

LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

DETAILED MAGNETOMETER SURVEY



Report Number: 1041

October 2013



LAND TO THE SOUTH OF CAWSTON ROAD, AYLSHAM, NORFOLK

Detailed Magnetometer Survey

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Site Code	ENF132560	NGR	TG 1833 2620
Planning Ref.	n/a	OASIS	britanni1- 162377
Approved By	Matthew Adams	DATE	October 2013



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ABSTRACT

This detailed fluxgate gradiometer survey was successful in identifying a range of anomalies, some of which have a possible archaeological origin and are worthy of further investigation.

Two parallel linear trends may be remnants of post-medieval field boundaries that were also present during a programme of archaeological works undertaken to the north of Cawston Road, or could relate to a recently ploughed out agricultural bed.

Four weak positive discrete anomalies indicative of rubbish pits and two weak curvilinear anomalies interpreted as a ring ditch or drip gully were also recorded in the dataset, however a geological origin cannot be ruled out.

The most interesting results are the two sets of strong dipolar discrete anomalies that have been interpreted as two individual kilns with associated stoke-pits. Kiln fragments were recovered during the last ploughing season just to the north-west which gives credence to this hypothesis.

It would be prudent to further evaluate the features of potential archaeological origin by means of a trial trench evaluation to assess the interpretations given in this report.



1.0 INTRODUCTION

On Tuesday 15^{th} October 2013 Britannia Archaeology Ltd (BA) undertook a detailed fluxgate gradiometer survey over *c*.1 hectare of land at Woodgate Nursery, Cawston Road, Aylsham, Norfolk (TG 1833 2620) on one field currently under set-aside.

The survey was undertaken on behalf of the land owner Mr Peter Purdy with the approval of Dr Ken Hamilton of Norfolk County Council Historic Environment Team (NCC HET). The weather was overcast for most of the day with outbreaks of sunshine, following a period of rain. This survey was undertaken as part of a programme of archaeological research investigations that are to be carried out over the area.

2.0 SITE DESCRIPTION

The survey was undertaken on one field located to the south-west of Aylsham in an area dominated by arable cultivation. Cawston Road borders the site to the north, a copse of well-established trees is present to the south, Woodgate Nursery car park is located to the west and a grass field lies to the east. A 5m exclusion zone around the periphery of the field was kept due to the presence of a bordering metal fence.

The bedrock is described as Wroxham Crag Formation sand and gravel, a sedimentary bedrock formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by swamps, estuaries and deltas periodically inundated by the sea (BGS, 2013).

The superficial deposits are described as Mid Pleistocene Glaciofluvial Deposits of sand and gravel formed up to 2 million years ago in the Quaternary Period when the local environment was dominated by ice age conditions with glaciers scouring the landscape depositing moraines of till with outwash sand and gravel from seasonal and post glacial meltwaters (BGS, 2013).

3.0 ARCHAEOLOGICAL BACKGROUND

The archaeological background summarises finds and features located on the Norfolk Heritage Explorer Website.

A detailed magnetometer survey was undertaken over c.1 hectare of land currently under set-aside that has been previously cultivated and ploughed. The survey was undertaken within the grounds of the Grade II* Listed Woodgate House (12216) that was built between 1706 and 1726. A plethora of Roman pottery has been collected by the land owner over the last few years within this field that show an apparent clustering and concentration depicted in Figure 1 (Magenta Hatching). Kiln fragments were discovered for the first time during the last ploughing season and is the principal reason why a magnetometer survey was employed to evaluate the area.



In the fields to the north of Cawston Road a detailed magnetometer survey was carried out over 20 hectares in 2011 by ASWYAS (Webb, A. 2011) followed by a subsequent trial trench evaluation by NAU that recorded some evidence of Roman activity to the south of the area and predominantly a series of late medieval and post-medieval field boundaries and trackways that were also present on air photographs. Bordering this field to the north of Cawston Road lies the railway embankment of the former East Norfolk Railway Line.

