magnitude surveys

Geophysical Survey Report

of

Albourne, Sussex

For

Orion Heritage

Magnitude Surveys Ref: MSTQ1221

March 2022

magnitude surveys

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Abstract

Magnitude surveys was commissioned to assess the subsurface archaeological protentional of a c. 11.4ha area of land at Albourne, Sussex. A fluxgate gradiometer survey was successfully completed across the entire survey area. Anomalies of agricultural origins, including ridge and furrow and drainage features, have been identified. In addition, several anomalies have been classified as undetermined. These are of uncertain date and origin and have little supporting context, but an archaeological origin cannot be ruled out. Modern interference is present around field boundaries and as a ferrous spread which covers the majority of the survey area.

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1. Introduction

1.1. Magnitude Surveys Ltd (MS) was commissioned by Orion Heritage to undertake a geophysical survey over a c. 11.4ha area of land at Albourne, Sussex (TQ 26183 16681).

1.2. The geophysical survey comprised a hand-carried GNSS-positioned fluxgate gradiometer survey. Magnetic survey is the standard primary geophysical method for archaeological applications in the UK due to its ability to detect a range of different features. The technique is particularly suited for detecting fired or magnetically enhanced features, such as ditches, pits, kilns, sunken featured buildings (SFBs) and industrial activity (David *et al*., 2008).

1.3. The survey was conducted in line with the current best practice guidelines produced by Historic England (David *et al*., 2008), the Chartered Institute for Archaeologists (CIfA, 2020) and the European Archaeological Council (Schmidt *et al.,* 2015).

1.4. It was conducted in line with a WSI produced by MS (Dyulgerski, 2022).

1.5. The survey commenced on 22/03/2022 and took 2 days to complete.

2. Quality Assurance

2.1. Magnitude Surveys is a Registered Organisation of the Chartered Institute for Archaeologists (CIfA), the chartered UK body for archaeologists, and a corporate member of ISAP (International Society for Archaeological Prospection).

2.2. The directors of MS are involved in cutting edge research and the development of guidance/policy. Specifically, Dr Chrys Harris has a PhD in archaeological geophysics from the University of Bradford, is a Member of CIfA and is the Vice-Chair of the International Society for Archaeological Prospection (ISAP); Finnegan Pope-Carter has an MSc in archaeological geophysics and is a Fellow of the London Geological Society, as well as a member of GeoSIG (CIfA Geophysics Special Interest Group); Dr Paul Johnson has a PhD in archaeology from the University of Southampton, is a Fellow of the Society of Antiquaries of London, has been a member of the ISAP Management Committee since 2015, and is currently the nominated representative for the EAA Archaeological Prospection Community to the board of the European Archaeological Association.

2.3. All MS managers, field and office staff have degree qualifications relevant to archaeology or geophysics and/or field experience.

3. Objectives

3.1. The objective of this geophysical survey was to assess the subsurface archaeological potential of the survey area.

4. Geographic Background

4.1. The survey area was located c. 300m west Albourne (Figure 1). Gradiometer survey was undertaken across 3 fields under both arable cultivation and pasture. The survey area was bordered by the B2116 and further fields to the north, Albourne Church of England Primary School to the east, further fields to the west and church lane to the south(Figure 2).

4.2. Survey considerations:

Survey Area	Ground Conditions	Further Notes
1	This area is under arable cultivation. A gentle slope runs east to west across half the field, while a steep slope runs from northwest to southeast.	The east boundary is comprised of a hedgerow with trees, as is the western part of the north boundary. The southern boundary is a fenced hedgerow, while the northern boundary is young saplings. A footpath runs along the eastern boundary
2	This area primarily comprises of a flat arable field, with the eastern fifth of the area being pasture.	The north and western boundaries are comprised of overgrown treeline with a stream alongside the northern boundary. A farm track runs north to west marking the boundary between the arable crop and pasture. The southern boundary is marked by young saplings
3	This area is under pasture, with an orchard occupying part of the area. There is no prominent topography	The east and south boundaries are composed of overgrown vegetation. The boundary running northwest to southeast is marked by a hedge.

4.3. The underlying geology comprises mudstone of the Weald Clay formation in area 2 and 3, and Silty Sandstone of the Lower Greensand Group in area 1. No superficial deposits have been recorded (British Geological Survey, 2022).

4.4. The soils consist of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils (Soilscapes, 2022).

5. Archaeological Background

5.1. Awaiting Background Information (DBA or other) from Client.

6. Methodology

6.1. Data Collection

6.1.1. Magnetometer surveys are generally the most cost effective and suitable geophysical technique for the detection of archaeology in England. Therefore, a magnetometer survey should be the preferred geophysical technique unless its use is precluded by any specific survey objectives or the site environment. For this site, no factors precluded the recommendation of a standard magnetometer survey. Geophysical survey therefore comprised the magnetic method as described in the following section.

