NEW CEMETERY, ST MARY’S FIELD, GAMLINGAY, CAMBRIDGESHIRE

DETAILED MAGNETOMETER SURVEY

Report Number: 1028

June 2013
NEW CEMETERY, ST MARY’S FIELD, GAMLINGAY, CAMBRIDGESHIRE

Detailed Magnetometer Survey

Prepared for:
Kirstin Rayner
Parish Clerk
Gamlingay
Cambridgeshire

By:
Timothy Schofield HND BSc PIfA

Britannia Archaeology Ltd
4 The Mill, Clovers Court, Stowmarket, Suffolk, IP14 1RB
T: 01449 763034
info@britannia-archaeology.com
www.britannia-archaeology.com
Registered in England and Wales: 7874460

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<td>Matthew Adams</td>
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The results and interpretation of the report cannot be considered an absolute representation of the archaeological or any other remains. In the case of geophysical surveys the data collected, and subsequent interpretation is a representation of anomalies recorded by the survey instrument. Britannia Archaeology Ltd will not be held liable for any errors of fact supplied by a third party, or guarantee the proper maintenance of the survey stations.
ABSTRACT

On the 12th June 2013 Britannia Archaeology Ltd undertook detailed magnetometer survey over c.1.25 hectares of land at the site of a proposed new cemetery at St Mary’s Field, Gamlingay, Cambridgeshire (NGR TL 2426 5224).

The geological conditions were not particularly favourable for magnetometer survey with the soils proving to be of low magnetic susceptibility, providing poor contrast between the anomalies and the background magnetic field. Despite this a wide range of anomalies were recorded, the majority of which were weak in nature but appear to be of an archaeological origin. Many of them correlate well with features depicted on medieval and post-medieval historical maps.

Isolated dipolar responses were most frequent throughout the dataset and probably indicate the presence of ferrous material buried within the topsoil.

An area of strong magnetic enhancement present in a similar location to that labelled ‘tieth barne’ on the 1602 map, could be the remains of a structure believed to have burnt down and been subsequently demolished. To its immediate east is a positive linear trend, interpreted as the associated boundary ditch that is recorded on the map of 1844.

Weak negative and positive curvilinear anomalies, indicative of banks and ditches, and an associated positive linear trend are interpreted as the remains of a former boundary that bisected the field, and is also recorded on the 1844 map.

A broad linear area of very high magnetic disturbance present in the south-eastern and south-western corners is consistent with a potential moat depicted on both historical maps. It was reported in a Gamarch meeting that rubbish and old cars were backfilled here in the 1960’s and 70’s when St Marys Close housing development was built.

Three linear trends arranged on a different alignment to those depicted on the maps suggests a second potential archaeological phase of unknown origin. Further archaeological investigation will help to establish the nature of these anomalies, and will also allow the interpretations in this report to be put to test.
1.0 INTRODUCTION

On the 12th June 2013 Britannia Archaeology Ltd (BA) undertook a detailed magnetometer survey over c.1.25 hectares of land that was suitable for survey at the site of the proposed new cemetery at St Mary’s Field, Gamlingay, Cambridgeshire (NGR TL 2426 5224) (see Figure 1). The survey was undertaken on behalf of Kirstin Rayner, the Parish Clerk, in response to a pre-determination brief issued by Cambridgeshire County Council, Historic Environment Team (CCC HET), (McConnell, D, dated 25/04/2013). The weather was sunny all day following a period of inclement weather.

2.0 SITE DESCRIPTION

The site is located on the eastern bounds of the historic core of Gamlingay, Cambridgeshire at an average height of 49.0m AOD.

The bedrock is described as Woburn Sands Formation, a sedimentary sandstone formed approximately 99 to 121 million years ago in the Cretaceous Period when the local environment was dominated by shallow seas. Comprising mainly of siliciclastic sediments deposited as mud, silt, sand and gravel (BGS, 2012).

The superficial deposits have not been recorded at this location (BGS, 2012).

3.0 ARCHAEOLOGICAL BACKGROUND

The site is located within the medieval core of Gamlingay and directly to the east of St Mary’s Church (HER No. MCB340) that dates from the 13th century. The Emplins, a 15th century house (HER No. MCB2922) is also directly adjacent to the site and sits atop a possible moated area (HER No. MCB1476). Adjacent to the south of the site lies the location of another possible medieval moat that is present along the western boundary (HER No. MCB2983), however this may form part of a hollow way that runs through the site. The 16th century Merton Manor (HER No. MCB2982) is located directly to the south within the bounds of the aforementioned moat. A now demolished barn (referred to as a Tithe barn) rested within the site bounds (HER No. MCB2932) (Figures 7 & 8). A second barn is also believed to have existed along the northern boundary of the site and can be seen on pre WWII photographs, it also appears to have been demolished.

