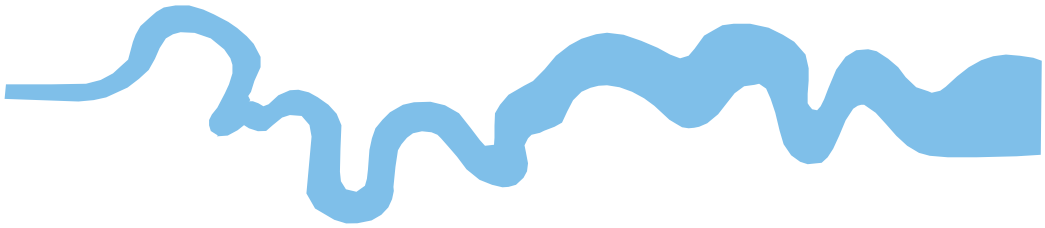
T V A S



NORTH MIDLANDS

Land north of Shardlow Road, Aston-on-Trent, Derbyshire

Geophysical Survey (Magnetic)

by Garreth Davey

Site Code: LRS17/231

(SK 4223 2957)

Land north of Shardlow Road, Aston-on-Trent, Derbyshire

Geophysical Survey (Magnetic) Report

For Commercial Archaeology Limited

by Garreth Davey

Thames Valley Archaeological Services Ltd.

Site Code LRS 17/231

November 2017

Summary

Site name: Land north of Shardlow Road, Aston-on-Trent, Derbyshire

Grid reference: SK 4223 2957

Site activity: Magnetometer survey

Date and duration of project: 6th November 2017

Project coordinator: Tim Dawson

Site supervisor: Garreth Davey

Site code: LRS 17/231

Area of site: 0.9 ha

Summary of results: The survey was completed across the majority of the site area but identified no definite archaeological features, however two small areas of increased magnetic response were identified in the east of the dataset.

Location of archive: The archive is presently held at TVAS, North Midlands in accordance with TVAS digital archiving policies.

Report edited/checked by:	Steve Ford✓ 16.11.17
	Tim Dawson✓ 16.11.17

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Land north of Shardlow Road, Aston-on-Trent, Derbyshire
A Geophysical Survey (Magnetic)

By Garreth Davey

Report 17/231

Introduction

This report details the results of a detailed gradiometer survey conducted over land north of Shardlow Road, Aston-on-Trent, Derbyshire (SK 4223 2957) (Figure 1). The geophysical survey was commissioned by Ms Helen Martin-Bacon of Commercial Archaeology working on behalf of Mr O'Brien in support of a planning application to develop the site as a residential caravan site with amenities and hardstanding (Planning application 9/2017/0893C).

The fieldwork was undertaken by Garreth Davey and Kyle Beaverstock on 6th November 2017 and the site code is LRS 17/231. The archive is presently held at TVAS North Midlands, Stoke-on-Trent in accordance with TVAS digital archiving policies.

Location, topography and geology

The site comprises a single 0.9 ha triangular parcel of land, located approximately 720 m east of Aston-on-Trent and approximately 9.5 km south-east of Derby, Derbyshire. The site is flat and lies at approximately 40 m above Ordnance Datum (aOD). It is bounded to the south-east by Shardlow Road, to the west by an unnamed lane, and to the north by agricultural land. The land is currently utilised for haylage. The solid geology of the site is recorded as mudstone, siltstone and sandstone of the Triassic Rocks group with superficial deposits of Alluvium (BGS, 2017).

Site history and archaeological background

There are no recorded historical assets within the site, however within 1 km there are a number of features recorded in the Derbyshire Historic Environment Record. The most significant comprise an area of crop marks recorded by aerial photography directly south-east of the site, 12 listed buildings within Aston-on-Trent and a further 3 listed buildings along the route of the Trent and Mersey Canal. Aston-on Trent has late Saxon origins and is recorded in Domesday Book of 1086 as a small settlement with only 3 households.

The cropmarks, some of which have been investigated and some are scheduled monuments include an Iron Age settlement, Bronze Age round barrows and a Late Neolithic henge monument. The fieldwork recorded further neolithic deposits .Other cropmakrs are thought to be of Roman origin with evidence for medieval agriculture.

Map regression shows that site area has been in use as arable fields from at least the 19th century to present, with no significant boundary alterations since at least 1882.