A post-medieval brick kiln (15883) is also located 330m to the south-west of the site.

4.0 PROJECT AIMS

A detailed magnetometer survey of the area was undertaken to enable the archaeological resource, both in quality and extent, to be investigated. Specific research questions are as follows:

- Can any evidence of potential archaeological activity associated with the pottery cluster and kiln fragments be seen in the dataset?
- What is the extent of the areas of archaeological potential?
- Are there any anomalies similar to those found to the north of Cawston Road recorded in the dataset?

5.0 METHODOLOGY

5.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington Dual Grad 601-2 fluxgate gradiometer to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that that the site had a fairly low magnetic background susceptibility probably due to the nature of the glacial till that is predominant in this area.

5.2 Instrument Calibration

One hour was allowed in the morning for the magnetometers sensors to settle before the start of the first grid. The instrument was zeroed after every three grids to minimise the effect of sensor drift. An area with a relatively low magnetic reading was chosen to calibrate the instrument; this same station was used to zero the sensors throughout the survey providing a common zero point. Sensor drift was noted throughout the day particularly during outbreaks of sunshine.

5.3 Sampling Interval and Grid Size

The sampling interval was set at 0.25m along 1m traverse intervals, providing 4 readings a metre, the magnetometer survey was undertaken on 20 x 20m grids.



5.4 Survey Grid Location

To keep the survey costs to a minimum fibre tapes were employed to lay out the grid using a geo-referenced scale drawing created in AutoCAD. The grids were positioned on a NNW-SSE alignment (Figure 1).

5.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at lunchtime and then also at the end of the day. The grid order was recorded on a BA pro-forma to aid in the creation of the data composites. Data were filed in job specific folders. These data composites were checked for quality on site by BA, allowing grids to be re-surveyed if necessary. The data were backed up onto an external storage device in the office and finally a remote server at the end of the day. A five metre exclusion zone was left between the boundaries and the survey area to reduce the amount of field boundary magnetic disturbance which slightly reduced the area available.

5.6 Data Presentation and Processing

Data are presented in both raw and processed data plots in greyscale format (Figures 2 and 3). An XY trace plot of the processed data has also been included (Figure 4). The raw data is presented with no processing, and was clipped to produce a uniform greyscale plot. The processed data schedule is also displayed below, metadata sheets are presented in Appendix 1.

<i>Raw Data:</i> Data Clipping:	3 standard deviations.
Processed Data: De-spike :	X diameter = 3, Y diameter = 3, Threshold = 1, centre
	value=mean, replace with = mean;
Data Clipping:	1 standard deviation;
De-stripe:	Traverse, Median, X (Horizontal).

An interpretation plan characterising the anomalies recorded can be found at Figure 5, it draws together the evidence collated both from the greyscale and XY trace plots (Figures 2, 3, and 4). All figures are tied into the National Grid and printed at an appropriate scale.

5.7 Software

Raw data were downloaded using Bartington software Grad601 and will be stored in this format as raw data. The software used to process the data and produce the composites was DW Consulting's Archeosurveyor v2.0. Datasets were exported into AutoCAD and placed onto the local survey grid. An interpretation plot was then produced using AutoCAD.



5.8 Grid Restoration

Britannia Archaeology Ltd positioned two reference stations in the field to enable the grid to be accurately relocated using the geo-referenced stations printed in Figure 1, this will also enable the accurate relocation of geophysical anomalies.

6.0 RESULTS & DISCUSSION (Figures 1 – 5)

The surveyors noted that the sites overall magnetic background was relatively low, causing little difficulty in locating a suitable zero station to set-up the instruments sensors. Isolated dipolar ('iron spike') responses were most numerous and probably caused by modern ferrous cultural debris being introduced into the topsoil through manuring and loss rather than resulting from the presence of buried archaeological artefacts. These responses (yellow hatched circles) seem to be fairly evenly spaced throughout the field with no apparent concentration.

