ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
The Woodland Trust

Low Hill House Farm
Ferryhill
Co Durham

geophysical survey

report 3023
November 2012

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed tree planting at Low Hill House Farm near Ferryhill in County Durham. The works comprised the geomagnetic survey of approximately 18ha of farmland in the west of the proposed development area.

1.2 The works were commissioned by The Woodland Trust and conducted by Archaeological Services Durham University.

Results

1.3 The only features of likely archaeological potential comprise the possible remains of ditches in Areas 2 and 4.

1.4 The course of a former mineral railway and a considerable amount of colliery waste was detected across most of Area 3; the latter is the result of recent landscaping of spoilheaps from the former Dean & Chapter Colliery. It is possible that archaeological remains might survive beneath the landscaping and colliery waste in this area.

1.5 Several pipes and probable drains were detected in the north-west of the site, Areas 1 and 2.

2. Project background

Location (Figure 1)

2.1 The proposed development area is located at Low Hill House Farm, near Ferryhill in County Durham (NGR centre: NZ 277 333). It is roughly rectangular in plan and covers an area of approximately 70ha. The site is surrounded by agricultural land with an area of woodland to the north-east and industrial estates to the west and south-east. Spennymoor lies to the north-west and Ferryhill to the south-east. The A167 road runs along the eastern boundary of the site.

2.2 The geophysical surveys covered approximately 18ha in the west of the proposed development area, to the west of the former Dean & Chapter Colliery and recent landscaping works.

Development proposal

2.3 The proposal is to create new woodland by planting native broadleaved trees and shrubs into the existing sward. A minimum of 20% of the site's total area will be maintained as unplanted open ground with rides and glades.

Objective

2.4 The principal aim of the surveys was to assess the nature and extent of any sub-surface features of potential archaeological significance within the proposed development area, so that an informed decision may be made regarding the nature and scope of any further scheme of archaeological works that may be required in relation to the development.

Methods statement

2.5 The surveys have been undertaken in accordance with instructions from the client and in line with national standards and guidance (see para. 5.1 below).

Dates

2.6 Fieldwork was undertaken between 16th and 19th October 2012. This report was prepared for 9th November 2012.

Personnel

2.7 Fieldwork was conducted by Natalie Swann (Supervisor) and David Graham. Geophysical data processing and report preparation was by Duncan Hale (the Project Manager), with illustrations by David Graham.

Archive/OASIS

2.8 The site code is **FLH12**, for **F**erryhill **L**ow **H**ill House Farm 20**12**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services Durham University 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 **archaeol3-137230**.

3. Historical and archaeological background

Previous archaeological works

3.1 An archaeological desk-based assessment has previously been undertaken for the proposed development area (Archaeological Services 2012). The results of that report are summarised here.

3.2 No archaeological resource has been identified which requires preservation *in situ*. There are no historic or statutorily protected buildings in the vicinity of the site. There are no Scheduled Ancient Monuments on or in the vicinity of the site.

3.3 There is no direct evidence of prehistoric or Roman activity in the proposed development area. There is, however, evidence that the surrounding area was exploited in prehistory, and an as yet unidentified resource relating to this has the potential to survive within the proposed development area.

3.4 The site is to north-west of the medieval village of Ferryhill and it is probable that the area was used in the medieval and post-medieval periods as agricultural land rather than for settlement. Evidence relating to this, in the form of ridge and furrow cultivation and field boundaries, may survive on the site, although this is likely to be of limited archaeological significance.

3.5 Evidence for 19th-century quarries, Barn Farm and elements of the 1902-1966 Dean & Chapter Colliery may survive in parts of the site. These remains are likely to be of limited archaeological significance.

3.6 The colliery covered the eastern part of the site. The spoilheaps and colliery area were landscaped in the late 20th century, and so these areas were excluded from the geophysical survey requirement.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised four fields of pasture, which were overgrown in some places and very boggy in others. An area of standing water in the north-west corner of the site, around an existing stream, could not be surveyed.

4.2 The part of the proposed development area which was covered by geophysical survey rose from 115m OD in the north to approximately 155m in the south.

4.3 The underlying solid geology of the area comprises Pennine Middle Coal Measures, which are overlain by Devensian till.