6.1.2. Geophysical prospection comprised the magnetic method as described in the following table.

6.1.3. Table of survey strategies:

Method	Instrument	Traverse Interval	Sample Interval
Magnetic	Bartington Instruments Grad-13 Digital Three-Axis Gradiometer	1m	200Hz reprojected to 0.125m

6.1.4. The magnetic data were collected using MS' bespoke hand-carried GNSS-positioned system.

6.1.4.1. MS' hand-carried system was comprised of Bartington Instruments Grad 13 Digital Three-Axis Gradiometers. Positional referencing was through a multi-channel, multi-constellation GNSS Smart Antenna RTK GPS outputting in NMEA mode to ensure high positional accuracy of collected measurements. The RTK GPS is accurate to 0.008m + 1ppm in the horizontal and 0.015m + 1ppm in the vertical.

6.1.4.2. Magnetic and GPS data were stored on an SD card within MS' bespoke datalogger. The datalogger was continuously synced, via an in-field Wi-Fi unit, to servers within MS' offices. This allowed for data collection, processing and visualisation to be monitored in real-time as fieldwork was ongoing.

6.1.4.3. A navigation system was integrated with the RTK GPS, which was used to guide the surveyor. Data were collected by traversing the survey area along the longest possible lines, ensuring efficient collection and processing.

6.2. Data Processing

6.2.1. Magnetic data were processed in bespoke in-house software produced by MS. Processing steps conform to the EAC and Historic England guidelines for 'minimally enhanced data' (see Section 3.8 in Schmidt *et al.*, 2015: 33 and Section IV.2 in David *et al.,* 2008: 11).

Sensor Calibration – The sensors were calibrated using a bespoke in-house algorithm, which conforms to Olsen *et al*. (2003).

Zero Median Traverse – The median of each sensor traverse is calculated within a specified range and subtracted from the collected data. This removes striping effects caused by small variations in sensor electronics.

Projection to a Regular Grid – Data collected using RTK GPS positioning requires a uniform grid projection to visualise data. Data are rotated to best fit an orthogonal grid projection and are resampled onto the grid using an inverse distance-weighting algorithm.

Interpolation to Square Pixels – Data are interpolated using a bicubic algorithm to increase the pixel density between sensor traverses. This produces images with square pixels for ease of visualisation.

6.3. Data Visualisation and Interpretation

6.3.1. This report presents the gradient of the sensors' total field data as greyscale images, as well as the total field data from the lower sensors. The gradient of the sensors minimises

external interferences and reduces the blown-out responses from ferrous and other high contrast material. However, the contrast of weak or ephemeral anomalies can be reduced through the process of calculating the gradient. Consequently, some features can be clearer in the respective gradient or total field datasets. Multiple greyscale images of the gradient and total field at different plotting ranges have been used for data interpretation. Greyscale images should be viewed alongside the XY trace plot (Figures 7 & 10). XY trace plots visualise the magnitude and form of the geophysical response, aiding anomaly interpretation.

6.3.2. Geophysical results have been interpreted using greyscale images and XY traces in a layered environment, overlaid against open street maps, satellite imagery, historical maps, LiDAR data, and soil and geology maps. Google Earth (2022) was also consulted, to compare the results with recent land use.

6.3.3. Geodetic position of results – All vector and raster data have been projected into OSGB36 (ESPG27700) and can be provided upon request in ESRI Shapefile (.SHP) and Geotiff (.TIF) respectively. Figures are provided with raster and vector data projected against OS Open Data.

7. Results

7.1. Qualification

7.1.1. Geophysical results are not a map of the ground and are instead a direct measurement of subsurface properties. Detecting and mapping features requires that said features have properties that can be measured by the chosen technique(s) and that these properties have sufficient contrast with the background to be identifiable. The interpretation of any identified anomalies is inherently subjective. While the scrutiny of the results is undertaken by qualified, experienced individuals and rigorously checked for quality and consistency, it is often not possible to classify all anomaly sources. Where possible, an anomaly source will be identified along with the certainty of the interpretation. The only way to improve the interpretation of results is through a process of comparing excavated results with the geophysical reports. MS actively seek feedback on their reports, as well as reports from further work, in order to constantly improve our knowledge and service.

7.2. Discussion

7.2.1. The geophysical results are presented in combination with historical maps (Figure 4).

7.2.2. A fluxgate gradiometer survey was successfully carried out across an 11.4ha area of land at Albourne, Sussex. The geophysical survey has successfully detected anomalies of agricultural and undetermined origins. The survey has responded well to the environment of the survey area though large expanses of ferrous spread are present across the majority of the survey area, this obscures the data and may stop anomalies and features from being identified. Magnetic disturbance is generally limited to the field boundaries.