Three areas of magnetic disturbance (yellow hatching) were recorded, one of which was caused by the proximity of sheds along the boundary fence to the north (see Figure 1). The second is recorded in the north-western corner where a car had previously been set on fire. A third area of magnetic disturbance is present on the eastern boundary that derives from responses caused by the proximity of the ferrous fence.

Two weak positive parallel linear trends (green lines) are present aligned south-west to north-east in the north of the field. This area contained a large rectangular bed for growing flowers and vegetables, present until recently ploughed flat allowing the survey to be undertaken without hindrance. These linear trends could be furrows related to this bed, however they are the only anomalies similar to those recorded on the magnetometer survey to the north and therefore may represent earlier field boundaries or potential trackway ditches.

Four weak positive discrete anomalies (orange hatching) were recorded during the survey, these anomalies can be indicative of cultural rubbish pits however a geological origin cannot be discounted.

Two weak positive curvilinear anomalies (red hatching) present to the south of the survey have been recorded in the dataset, they are indicative of a ring ditch or possible drip-gully type feature.

The most intriguing of the anomalies are four very strong dipolar discrete anomalies (magenta hatching) present close to the centre of the data plot. They are some of the strongest readings recorded by the magnetometer and have been interpreted as areas of intense localised burning of probable archaeological origin. Two of the four responses (located northern-most) are stronger and wider than the two present more southerly and have been interpreted as possible kilns. The two slightly smaller and weaker responses present to their south-west have been interpreted as associated kiln stoking-pits. This is



clear evidence of anomalies that could be related to kiln fragments recovered just to the north-west (see Figure 1).

7.0 CONCLUSION

The detailed fluxgate gradiometer survey was successful in identifying a range of anomalies, some of which have a possible archaeological origin and are worthy of further investigation.

Two parallel linear trends were the only anomalies similar to those found to the north of Cawston Road, however they may relate to the recently ploughed out agricultural bed.

Four weak positive discrete anomalies indicative of rubbish pits and two weak curvilinear anomalies interpreted as a ring ditch or drip gully were also recorded in the dataset, however a geological origin cannot be ruled out.

The most interesting results are the two sets of strong dipolar discrete anomalies that have been interpreted as two individual kilns with associated stoking-pits. Kiln fragments were recovered during the last ploughing season just to the north-west which gives credence to this hypothesis.

It would be prudent to further evaluate the features of potential archaeological origin by means of a trial trench evaluation to assess the interpretations given in this report.

8.0 PROJECT ARCHIVE AND DEPOSITION

A full archive will be prepared for all work undertaken in accordance with guidance from the *Selection, Retention and Dispersion of Archaeological Collections,* Archaeological Society for Museum Archaeologists, 1993. Arrangements will be made for the archive to be deposited with the relevant museum/HER Office.

9.0 ACKNOWLEDGEMENTS

Britannia Archaeology Ltd would like to Mr Peter Purdy for funding the project and for arranging site access, and to Dr Ken Hamilton and Mr James Albone of Norfolk County Council Historic Environment Team for their advice and input.



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Norfolk Heritage Explorer. <u>http://www.heritage.norfolk.gov.uk/home.</u>



APPENDIX 1 METADATA SHEETS

Raw Data

Ran Bata	
Filename:	Ayl1Raw.xcp
Instrument Type:	Grad 601-2 (Gradiometer)
Units:	nT
Surveyed by:	TPS/MB on 10/15/2013
Assembled by:	TPS on 10/15/2013
Direction of 1st	90 deg
Traverse:	
Collection Method:	ZigZag
Sensors:	2 @ 1.00 m spacing.
Dummy Value:	32702.00
Dimensions	
Composite Size	400 x 120
(readings):	
Survey Size	100.00m x 120.00 m
(meters):	
Grid Size:	20.00 m x 20.00 m
X Interval:	0.25 m
Y Interval:	1.00 m
Stats	
Max:	100.00
Min:	
Std Dev:	8.01
Mean:	-0.55
Median:	-0.15
Composite Area:	1.20 ha
Surveyed Area:	0.66 ha
Program	
Name:	ArcheoSurveyor
Version:	2.5.16.0

