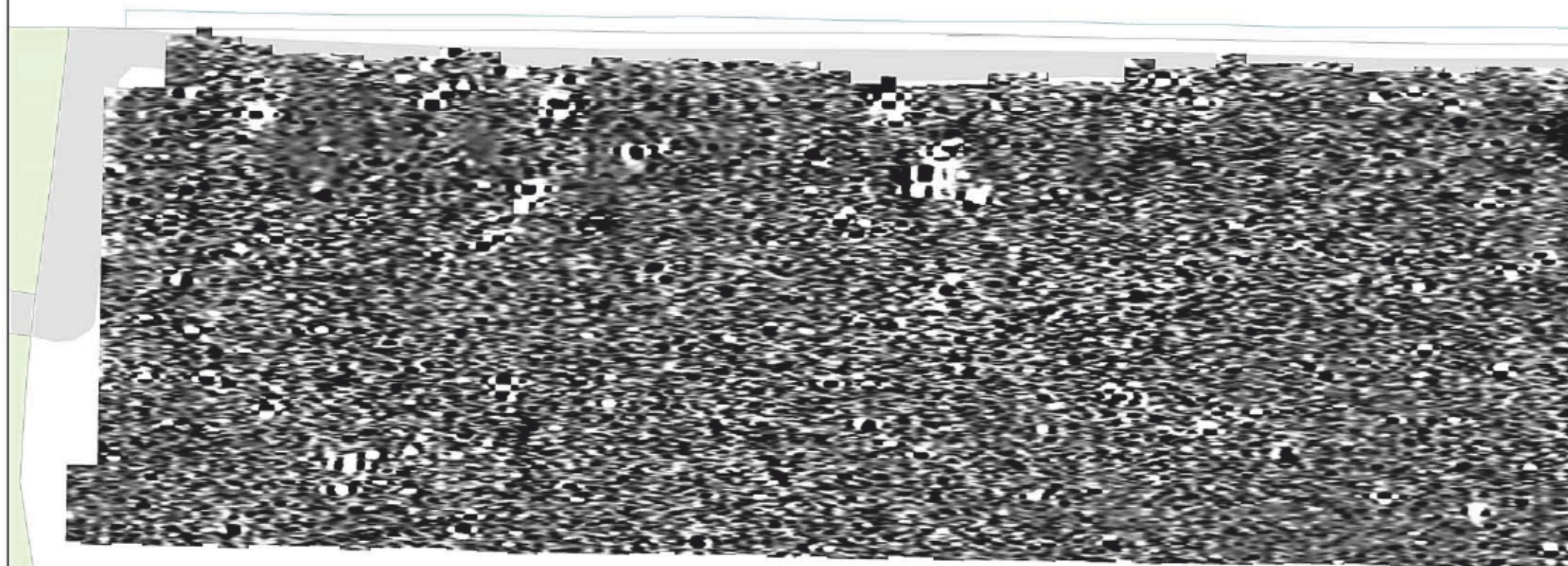
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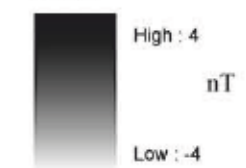
Report: 111123