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both English Heritage (2008) and the Chartered Institute *for* Archaeologists (2002, 2011, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for the fast yet detailed surveying of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two fluxgates mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seen from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	**Effect**
Clip from -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: *y* doubled	Increases the resolution of the readings in the *y* axis, enhancing the shape of anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

The raw data plot is presented as a greyscale plot shown in relation to the site (Fig. 3) with the processed data then presented as a second figure (Fig. 4), followed by a third plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 5). Anomalies are shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.16.2 and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

The total surveyed area was 0.8 hectares, the 0.1 hectare reduction was due to field boundaries and a small area of overgrowth in the north-east corner of the field. A number of anomalies have been identified within the gradiometer survey data (Figures 3 and 4). The majority of these consist of readings are consistent with magnetic disturbance and ferrous items however two small areas of increased positive responses [Fig. 4: 1] and [2], where identified on the eastern boundary. Given the proximity to the field boundary and associated magnetic disturbance there is no clear shape to the anomalies and these are therefore difficult to interpret however given their location it is possible that these may be outlying features related to the expansive and continued occupation detailed east of the site.

Conclusion

In conclusion, despite the sites proximity to a varied and expansive landscape of historical occupation, very little of archaeological potential has been detected in the dataset. The anomalies identified on the eastern extent may be of archaeological origin and further investigation may be required.

References

British Geological Survey, http://www.bgs.ac.uk
CI*f*A, 2014, *Standard and Guidance: for archaeological geophysical survey*, Reading
English Heritage, 2008, *Geophysical Survey in Archaeological Field Evaluation*, English Heritage, Portsmouth (2nd edn)
I*f*A, 2002, *The Use of Geophysical Techniques in Archaeological Evaluation*, IFA Paper No. 6, Reading
IfA, 2011, *Standard and Guidance: for archaeological geophysical survey*, Reading

Appendix 1. **Survey and data information**

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Survey corner coordinates (X/Y):
Northwest corner: 442195.72, 329605.19 m
Southeast corner: 442295.72, 329465.19 m
Direction of 1st Traverse: 88.0642 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 400 x 140
Survey Size (meters): 100 m x 140 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

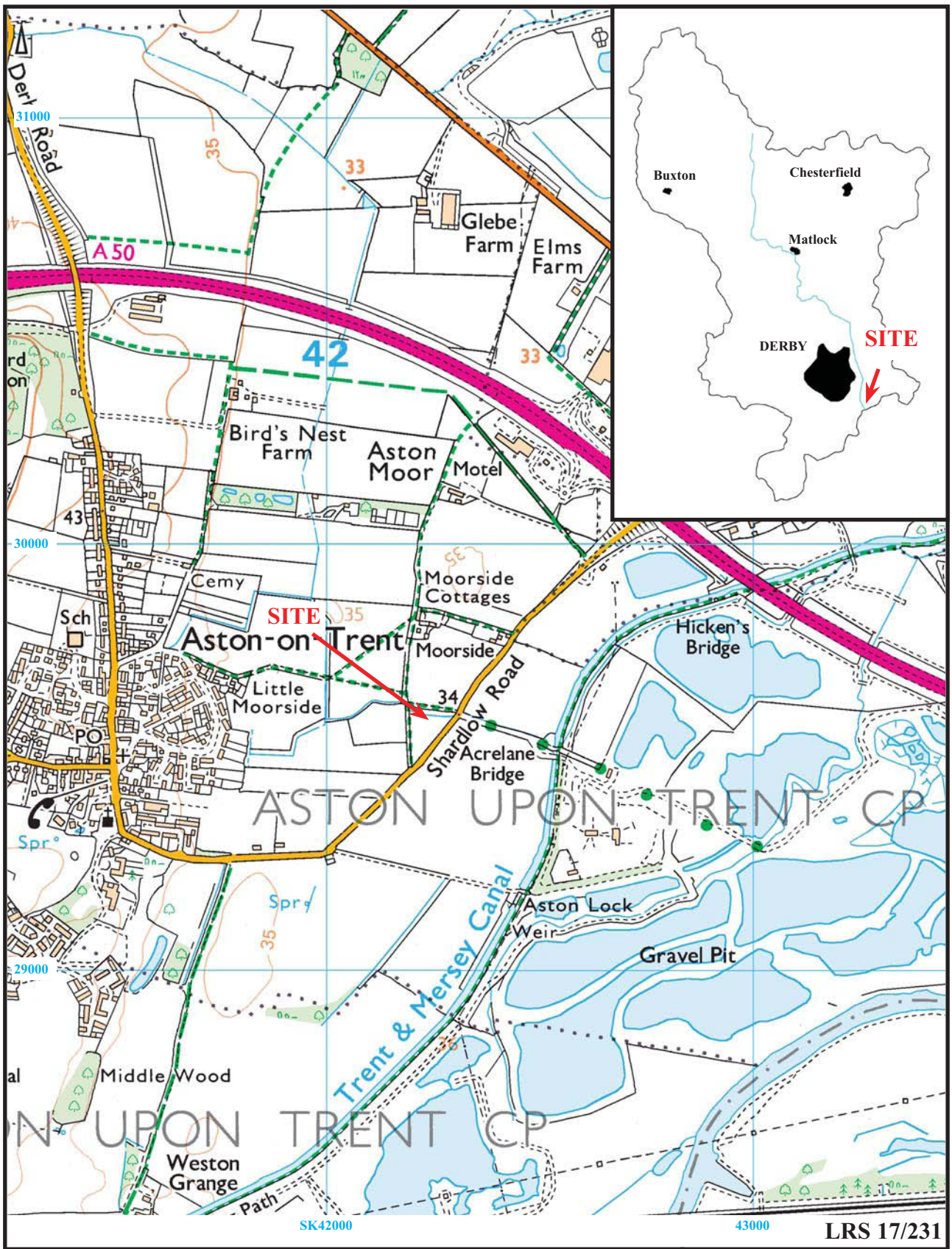
Stats
Max: 96.22
Min: -100.00
Std Dev: 9.11
Mean: -0.78
Median: -0.07
Composite Area: 1.4 ha
Surveyed Area: 0.65 ha