7.2.3. Agricultural activity has been identified in the form of drainage features identified across the majority of the survey area and ridge and furrow ploughing.

7.2.4. Linear and curvilinear anomalies have been identified throughout the survey area but have been categorised as undetermined. These anomalies do not correspond to any features recorded on historical or satellite imagery and may be the result of modern or agricultural activity, however a possible archaeological origin cannot be excluded.

7.3. Interpretation

7.3.1. General Statements

7.3.1.1. Geophysical anomalies will be discussed broadly as classification types across the survey area. Only anomalies that are distinctive or unusual will be discussed individually.

7.3.1.1 **Ferrous (Spike)** – Discrete dipolar anomalies are likely to be the result of isolated pieces of modern ferrous debris on or near the ground surface.

7.3.1.2 **Ferrous/Debris (Spread)** – A ferrous/debris spread refers to a concentration of multiple discrete, dipolar anomalies usually resulting from highly magnetic material such as rubble containing ceramic building materials and ferrous rubbish.

7.3.1.3 **Magnetic Disturbance** – The strong anomalies produced by extant metallic structures, typically including fencing, pylons, vehicles and service pipes, have been classified as 'Magnetic Disturbance'. These magnetic 'haloes' will obscure weaker anomalies relating to nearby features, should they be present, often over a greater footprint than the structure causing them.

7.3.1.4 **Undetermined** – Anomalies are classified as Undetermined when the origin of the geophysical anomaly is ambiguous and there is no supporting contextual evidence to justify a more certain classification. These anomalies are likely to be the result of geological, pedological or agricultural processes, although an archaeological origin cannot be entirely ruled out. Undetermined anomalies are generally distinct from those caused by ferrous sources.

7.4 Magnetic Results - Specific Anomalies

7.4.1.1 **Ridge and furrow (Trend)** – Parallel, weak, linear and curvilinear anomalies have been identified in the north of Area 2. The average 5-10m spacing and morphology is indicative of a ridge and furrow ploughing regime.

7.4.1.2 **Drainage Feature** – Multiple linear and curvilinear anomalies have been identified across areas 1 & 2 and have been interpreted as ditch-like drains, with a visible system.

7.4.1.3 **Undetermined (Strong/Weak)** – Anomalies across the survey area have been identified which have been classified as 'Undetermined', including weak and strong linear and curvilinear anomalies. Two alignments of strong anomalies have been identified in Area 3 and a further rectilinear alignment of strong and weak anomalies has been identified in the southwest of Area 1, with various other weak anomalies throughout the survey area. These have no distinctive signal or shape to suggest a specific interpretation and may have natural, agricultural or modern origins, though an archaeological origin cannot be completely ruled out.

7.4.1.4 **Ferrous (Spread)** – Across the majority of Areas 1 & 2 a ferrous spread is present, most likely due to green waste being spread across the survey area. This obscures any further anomalies and features from being fully visible.

8. Conclusions

8.1. A fluxgate gradiometer survey has been successfully undertaken across the 11.4ha survey area. Modern interference was visible at the field boundaries, and the majority of the survey area was also covered by a ferrous spread, most likely related to green waste. Anomalies of agricultural origin have been identified.

8.2. Agricultural activity has been identified across the survey area in the form of ridge and furrow ploughing and drainage.

8.3. Anomalies of undetermined origins have also been detected. It has not been possible to definitively determine whether these anomalies are the result of archaeological, agricultural, or modern practices.

9. Archiving

9.1. MS maintains an in-house digital archive, which is based on Schmidt and Ernenwein (2013). This stores the collected measurements, minimally processed data, georeferenced and un-georeferenced images, XY traces and a copy of the final report.

9.2. MS contributes reports to the ADS Grey Literature Library upon permission from the client, subject to any dictated time embargoes.

10. Copyright

10.1. Copyright and intellectual property pertaining to all reports, figures and datasets produced by Magnitude Services Ltd is retained by MS. The client is given full licence to use such material for their own purposes. Permission must be sought by any third party wishing to use or reproduce any IP owned by MS.