Legend

archaeology clip

Value



0 12.5 25 50 Meters

Figure 2: shade plot of processed gradiometer data

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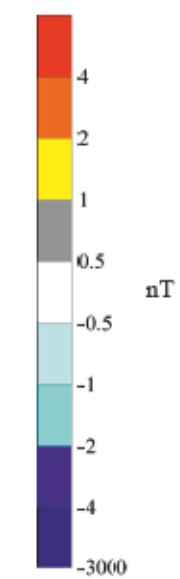
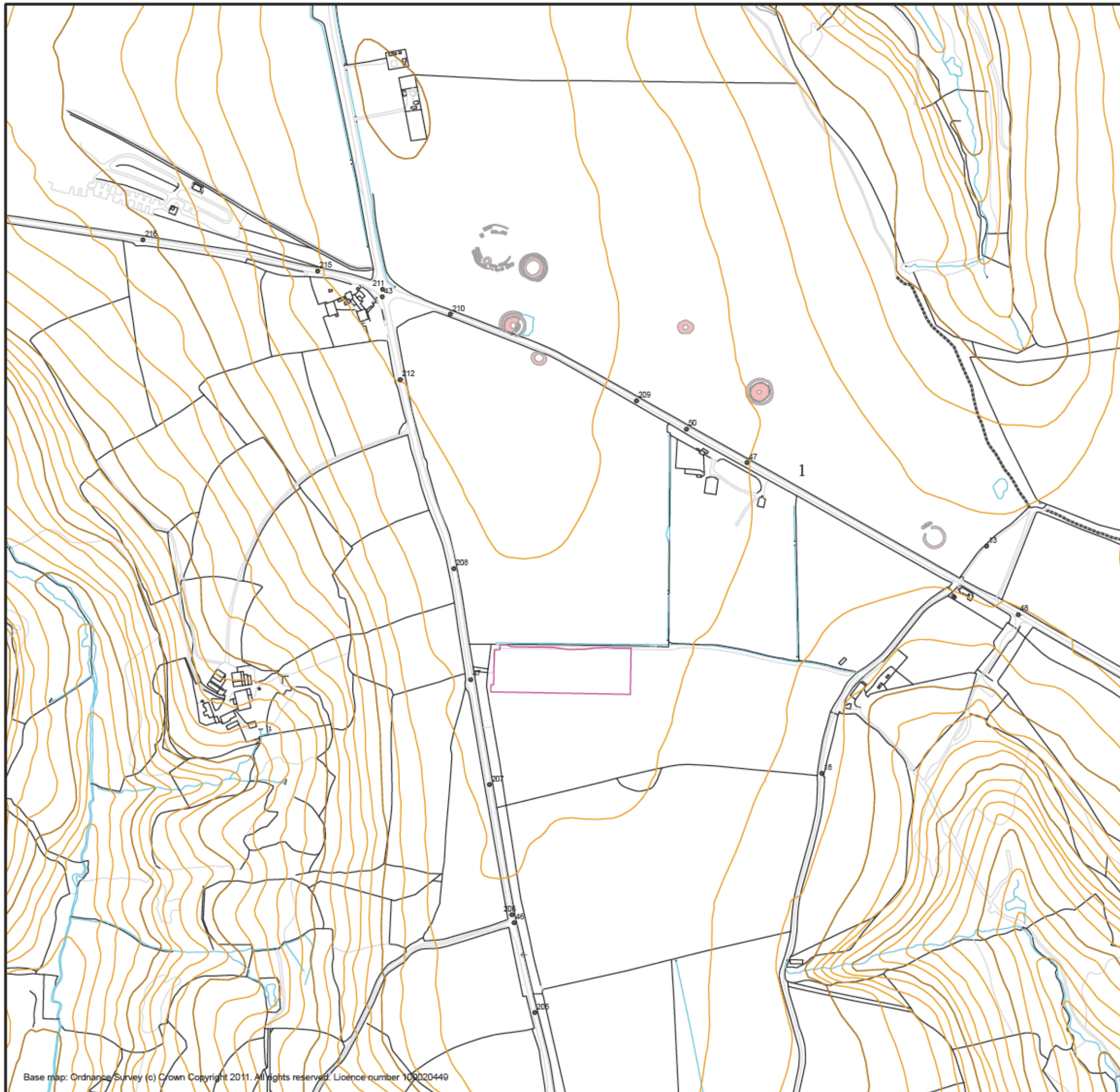


Figure 3: filled contour plot of processed gradiometer data



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Legend

- survey area
- Historic Interest; monument



Figure 4: survey location

Appendix 2 Methodology

Table 1: methodology	
Documents Brief: Reed (2011) Project design: Dean (2011)	
Methodology 1. The work was undertaken in accordance with the project design. The geophysical (gradiometer) survey was undertaken with reference to standard guidance provided by the Institute for Archaeologists (2011) and Schmidt (2002). 2. The survey used a temporary survey grid accurately positioned using a suitable DGPS system, co-registered to the Ordnance Survey National Grid using a digital map. The survey grid was composed of continuous 30m by 30m sub-grids. The survey grid location information and grid plan was recorded as part of the project in a suitable GIS system. 3. Data processing was undertaken using appropriate software, with all anomalies being digitised and geo-referenced. The final report included a graphical and textual account of the techniques undertaken, the data obtained and an archaeological interpretation of that data and conclusions about any likely archaeology.	
Grid <i>Method of Fixing:</i> DGPS set-out using pre-planned survey grids and Ordnance Survey coordinates. <i>Composition:</i> 20-metre by 20-metre and 30-metre by 30-metre grids <i>Recording:</i> Geo-referenced and recorded using digital map tiles.	
Equipment <i>Instrument:</i> Bartington Instruments grad601-2 <i>Firmware:</i> version 6.1	Data Capture <i>Sample Interval:</i> 0.125-metres <i>Traverse Interval:</i> 1 metre <i>Traverse Method:</i> zigzag <i>Traverse Orientation:</i> grid north
Data Processing, Analysis and Presentation Software DW Consulting ArcheoSurveyor2 ArcGIS 9.3 Microsoft Corp. Office Publisher 2003.	