Source Grids: 23
1 Col:0 Row:0 grids\01.xgd
2 Col:0 Row:1 grids\02.xgd
3 Col:0 Row:2 grids\03.xgd
4 Col:0 Row:3 grids\04.xgd
5 Col:0 Row:4 grids\05.xgd
6 Col:0 Row:5 grids\06.xgd
7 Col:0 Row:6 grids\07.xgd
8 Col:1 Row:0 grids\08.xgd
9 Col:1 Row:1 grids\09.xgd
10 Col:1 Row:2 grids\10.xgd
11 Col:1 Row:3 grids\11.xgd
12 Col:1 Row:4 grids\12.xgd
13 Col:1 Row:5 grids\13.xgd
14 Col:2 Row:0 grids\14.xgd
15 Col:2 Row:1 grids\15.xgd
16 Col:2 Row:2 grids\16.xgd
17 Col:2 Row:3 grids\17.xgd
18 Col:2 Row:4 grids\18.xgd
19 Col:3 Row:0 grids\19.xgd
20 Col:3 Row:1 grids\20.xgd
21 Col:3 Row:2 grids\21.xgd
22 Col:4 Row:0 grids\22.xgd
23 Col:4 Row:1 grids\23.xgd

Processed data

Stats
Max: 2.20
Min: -1.80
Std Dev: 1.00
Mean: -0.02
Median: 0.01

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: Grids: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -1.80 to 2.20 nT



Land north of Shardlow Road,
Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)

Figure 1. Location of site within Aston-on-Trent and Derbyshire.