4.4 The eastern part of the site is covered by colliery waste that was landscaped in the late 20th century.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation* (David, Linford & Linford 2008); the Institute for Archaeologists (IfA) *Standard and Guidance for archaeological geophysical survey* (2011); the IfA Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Guide to Good Practice: Geophysical Data in Archaeology* (Schmidt & Ernenwein 2011).

Technique selection

5.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on 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 the desk-based assessment, it was considered possible that cut features such as ditches and pits might be present on the site, and that other types of feature such as trackways, wall foundations and fired structures (for example kilns and hearths) could 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 the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record 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 A 30m grid was established across each survey area and related to known, mapped Ordnance Survey (OS) points and the National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 30m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 3,600 sample measurements per 30m grid unit.

Data processing

5.7 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 (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; the trace plots are provided in Figure 6. In the greyscale images, positive magnetic

anomalies are displayed as dark grey and negative magnetic anomalies as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla.

5.8 The following basic processing functions have been applied to the data:

clip	clips 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 geomagnetic 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 data have been interpolated to 0.25m x 0.25m intervals

Interpretation: anomaly types

5.9 Colour-coded geophysical interpretations are provided. Three 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
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
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

General comments

5.10 A colour-coded archaeological interpretation plan is provided.

5.11 Small, discrete dipolar magnetic anomalies have been detected in each 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 plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

5.12 Particularly high concentrations of dipolar magnetic anomalies have been detected in Area 3. These anomalies almost certainly reflect colliery waste, which was moved around the area as part of relatively recent landscaping works.

5.13 Series of parallel, alternate, positive and negative magnetic anomalies have been detected across Areas 1, 2, 4 and 5. These anomalies almost certainly reflect former ploughing and have been omitted from the geophysical interpretation plan.

Area 1

5.14 A chain of dipolar magnetic anomalies was detected at the eastern edge of this survey. This corresponds to a water pipe, which continues across Area 2 to the south.

5.15 An irregular band of small dipolar magnetic anomalies was detected this area. This probably reflects the remains of a drain or pipe across the field. The land immediately south of here, and in the north of Area 2 to the south, either side of an existing open drain, was flooded at the time of survey. Part of another pipe may have been detected immediately north of the former drain/pipe.

Area 2

5.16 A chain of dipolar magnetic anomalies detected traversing the north-western corner of this area is a continuation of the water pipe detected in Area 1.

5.17 A series of small dipolar magnetic anomalies aligned broadly east-west across the northern part of the survey almost certainly reflects another former drain; this broadly corresponds to a drain shown on some 20th-century OS editions. Another probable drain or pipe has been detected aligned broadly north-south in the north-western corner of the survey.

5.18 Several large and intense dipolar magnetic anomalies in this area correspond to electricity pylons.

5.19 Two weak, linear positive magnetic anomalies detected in the south-western corner of the survey could reflect soil-filled features, either associated with ploughing at the edge of the field, or possibly reflecting a former ditched trackway.

5.20 A third weak linear positive magnetic anomaly in the south-east of this area could reflect the remains of a soil-filled ditch.

Area 3

5.21 The majority of this survey is covered by a high concentration of dipolar magnetic anomalies, almost certainly reflecting coal waste. The eastern part of the proposed development used to house the Dean & Chapter Colliery and its associated spoilheaps; these have been landscaped in recent years, resulting in a spread of mining waste over a large area. Striations within the geomagnetic data here almost certainly reflect the movements of machines across the site, spreading the materials as they went.

5.22 At least one very intense magnetic lineation detected in the north of this area, aligned north-west/south-east, is probably associated with the former mineral railway that crossed this field to join the LNER Bishop Auckland & Ferryhill line to the north.

Area 4

5.23 Two weak, linear positive magnetic anomalies were detected in the southern part of the survey. These could reflect soil-filled features such as former ditches.

Area 5

5.24 The only anomalies recorded in this area almost certainly reflect near-surface ferrous/fired materials and former ploughing.

6. Conclusions

6.1 Approximately 18ha of geomagnetic survey was undertaken at Low Hill House Farm, near Ferryhill in County Durham, prior to proposed tree planting.

6.2 The only features of likely archaeological potential comprise the possible remains of ditches in Areas 2 and 4.

6.3 The course of a former mineral railway and a considerable amount of colliery waste was detected across most of Area 3; the latter is the result of recent landscaping of spoilheaps from the former Dean & Chapter Colliery. It is possible that archaeological remains might survive beneath the landscaping and colliery waste in this area.