Appendix 3 Data processing

Table 2: survey data processing - archaeology clip processing plot	
Software: DW Consulting ArcheoSurveyor2 v 2.5.11.0	
Stats	
Max:	290.83
Min:	-289.44
Std Dev:	10.84
Mean:	0.19
Median:	0.00
Processes:	3
1	Base Layer
2	Clip at 3.00 SD
3	DeStripe Median Sensors: All
Note: interpolation match x & y doubled is completed during export from ArcheoSurveyor to georeferenced ERSI format	

Appendix 4 Geophysical surveying techniques

1 Introduction

Substrata offers magnetometer and earth resistance surveying. We also provide other archaeology-specific geophysical surveys such as ground penetrating radar and resistivity. The particular method or combination of methods used depends on local soil conditions and the survey requirements. These methods are capable of delivering fast and accurate assessments of the archaeology of both large and small sites. The gradiometers (a type of magnetometer) and resistance meters employed are sensitive to depths of between 0 and 1.5m below ground level, with maximum sensitivity at depths of 1m or less.

2 Magnetometer surveying

Magnetometer surveying is used to detect and map small changes in the earth's magnetic field caused by concentrations of ferrous-based minerals within the soil and subsoil, and by magnetised materials buried beneath the surface. While most of these changes are too small to affect a compass needle, they can be detected and mapped by sensitive field equipment. During surveys the different magnetic properties of top-soils, sub-soils, rock formations and archaeological features are recorded as variations against a background value. Subsequently magnetic anomalies resulting from potential archaeology can be identified and interpreted. Identifiable archaeological features include areas of occupation, hearths, kilns, furnaces, ditches, pits, post-holes, ridge-and-furrow, timber structures, wall footings, roads, tracks and similar buried features.

A gradiometer is a type of magnetometer and is sensitive to relatively small changes in the earth's magnetic field. Substrata uses two types of gradiometer both specifically designed for field use by archaeologists. Our primary surveying instruments are Bartington *Grad601-2* (dual sensor) fluxgate gradiometers with automatic data loggers. We also use a Geoscan FM36 fluxgate gradiometer with the option of either manual or automatic sampling triggers. The Bartington gradiometers provide proven technology in archaeological magnetic surveying and offer fast, accurate set-up and survey rates. The Geoscan FM36 provides an effective, if older, solution when surveys are required within woodland and other areas of limited accessibility.

3 Earth resistance surveying

This method measures changes in the electrical resistance of the ground being surveyed. In practice, differences in the electrical resistance of materials facilitates the detection and interpretation of masonry and brick foundations, paving and floors, drains and other cavities, large pits, building platforms, robber trenches, timber structures, ditches, graves and similar buried features.

Resistance to electrical current flow in the ground depends on the moisture content and structure of the soil and other materials buried beneath the surface. For example, the higher the moisture content of a soil, the less resistant it is to electrical current flow. A ditch completely buried beneath the present ground surface is likely to have an infill soil different to that surrounding the ditch in terms of compactness and composition. As a result, the soil filling the buried ditch will retain moisture in a different way to the surrounding soil which means it will have an electrical resistance at variance with the surrounding environment. By passing a small current through the ground it is possible to detect, record, plot and interpret such changes in electrical resistance.

For earth resistance surveying Substrata uses the Geoscan Research RM15 multi-probe resistance meters and purpose-built automatic data-loggers. The MPX15 multi-probe facility can be used to speed up standard surveys and it is also useful when simultaneous multiple-depth analysis is required.