Archaeological Services
University of Durham

Land at Bishopsgarth, Stockton-on-Tees, Cleveland

geophysical surveys

on behalf of
Tees Archaeology

Report 1663
May 2007

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Community Services Department, Hartlepool Borough Council, Sir William Gray House, Clarence Road, Hartlepool TS24 8BT

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted as part of a Community Services project on land at Bishopsgarth, Stockton-on-Tees, Cleveland. The works comprised gradiometer surveys of four areas totalling approximately 2ha.

1.2 The works were undertaken on behalf of Tees Archaeology.

Results

1.3 The surveys identified a number of weak anomalies possibly reflecting soil-filled features in Areas 1, 2 and 3. Soil-filled features detected in Area 3 may reflect former field boundaries.

1.4 Traces of former ridge and furrow cultivation have been detected in all four of the survey areas.

2. Project background

Location (Figure 1)

2.1 The study area is located on agricultural land at Bishopsgarth, Stockton-on-Tees, Cleveland (NGR centre: NZ 4038 2115). Open fields bound the site to the north and south; California farm is to the west and Bishopsgarth School to the east. Four surveys were undertaken, totalling *c*.2ha (Figure 2).

Aim

2.2 The geophysical surveys were conducted as part of a Community Services project involving Tees Archaeology and Archaeological Services Durham University. This work was a result of recent aerial photographic evidence of cropmarks and the collection of artefacts from the ploughed fields.

Objective

2.3 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions provided by Tees Archaeology and a methods statement prepared by Archaeological Services.

Dates

2.5 Fieldwork was undertaken on 8th May 2007. This report was prepared between 21st and 25th May 2007.

Personnel

2.6 Fieldwork was conducted by Lorne Elliott (Supervisor) and Louise Robinson. This report was prepared by Lorne Elliott with illustrations by Janine Wilson. The Project Manager was Duncan Hale.

Archive/OASIS

2.7 The site code is **BGS07**, for **B**isops**G**arth **S**tockton 20**07**. The survey archive will be supplied on CD to the Community Services Department, Hartlepool Borough Council. Archaeological Services is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (OASIS). The OASIS ID number for this project is **archaeol3-27166**.

3. Archaeological and historical background

3.1 Until recently the study site has been an archaeologically sterile area on the Tees Archaeology Historic Environment Record (HER). Over the past few years artefact scatters collected and reported have indicated possible human presence in the prehistoric and medieval periods. These have included a small quantity of prehistoric worked flints (HER 5425 and 6198), a socketed bronze adze (HER 5431) and flint discoidal knife (HER 6193) from the Bronze Age, and a significant amount of medieval pottery (HER 5383 and 5423).

3.2 In addition to the artefacts, recent aerial photographs show a series of cropmarks consisting of two possible sub-rectangular enclosures with a droveway in between (HER 6230). These have affinities with Romano-British sites in the local area.

4. Landuse, topography and geology

4.1 At the time of surveys the area comprised one field of 'set-aside' with arable weeds of less than half a metre in height.

4.2 The elevation of the site ranges between *c.*45m and *c.*50m OD.

4.3 The underlying solid geology of the area comprises Triassic Sandstones and Mudstones, which are overlain by boulder clay.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation* (David 1995); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

Technique selection

5.2 Geophysical surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

5.3 In this instance, based on cropmark evidence and finds, it was considered likely that cut features, such as ditches and pits, would be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) might also be present.

5.4 Given the anticipated shallowness of targets and the non-igneous geological environment of the study area a geomagnetic technique, fluxgate gradiometry, was considered appropriate for detecting each of the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record minute anomalies in the vertical component of the Earth's magnetic field caused by variations in soil magnetic

susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

Field methods

5.5 The study area comprised one land parcel containing four separate survey areas measuring *c.*2ha (Figure 2). These were located to cover several cropmarks noted on recent aerial photographs.

5.6 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system (GPS) with real-time calibration.