6.4 Several pipes and probable drains were detected in the north-west of the site, Areas 1 and 2.

7. Sources

Archaeological Services 2012 *Low Hill House Farm, Ferryhill, County Durham: archaeological desk-based assessment.* Unpublished report **3002**, Archaeological Services Durham University

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation*. English Heritage

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

IfA 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

Schmidt, A, & Ernenwein, E, 2011 *Guide to Good Practice: Geophysical Data in Archaeology*. Archaeology Data Service

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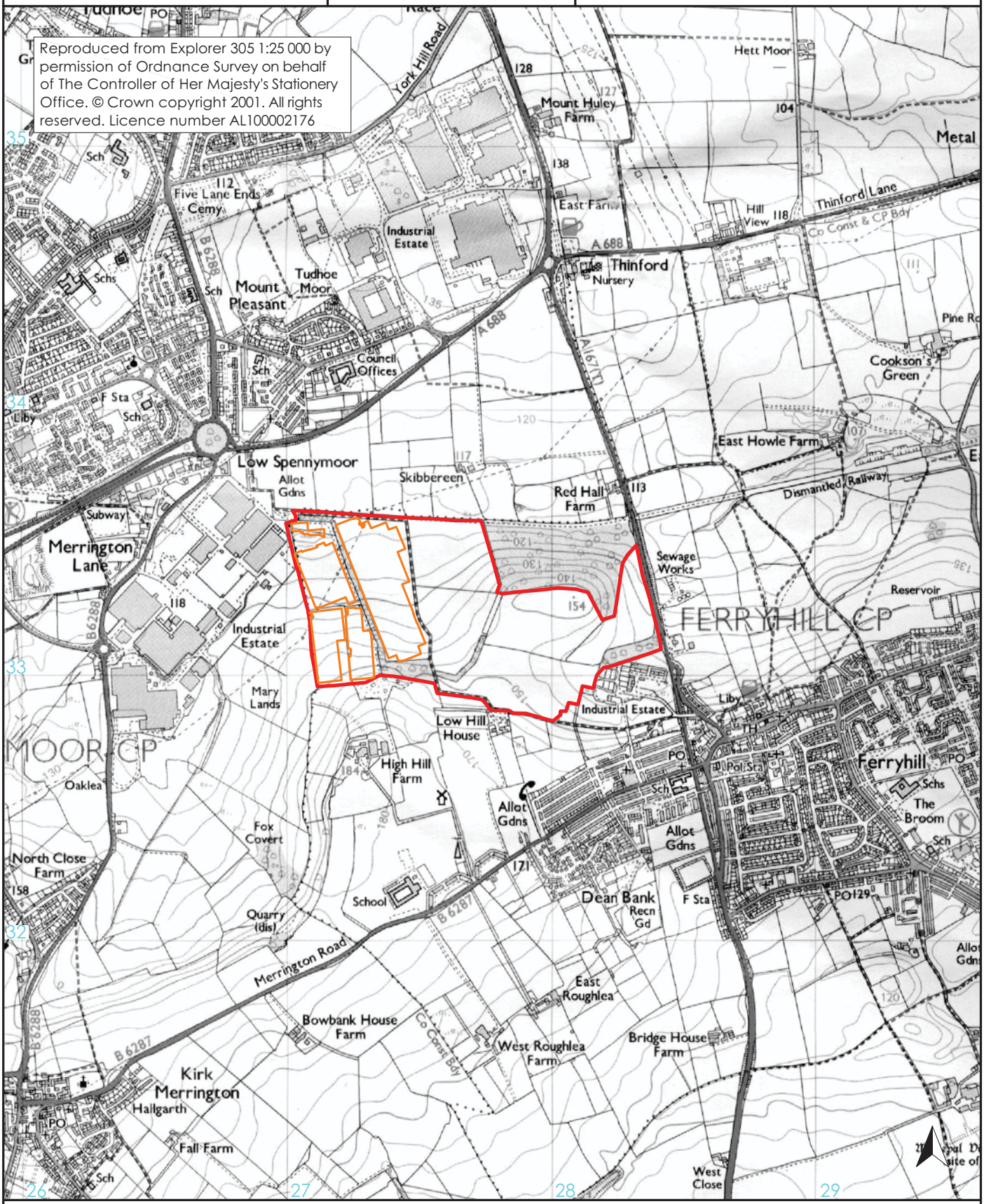
Figure 1: Site location



site location

survey area

0 1km

scale 1:20 000 for A4 plot

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0 100m
scale 1:2500 for A3 plot