Sour	rce Grio	ds: 25	
1	Col:0	Row:1	grids\01.xgd
2	Col:0	Row:2	grids\02.xgd
3	Col:0	Row: 3	grids\03.xgd
4	Col:0	Row: 4	grids\04.xgd
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13	Col:2	Row: 4	grids\13.xgd
14	Col: 3	Row:0	grids\14.xgd
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16	Col:3	Row: 2	grids\16.xgd
17	Col:3	Row: 3	grids\17.xgd
18	Col:3	Row: 4	grids\18.xgd
19	Col: 3	Row: 5	grids\19.xgd
20	Col:4	Row:0	grids\20.xgd
21	Col:4	Row: 1	grids\21.xgd
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23	Col:4	Row: 3	grids\23.xgd
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Processed Data

Filename:Ayl1.xcpInstrument Type:Grad 601-2 (Gradiometer)Units:nTSurveyed by:TPS/MB on 10/15/2013Assembled by:TPS on 10/15/2013Direction of 1st90 degTraverse:	FIOCESSEU Data	
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4	Col:0	Row: 4	grids\04.xgd
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APPENDIX 2 TECHNICAL DETAILS

Magnetometer Survey

The magnetometer differs from the 'active' magnetic susceptibility meter by being a 'passive' instrument. Rather than injecting a signal into the ground it detects slight variations in the Earth's magnetic field caused by cultural and natural disturbance (Clark).

Thermoremanent magnetism is produced when a material containing iron oxides is strongly heated. Clay for example has a high iron oxide content that in a natural state is weakly magnetic, when heated these weakly magnetic compounds become highly magnetic oxides that a magnetometer can detect.

The demagnetisation of iron oxides occurs above a temperature known as the Curie point; for example haematite has a Curie point of 675 Celsius and magnetite 565C. At the time of cooling the iron oxides become permanently re-magnetised with their magnetic properties re-aligned in the direction of the Earth's magnetic field (Gaffney and Gater). The direction of the Earth's magnetic field shifts over time and these subtle alignment differences can be recorded. Kilns, hearths, baked clay and ovens can reach Curie point temperatures, and are the strongest responses apart from large iron objects that can be detected. Other cultural anomalies that can be prospected include occupation areas, pits, ditches, furnaces, sunken feature buildings, ridge and furrow field systems and ritual activity (David, 2011). Commonly recorded anomalies include modern ferrous service pipes, field drainage pipes, removed field boundaries, perimeter fences and field boundaries.

Fluxgate Gradiometers

Fluxgate gradiometers are sensitive instruments that utilise two sensors placed in a vertical plane, spaced 1 metre apart. The sensor above reads the Earth's magnetic (background) response while the sensor below records the local magnetic field. Both sensors are carefully adjusted to read zero before survey commences at a 'zeroing' point, selected for its relatively 'quiet' magnetic background reading. When differences in the magnetic field strength occur between the two sensors a positive or negative reading is logged. Positive anomalies have a positive magnetic value and conversely negative anomalies have a negative magnetic value relative to the site's magnetic background. Examples of positive magnetic anomalies include hearths, kilns, baked clay, areas of burning, ferrous material, ditches, sunken feature buildings, furrows, ferrous service pipes, perimeter fences and field boundaries. Negative magnetic anomalies include earthwork embankments, plastic water pipes and geological features.

The instruments are usually held approximately 0.30m to 0.50m above the ground surface and can detect to a depth of between 1-2metres. Best practice dictates that the optimal direction of traverse in Britain is east to west.