5.7 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 fluxgate gradiometer. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

5.8 Data were downloaded on-site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.9 Geoplot v.3 software was used to process the geophysical data and to produce both continuous tone greyscale images and trace plots of the raw (unfiltered) data. The greyscale images and interpretations are presented in Figures 3-5; the trace plots are provided in Appendix I. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.10 The following basic processing functions have been applied to each dataset:

Clip	clips, or limits data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic.
Zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities.
Destagger	corrects for displacement of anomalies caused by alternate zig-zag traverses.
Interpolate	increases the number of data points in a survey to match sample and traverse intervals. In this instance the gradiometer data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.11 Colour-coded geophysical interpretation plans are provided. Two types of geomagnetic anomaly have been distinguished in the data:

positive magnetic — regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches.

dipolar magnetic — paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and service pipes) and/or fired structures such as kilns or hearths.

Interpretation: features

5.12 A colour-coded archaeological interpretation plan of the surveys is provided in Figure 5.

General comments

5.13 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.14 Weak and diffuse parallel positive magnetic anomalies were detected across all four survey areas, aligned broadly north/south in Areas 1, 2 and 4 and east/west in Area3. These anomalies spaced at 4-5m intervals almost certainly reflect traces of former ridge and furrow cultivation.

5.15 Small, discrete dipolar magnetic anomalies have been detected in all of the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the geophysical interpretation plans, however, they have been omitted from the archaeological interpretation plans and the following discussion.

Area 1 (Figures 3-5)

5.16 A number of weak and diffuse positive magnetic anomalies both linear and discrete have been detected in the southern and western parts of the survey. These almost certainly reflect soil-filled features such as ditches and pits.

Area 2 (Figures 3-5)

5.17 A cluster of small discrete positive magnetic anomalies in the central part of the survey possibly reflects a group of pits.

5.18 A chain of intense dipolar magnetic anomalies aligned broadly east/west across the southwest corner of the survey almost certainly reflects a service.

Area 3 (Figures 3-5)

5.19 Weak curvilinear positive magnetic anomalies detected in the eastern half of the survey with broadly north/south alignments almost certainly reflect soil-filled features. One of these anomalies traverses across the traces of ridge and furrow detected in this area; the eastern anomaly possibly respects the ridge and furrow and may therefore reflect a former field boundary. The western of these anomalies appears to correspond to a cropmark shown on the aerial photograph.

5.20 A positive magnetic anomaly detected in the eastern half of the survey almost certainly reflects a large soil-filled pit.

5.21 A series of very weak positive magnetic lineations was detected aligned broadly northeast/southwest. These anomalies are narrow and regularly spaced at 1m intervals, and are likely to reflect the present plough regime.

Area 4 (Figures 3-5)

5.22 An intense dipolar anomaly detected in the southeast corner of the survey almost certainly reflects the edge of a large service pipe.

5.23 A cluster of dipolar magnetic anomalies on the western boundary most likely reflects larger pieces of near surface ferrous or fired debris.

6. Conclusions

6.1 Fluxgate gradiometer surveys have been undertaken on land at Bishopsgarth, Stockton-on-Tees, Cleveland, as part of a Community Services project involving Tees Archaeology and Archaeological Services Durham University.

6.2 The surveys identified a number of weak anomalies possibly reflecting soil-filled features in Areas 1, 2 and 3. Soil-filled features detected in Area 3 may reflect former field boundaries.