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Figure 2: Geophysical survey overview

magnetic survey

-6 nT 6

0 50m
scale 1:1000 for A1 plot

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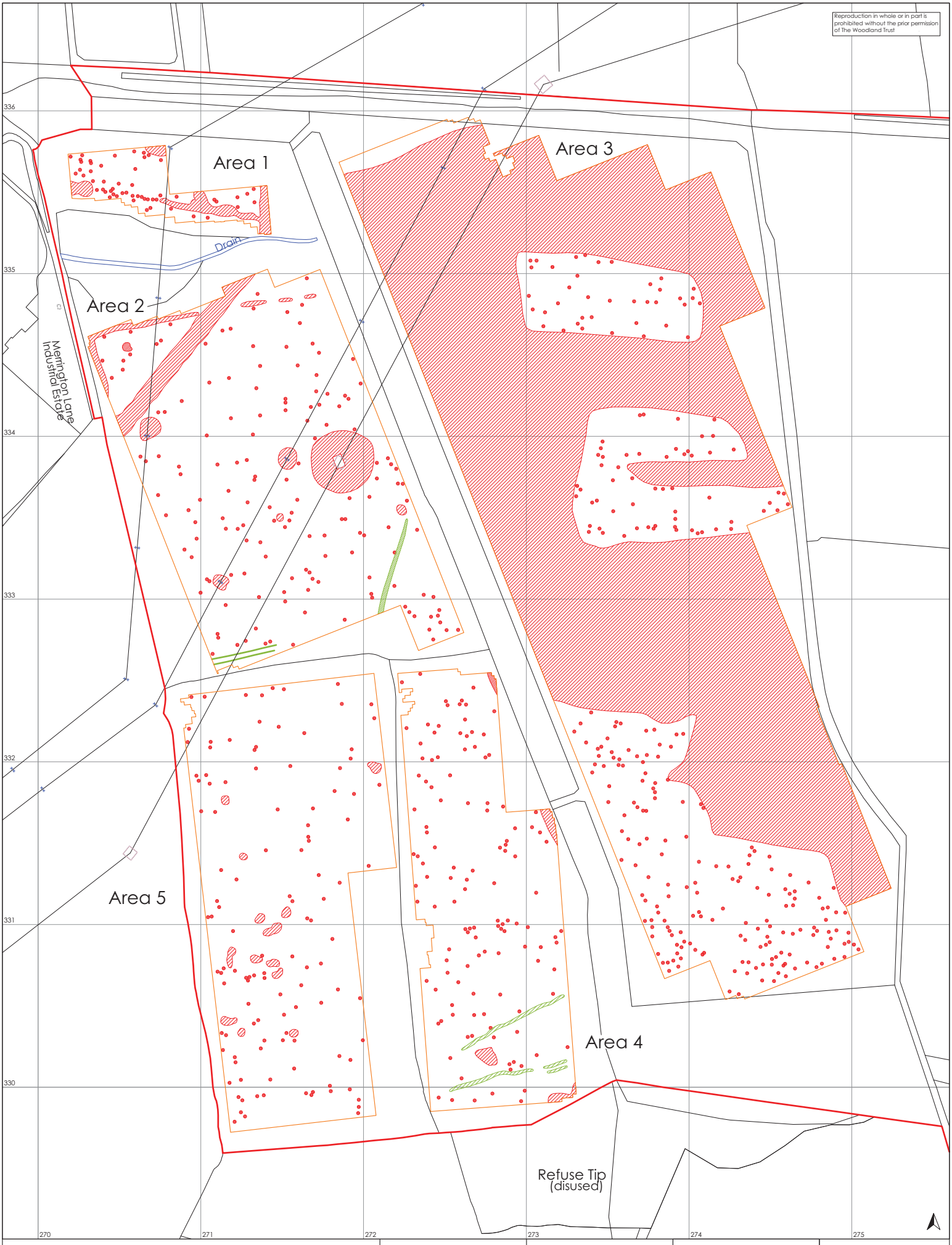
Figure 3: Geophysical survey



magnetic survey
dipolar magnetic anomaly
positive magnetic anomaly
negative magnetic anomaly