The area may have been utilized as a settlement or burial ground during the Saxon period. Evidence of this was seen during an archaeological excavation in 1997 200m to the south where a Saxon settlement and cemetery was unearthed (HER No. MCB14105). Combined with the proximity of the 13th century church, it is highly likely that early medieval deposits are located within the site bounds.
4.0 PROJECT AIMS

The evaluation aimed to determine, the location, extent, date, character, condition, significance and quality of any surviving archaeological remains liable to be threatened by the proposed development.

5.0 METHODOLOGY

5.1 Instrument Type Justification

Britannia Archaeology Ltd employed a Bartington DualGRAD 601-2 to undertake the survey, because of its high sensitivity and rapid ground coverage. The surveyors noted that the magnetic background was fairly low across the site causing no difficulty in locating a zero station.

5.2 Instrument Calibration

A minimum of 20 minutes 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. One set-up station was employed, providing a common zero-point throughout the survey. Sensor drift was noted throughout the day caused by the outbreaks of sunshine.

5.3 Sampling/Traverse Interval and Grid Size

The sampling interval was set at 0.25m along 1.0m traverse intervals, providing 4 readings a metre, the survey was undertaken on 20 x 20m grids.

5.4 Survey Grid Location

The survey grid was set out by hand with the grid being later geo-referenced in AutoCAD. Britannia Archaeology Ltd usually employ a Leica differential global positioning system (DGPS), but to keep the costs to a minimum tapes were used to set-up the grid points (see Figure 2).

5.5 Data Capture

Instrument readings were recorded on an internal data logger that were downloaded to a laptop at midday and at the end of the survey. The grid order (see Figure 2) 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. Data were backed up onto an external storage device in the office and finally a remote server at the end of the day.
5.6  **Data Presentation and Processing**

Raw and processed greyscale and XY trace plots have been employed to interpret the data. Detail regarding the processing is shown below.

- **Raw Data:**
  - **Data Clipping:** -3/+3 standard deviation.

- **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).
  - **Data Display:** Clip to -3/+3 standard deviation.

An interpretation plan characterising the anomalies recorded can be found at Figure 6, it draws together the evidence collated from both raw and processed greyscale and XY trace plots (Figures 3, 4 & 5). All figures were tied into the National Grid and printed at an appropriate scale.

5.7  **Software**

Raw data were downloaded using DW Consulting’s Archeosurveyor v2.0 (now TerraSurveyor) and will be stored in this format as raw data. The software used to process the data and produce the composites was also 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 did not position reference stations within the field although two stations (D & H) along the baseline (Figure 2) can be relocated using the measurements depicted to reconstruct the survey grid or to relocate the geophysical anomalies. Please note that the delta declination currently in the UK is 34 minutes west, therefore the actual location of the anomalies lies approximately one metre to the east of those recorded on the data plots.

6.0  **DESCRIPTION OF RESULTS**

Isolated dipolar ‘iron-spike’ responses are the most numerous occurring anomaly within the dataset (Figures 3 to 8). It is possible that they demarcate the location of individual archaeological artefacts, however it is also likely that they are indicative of modern cultural debris lost or deposited within the topsoil.

There is one ‘L’ shaped area of strong magnetic enhancement that is present in the south-western corner of the dataset. This anomaly is located where a previous building structure is depicted on the 1602 map as a ‘Tieth barne’ and is also recorded on the map.
of 1844 (Figures 7 & 8) and within the CHER (HER No. MCB2932). The strong magnetically enhanced readings are consistent with that of burnt material, which gives credence to the theory that the building structure was burnt down before being demolished (Gamarch pers. comm.). Its shape is also consistent with the building, which is depicted as a rectangular structure on the maps. An associated positive linear anomaly has been recorded running parallel to its eastern side that terminates in the north-western corner of the data plot. It is very similar to a potential boundary ditch depicted on the 1844 map.

A broad linear area of very high magnetic disturbance present on the south-eastern and south-western corners of the plot is consistent with a possible moat recorded on both of the historical maps and within the CHER (HER No. MCB2983). In a Gamarch (Local Society) meeting it was reported that rubbish and old cars were backfilled here in the 1960’s and 70’s, when St Marys Close housing development was built. These anomalies have very high readings which suggests that ferrous material has indeed been buried here.

Ten positive discrete anomalies have been recorded that are of possible archaeological origin and are usually indicative of features such as rubbish pits. Further investigation should help to prove their derivation.