6.3 Traces of former ridge and furrow cultivation have been detected in all four of the survey areas.

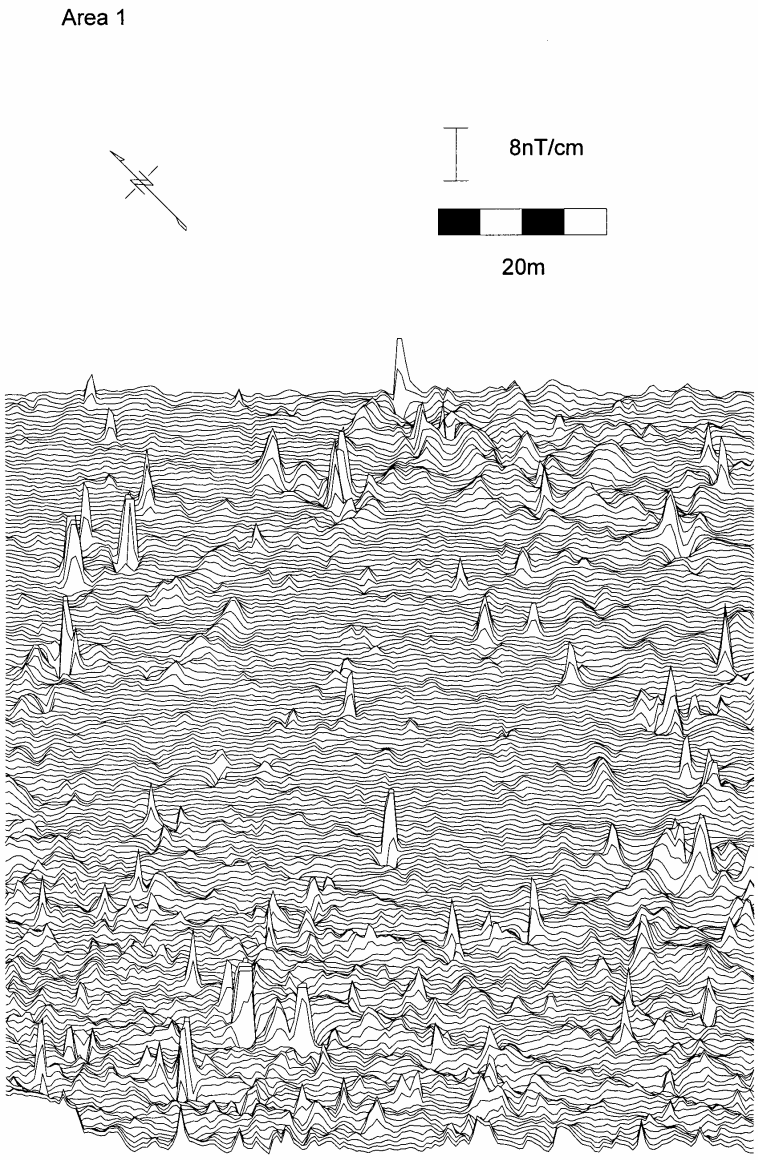
7. Sources

David, A, 1995 *Geophysical survey in archaeological field evaluation*, Research and Professional Services Guideline **1**, English Heritage

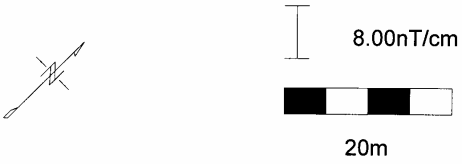
Gaffney, C, Gater, J, & Ovenden, S, 2002 *The use of geophysical techniques in archaeological evaluations*, Technical Paper **6**, Institute of Field Archaeologists

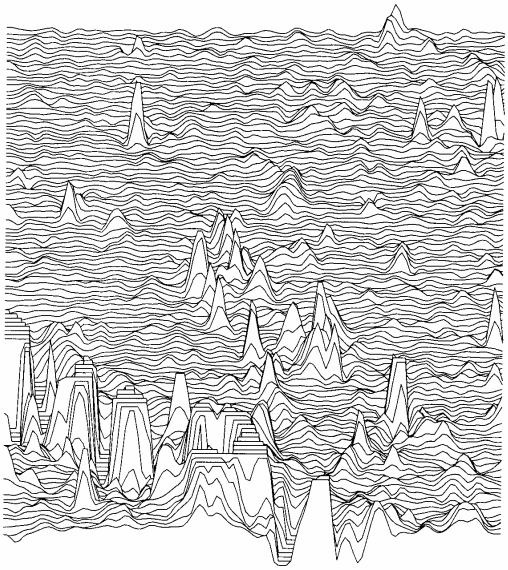
Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