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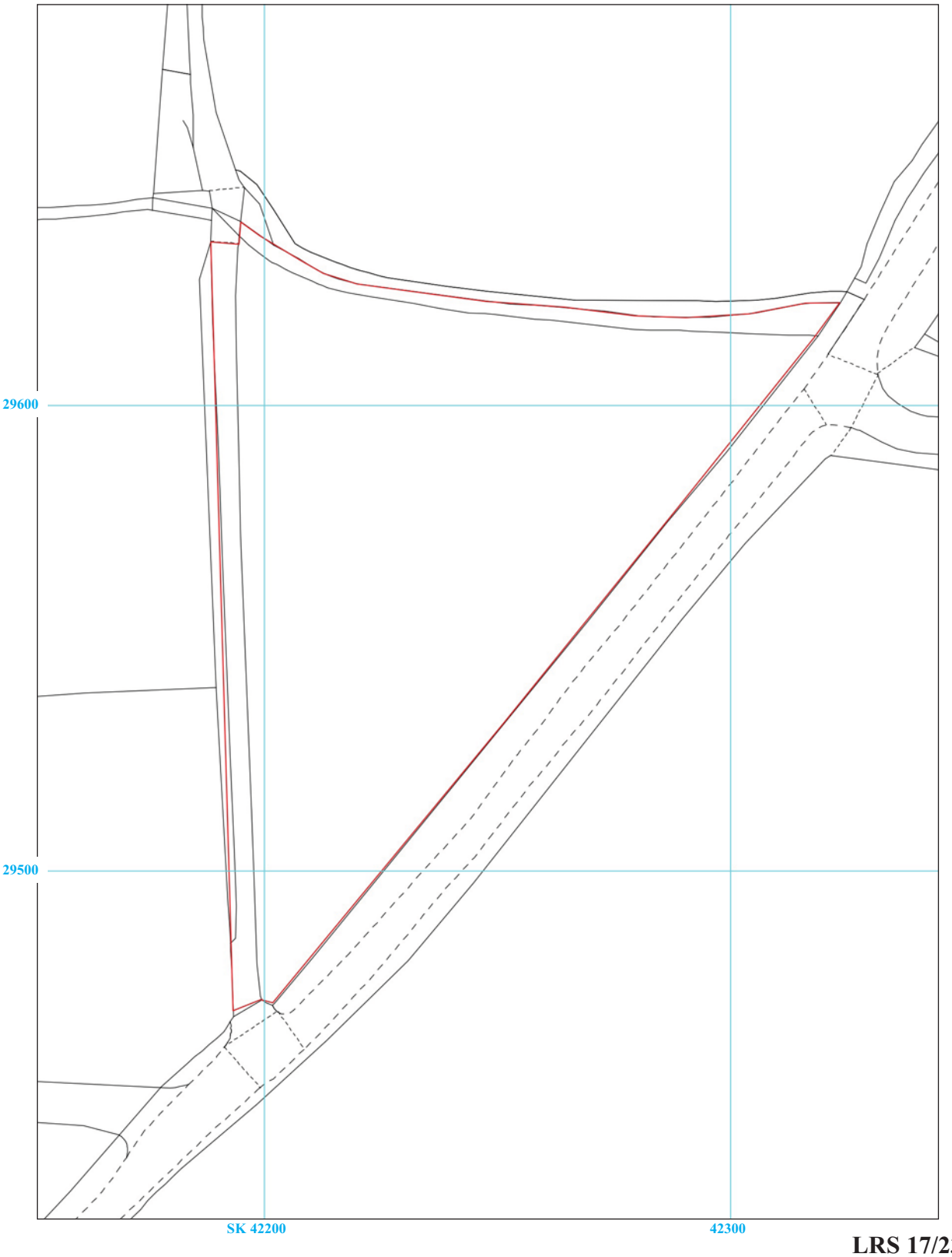

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Land north of Shardlow Road,
Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)

Figure 2. Detailed location of the site and survey grids.

0m 100m

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Land north of Shardlow Road, Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)
Figure 3. Raw geophysical data plot.

0m 100m

+100
nT
-100

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N

Land north of Shardlow Road, Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)
Figure 4. Processed geophysical data plot.