Two weak positive curvilinear anomalies located to the south-east of two weak negative curvilinear anomalies, are present towards the eastern boundary of the site. One of them appears to be the curving boundary ditch that bisects the site recorded on the 1844 map. The material excavated to create these ditches could have been up-cast and stored to form banks, which could explain the origin of the weak negative curvilinear anomalies located to their north-west. Almost adjoining to the west of the curvilinears is a straight (north-west to south-east orientated) weak positive linear anomaly that could be the continuation of a potential ditch recorded on the 1844 map.

Three other weak positive linear trends indicative of backfilled ditch-type anomalies are present in the dataset, two of which run on a parallel course (north-east to south-west) and the third runs perpendicular forming a possible corner with the south-eastern most trend. They are present on a different alignment to the other weak linear anomalies which suggests a different phase of potential archaeological activity, intriguingly none of them correlate with features present on the historical maps.

7.0 CONCLUSION

The geological conditions were not particularly favourable for magnetometer survey, with the soils being of a generally low magnetic susceptibility. Despite this a wide range of anomalies were recorded, the majority of which were weak in nature but appear to have an archaeological origin. Many of the anomalies correlate well with those depicted on the historical maps, which would give them a medieval to post-medieval origin. Three linear trends are arranged on a different alignment which suggests a potential second archaeological phase of unknown origin. Further archaeological investigation will help to establish the nature of the anomalies and test 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 thank Kirstin Rayner for her help with arranging access, getting the grass cut and for funding the survey, also to Dan McConnell of CCC HET for his help and advice throughout the project.
Bibliography


Websites


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Heritage Gateway www.heritagegateway.org.uk

Archaeological Data Service (ADS) www.ads.ahds.ac.uk

English Heritage National List for England
www.english-heritage.org.uk/professional/protection/process/national-heritage-list-for-england

DEFRA Magic http://magic.defra.gov.uk/website/magic

Maps

Thomas Langdon's Map 1602

Gamlingay Inclosure Map 1844
APPENDIX 1 – 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 0.15m to 0.30m 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 2 – OASIS SHEET

**OASIS ID:** britanni1-153718

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### Project creators

| **Name of Organisation** | Britannia Archaeology Ltd |
| **Project brief originator** | Local Authority Archaeologist and/or Planning Authority/advisory body |
| **Project design originator** | Timothy Schofield |
| **Project director/manager** | Timothy Schofield |
| **Project supervisor** | Matthew Adams |
| **Type of sponsor/funding body** | Developer |
| **Name of sponsor/funding body** | Gamlingay Parish Council |

### Project archives

| **Physical Archive Exists?** | No |
| **Digital Archive recipient** | Cambridge HER |
| **Digital Media available** | "Survey" |
NEW CEMETERY, ST MARY’S FIELD, GAMLINGAY, CAMBRIDGESHIRE

MS K. RAYNER

INTERPRETATION PLOT OF MAGNETOMETER ANOMALIES

4 THE MILL, CLOVERS COURT, SUFFOLK IP14 1RB
T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

Scale: 1:750

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Isolated Dipolar Responses

Positive Discrete Anomaly, Archaeology?

Broad Linear Area of Magnetic Disturbance, Moat?

Area of Magnetic Enhancement, Burnt Structure?

Weak Positive Linear Anomaly, Archaeology?

Weak Negative Linear Anomaly, Archaeology?

Weak Positive Linear Anomaly, Archaeology?

Weak Positive Linear Anomaly, Archaeology?

Weak Positive Linear Anomaly, Archaeology?
NEW CEMETERY, ST MARY'S FIELD, GAMLINGAY, CAMBRIDGESHIRE

MS K. RAYNER

DESCRIPTION:
INTERPRETATION PLOT OF MAGNETOMETER DATA & 1602 MAP

07
PROJECT:

CLIENT:

DESCRIPTION:

SCALE:

DATE:

PLOT:

AUTHOR:

A3

JUN 2013

TPS

APPROVED:

VERSION:

MCA

01

08

INTERPRETATION PLOT OF MAGNETOMETER DATA & 1844 MAP

NEW CEMETERY, ST MARY'S FIELD, GAMLINGAY, CAMBRIDGESHIRE

MS K. RAYNER

DESCRIPTION:

INTERPRETATION PLOT OF MAGNETOMETER DATA & 1844 MAP

BRITANNIA ARCHAEOLOGY LTD

4 THE MILL, CLOVERS COURT, SUFFOLK IP14 1RB

T: 01449 763034
E: info@britannia-archaeology.com
W: www.britannia-archaeology.com

Isolated Dipolar Responses

Weak Positive Linear Anomaly, Archaeology?

Weak Negative Linear Anomaly, Archaeology?

Positive Discrete Anomaly, Archaeology?

Broad Linear Area of Magnetic Disturbance, Moat?

Area of Magnetic Enhancement, Burnt Structure?

25m

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