Appendix I: Trace plots of geophysical data

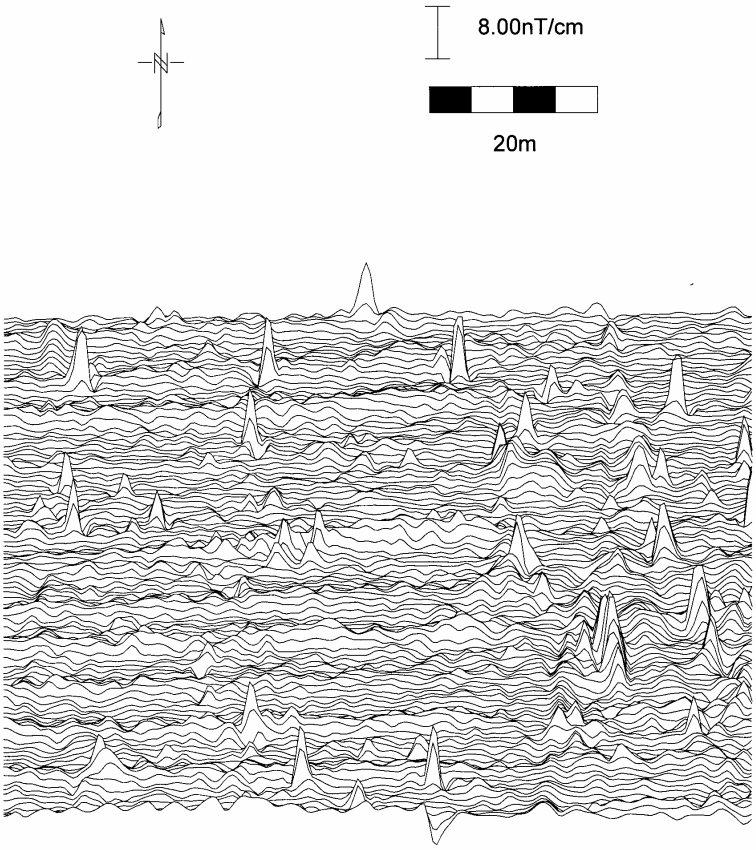


Area 2





Area 3



Area 4

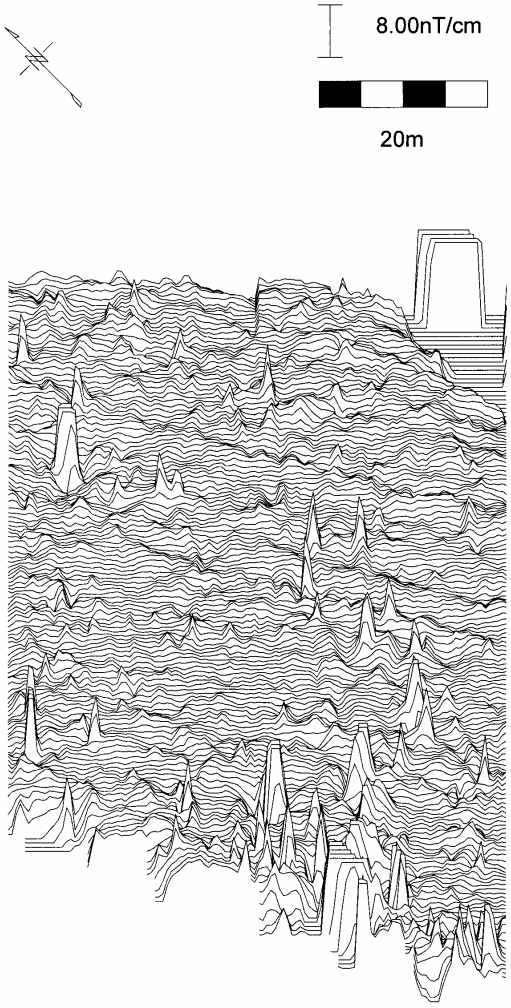


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Figure 1
Location of geophysical surveys