Magnetic Anomalies

Linear trends

Linear trends can be both positive and negative magnetic responses. If they are broad, relatively weak or negative in nature they may be of agricultural or geological origin, for example periglacial channels, land drains or ploughing furrows. If the responses are strong positive trends they are more likely to be of archaeological origin. Archaeological settlement ditches tend to be rich in highly magnetic iron oxides that accumulate in them via anthropogenic activity and humic backfills. Conversely surviving banks will be negative in nature, the material is derived from subsoil deposits that is less likely to be positively magnetic. Curvilinear trends can also be recorded and are indicative of archaeological structures such as drip-gullies.

Discrete anomalies

Discrete anomalies appear as increased positive responses present within a localised area. They are caused by a general increase in the amount of magnetic iron oxides present within the humic back-fill of for example a rubbish pit.

'Iron spike' anomalies

These strong isolated dipolar responses are usually caused by ferrous material present in the topsoil horizon. They can have an archaeological origin but are usually introduced into the topsoil during manuring.

Areas of magnetic disturbance

An area of magnetic disturbance is usually associated with material that has been fired. For example areas of burning, demolition (brick) rubble or slag waste spreads. They can also be caused by ferrous material, e.g. close proximity to barbwire or metal fences and field boundaries, buried services, pylons and modern rubbish deposits.



APPENDIX 3 OASIS FORM

OASIS ID: britanni1-162377

Project details Project name

Project details	
Project name	Land South of Cawston Road, Aylsham, Norfolk
Short description of the project	A detailed fluxgate gradiometer survey was successful in
	identifying a range of anomalies, some of which have a possible
	archaeological origin and are worthy of further investigation. Two
	parallel linear trends may be remnants of post-medieval field
	boundaries that were also present during a programme of
	archaeological works undertaken to the north of Cawston Road,
	or could relate to a recently ploughed out agricultural bed. Four
	weak positive discrete anomalies indicative of rubbish pits and
	two weak curvilinear anomalies interpreted as a ring ditch or drip
	gully were also recorded in the dataset, however a geological
	origin cannot be ruled out. The most interesting results are the
	two sets of strong dipolar discrete anomalies that have been
	interpreted as two individual kilns with associated stoke-pits. Kiln
	fragments were recovered during the last ploughing season just
	to the north-west which gives credence to this hypothesis. It
	would be prudent to further evaluate the features of potential
	archaeological origin by means of a trial trench evaluation to
	assess the interpretations given in this report.
Project dates	Start: 15-10-2013 End: 15-10-2013
Previous/future work	No / Yes
Any associated project	P1024 - Contracting Unit No.
reference codes	ENF132560 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 1 - Minimal cultivation
Monument type	NONE None
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	None
Prompt	Research
Position in the planning	Not known / Not recorded
process Solid goology	Wreyham Crag Formation Sand and Gravel
Solid geology Drift geology	Wroxham Crag Formation Sand and Gravel GLACIAL SAND AND GRAVEL
Techniques	Magnetometry
Project location	Magnetometry
Country	England
Site location	NORFOLK BROADLAND AYLSHAM Woodgate Nursey,
	Cawston Road, Aylsham, Norfolk
Postcode	NR11 6UH
Study area	1.00 Hectares
Site coordinates	TG 1833 2620 52 1 52 47 19 N 001 14 17 E Point
Height OD / Depth	Min: 40.00m Max: 40.00m
Project creators	
Name of Organisation	Britannia Archaeology Ltd
Project brief originator	Self (i.e. landowner, developer, etc.)
Project design originator	Timothy Schofield
Project director/manager	Timothy Schofield
Project supervisor	Timothy Schofield
Name of sponsor/funding body	Mr Peter Purdy



Project archives Physical Archive Exists? Digital Archive recipient Digital Contents Digital Media available

Paper Archive recipient Paper Contents Paper Media available Entered by Entered on No Norfolk HER "Survey" "Geophysics", "Images raster / digital photography", "Images vector", "Survey", "Text" Norfolk HER "Survey" "Drawing", "Plan", "Report", "Survey ", "Unpublished Text" Tim Schofield (<u>tim@britannia-archaeology.com</u>) 25 October 2013