11. References

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12. Project Metadata

MS Job Code	MSTQ1221
Project Name	Albourne, Sussex
Client	Orion Heritage
Grid Reference	TQ26183 16681
Survey Techniques	Magnetometry,
Survey Size (ha)	11.4ha (Magnetometry)
Survey Dates	2022-03-22 to 2022-03-23
Project Lead	Krasimir Dyulgerski BA MRes
Project Officer	Krasimir Dyulgerski BA MRes
HER Event No	N/A
OASIS No	N/A
S42 Licence No	N/A
Report Version	0.3

13. Document History

Version	Comments	Author	Checked By	Date
0.1	Initial draft for Project Lead to Review	IT , DN	AC	28 March 2022
0.2	Corrections from Project Lead; Draft for Director's Approval	IT	AC	30 March 2022
0.3	Draft after Director's corrections	IT	FPC	30 March 2022

MSTQ1221: Albourne Sussex
Figure 1 - Site Location
1:25,000 @ A4

Site Boundary

N

0 0.5 1 km

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526000
527000
117000
117000
Chloe Wood
Gunners
B2116
Priestfield Farm
Westhouse Farm
Area 3
Albourne Green
West Town Farm
Play Space
Area 2
Albourne Church Of England Primary School
B2118
B2116
B2116
A23
Area 1
The Street
Leyfield
Northpark Farm
Albourne Street
Church Lane
Albourne
St Bartholomew's Church

MSTQ1221: Albourne Sussex
Figure 2 - Location of Survey Area
1:5,000 @ A3

Survey Area

N

0 150 300 450 m

magnitude surveys

525600 525800 526000 526200 526400 526600

117000 116800 116600 116400

Westhouse Farm

Area 3

Area 2

Area 1

B2116

Albourne Green

Barn Close

Play Space

Albourne Church Of England Primary School

Barleycroft

B2118

B2116

B2116

The Twitten

The Street

Leyfield

Albourne Street

Albourne

Church Lane

Wellcroft Cottages

MSTQ1221: Albourne Sussex
Figure 3 - Magnetic Total Field (Lower Sensor)
1:3,000 @ A3

48,997 nT 49,005

N

0 50 100 150 m

magnitude surveys

525600 525800 526000 526200 526400 526600

117000 116800 116600 116400

Area 1

Area 2

Area 3

B.M.113.2

Westhouse Farm

Albourne Green

Guide Post

B.M.138.0

King's Head

LONDON 42
BRIGHTON 9
M.P.

Gallops House

Albourne Street

National School
Boys, Girls & Infants

Spring Cottage

Yewtree House

Foot Br.

B.M.126.8

Elm Villa

Tipnoak

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Figure 4 - Magnetic Interpretation Over Historical Maps and Satellite Imagery
1:3,000 @ A3

Contains historical mapping © CLS Data 2022: Ordnance Survey, 6" 2nd edition c. 1882-1913
Contains satellite imagery © Bing Satellite 2022

Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

526000
526200
526400
116800
116600
Area 3
Area 2
B2116
Barn Close
The Street
Barleycroft
Albourne Church Of England Primary School
The Twitten

MSTQ1221: Albourne Sussex
Figure 5 - Magnetic Gradient (Areas 2 & 3)
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

526000
526200
526400
116800
116800
116600
116600
Area 3
Area 2
B2116
Barn Close
The Street
Barleycroft
The Twitten
Albourne Church Of England Primary School

MSTQ1221: Albourne Sussex
Figure 6 - Magnetic Interpretation (Areas 2 & 3)
1:1,500 @ A3

Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

526000
526200
526400
116800
116600
Area 3
Area 2
B2116
Barn Close
The Street
Barleycroft
Albourne Church Of England Primary School
The Twitten

MSTQ1221: Albourne Sussex
Figure 7 - XY Trace Plot (Areas 2 & 3)
90nT/cm at 1:1,500 @ A3

N
0
50
100
150 m
magnitude surveys

526000

526200

526400

Area 2

Albourne Church Of England Primary School

Barleycroft

116600

The Twitten

116600

Area 1

The Street

Church Lane

Albourne Street

Wellcroft Cottages

MSTQ1221: Albourne Sussex
Figure 8 - Magnetic Gradient (Areas 1 & 2)
1:1,500 @ A3

-1 nT 2

N

0 50 100 150 m

magnitude surveys

526000
526200
526400
116600
116600
Area 2
Area 1
Albourne Church Of England Primary School
Barleycroft
The Twitten
The Street
Church Lane
Albourne Street
Wellcroft Cottages

MSTQ1221: Albourne Sussex
Figure 9 - Magnetic Interpretation (Areas 1 & 2)
1:1,500 @ A3

Magnetic Disturbance
Ferrous/Debris (Spread)
Undetermined (Strong)
Undetermined (Weak)
Ridge and Furrow (Trend)
Drainage Feature
Ferrous (Spike)

N

0 50 100 150 m

magnitude surveys

526000

526200

526400

Area 2

Albourne Church Of England Primary School

Barleycroft

116600

The Twitten

116600

Area 1

The Street

Church Lane

Albourne Street

Wellcroft Cottages

MSTQ1221: Albourne Sussex
Figure 10 - XY Trace Plot (Areas 1 & 2)
90nT/cm at 1:1,500 @ A3

N

0 50 100 150 m

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