on behalf of
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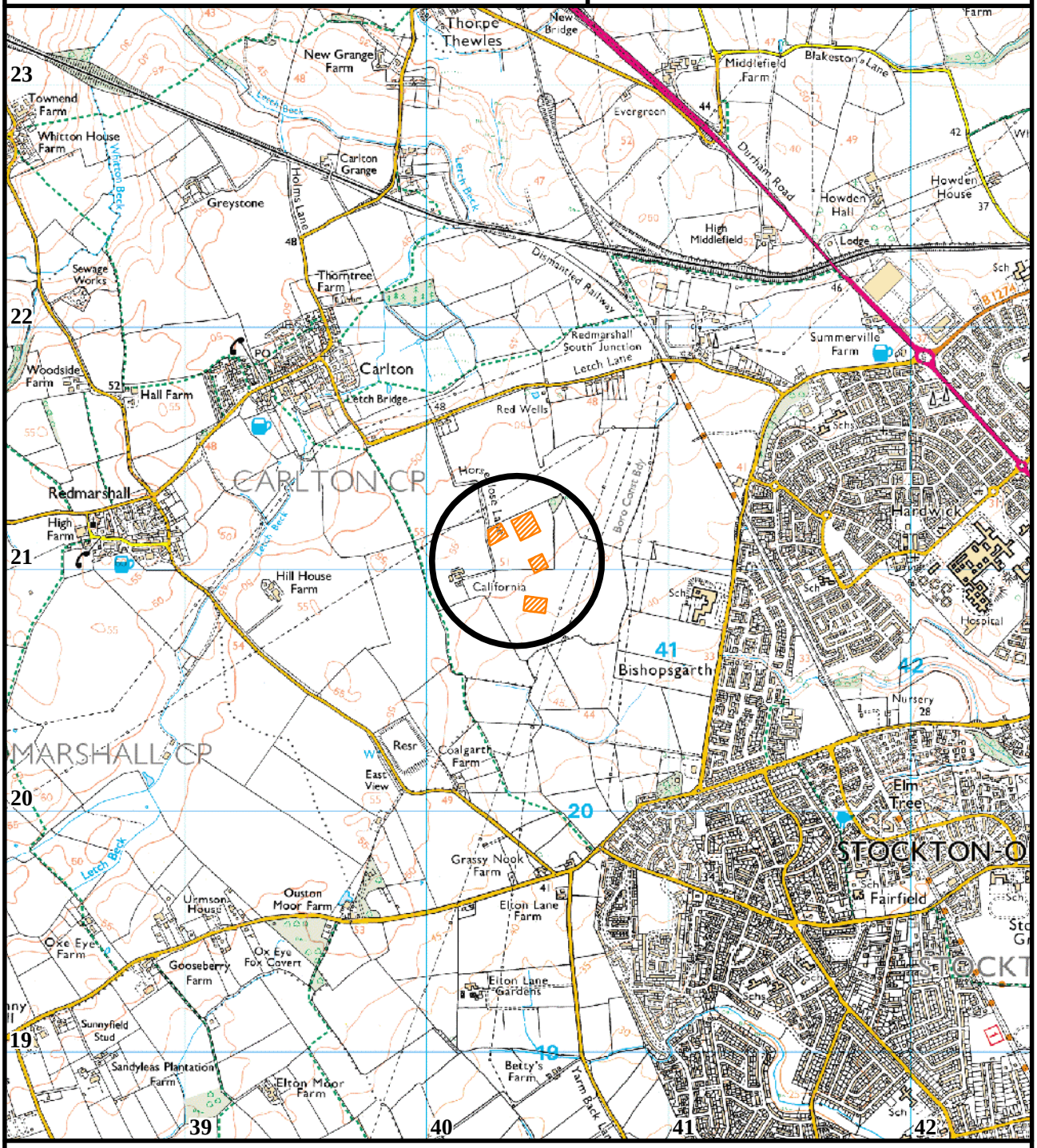

study area

0 1km

scale 1:25 000 - for A4 plot

Reproduced using significant survey information from Ordnance Survey basic and derived scales digital data with the permission of the controller of Her Majesty's Stationary Office.