0m 100m

+2.2
nT
-1.8

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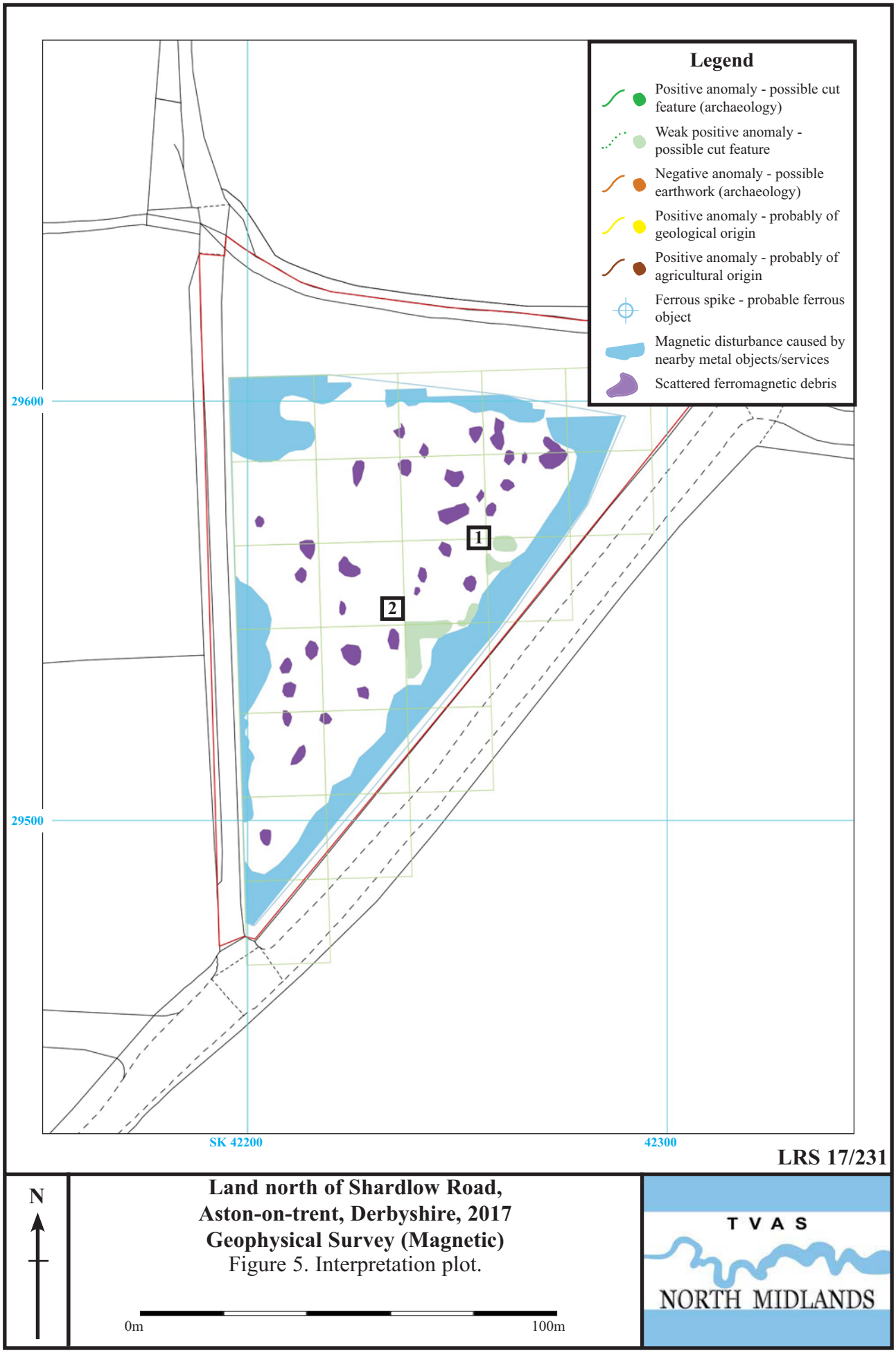

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Land north of Shardlow Road, Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)
Figure 5. Interpretation plot.

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Plate 1. Site shot, looking southwest.

Plate 2. Site shot, looking west.

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Land north of Shardlow Road,
Aston-on-trent, Derbyshire, 2017
Geophysical Survey (Magnetic)
Plates 1 and 2.

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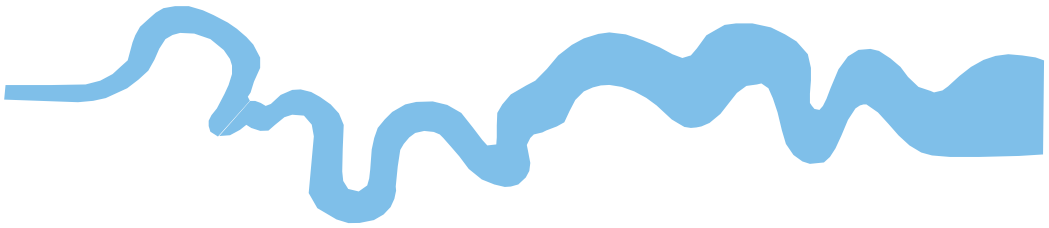
TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
Iron Age	BC/AD 750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC



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