Carlton

Letch Lane

Horseclose Lane

Area 1

Area 4

Area 2

Area 3

Bishopsgarth Comprehensive School

Harrowgate Lane

Bishopsgarth

21

40

41

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Figure 2

Location of geophysical surveys

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0 300m

scale 1:7500 - for A3 plot

geophysical surveys

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213

212

211

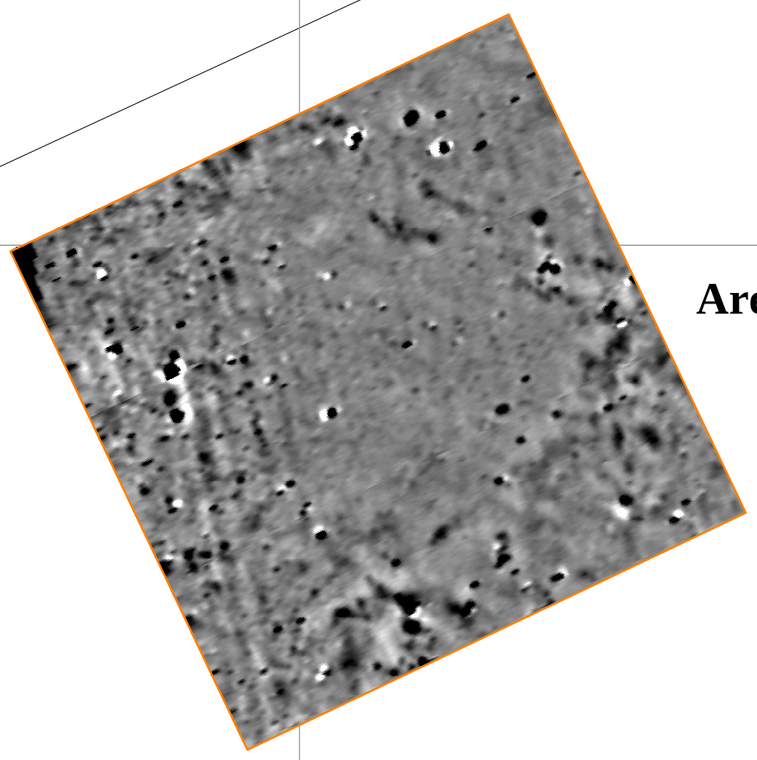
210

209

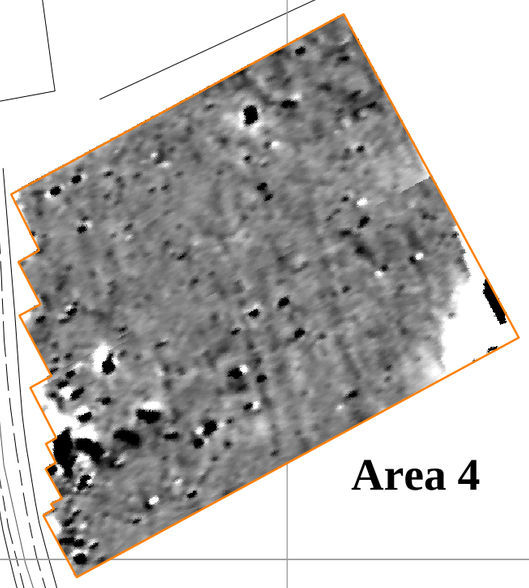
208

Pond

Area 1

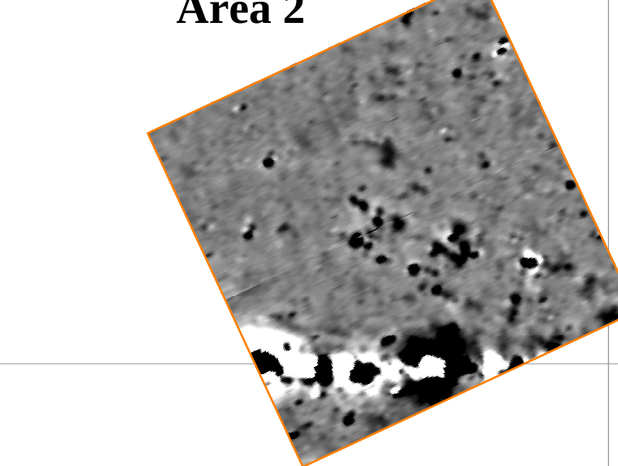


Area 4



Area 2

Area 3



3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

0 50m

scale 1:1000 - for A2 plot

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Figure 3

Geophysical surveys

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213

212

211

210

209

208

Pond

Area 1

Area 4

Area 2

Area 3

positive magnetic anomalies

dipolar magnetic anomalies

0 50m

scale 1:1000 - for A2 plot

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Figure 4

Geophysical interpretations

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213

212

211

210

209

208

Pond

Area 1

Area 4

Area 2

Area 3

soil-filled features

service pipes

orientation of ridge and furrow

0 50m

scale 1:1000 - for A2 plot

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Figure 5

Archaeological interpretations