0 50m
scale 1:1000 for A1 plot

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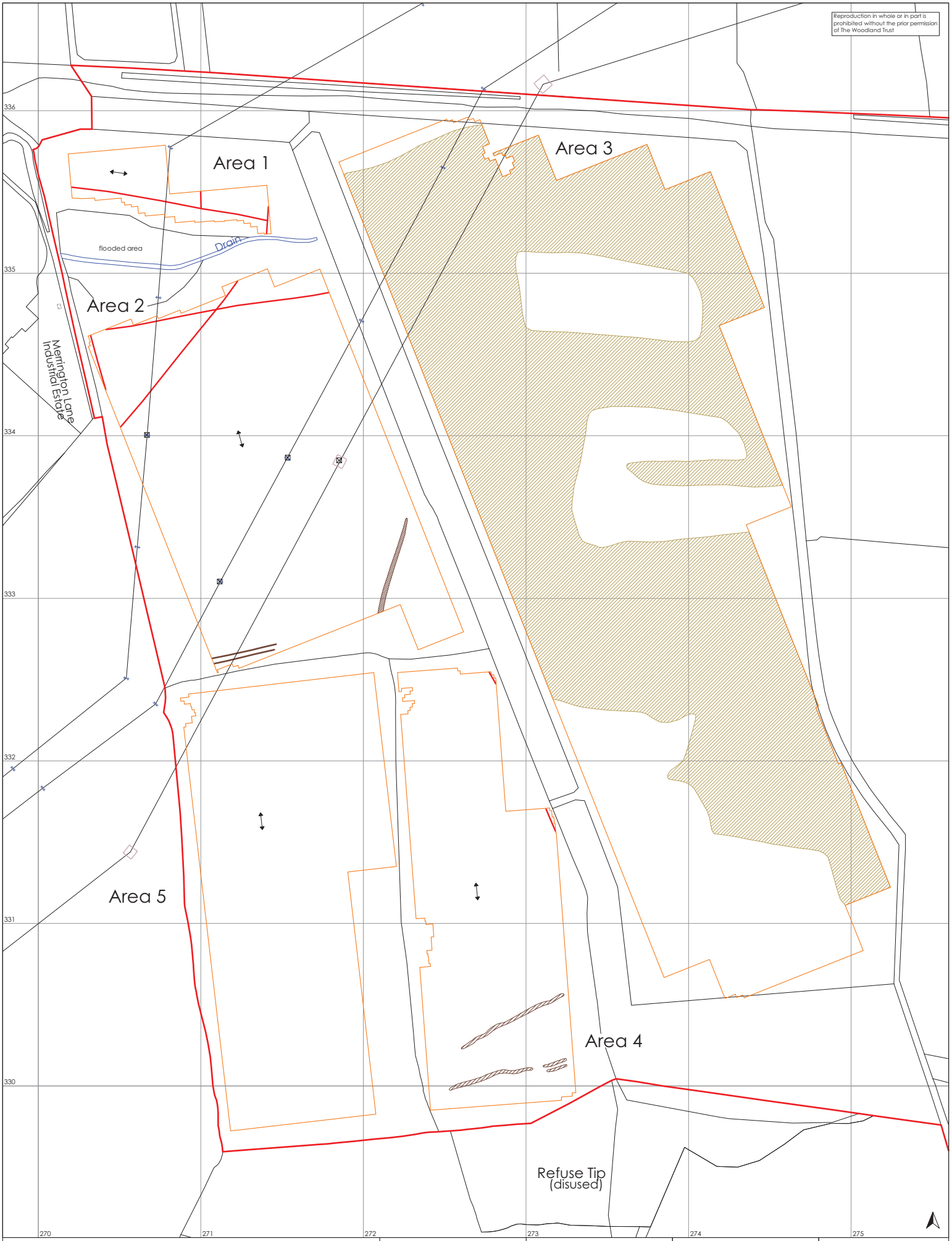
Figure 4: Geophysical interpretation



magnetic survey
soil-filled feature
former ploughing
disturbed area
pylon
service pipe

0 50m
scale 1:1000 for A1 plot

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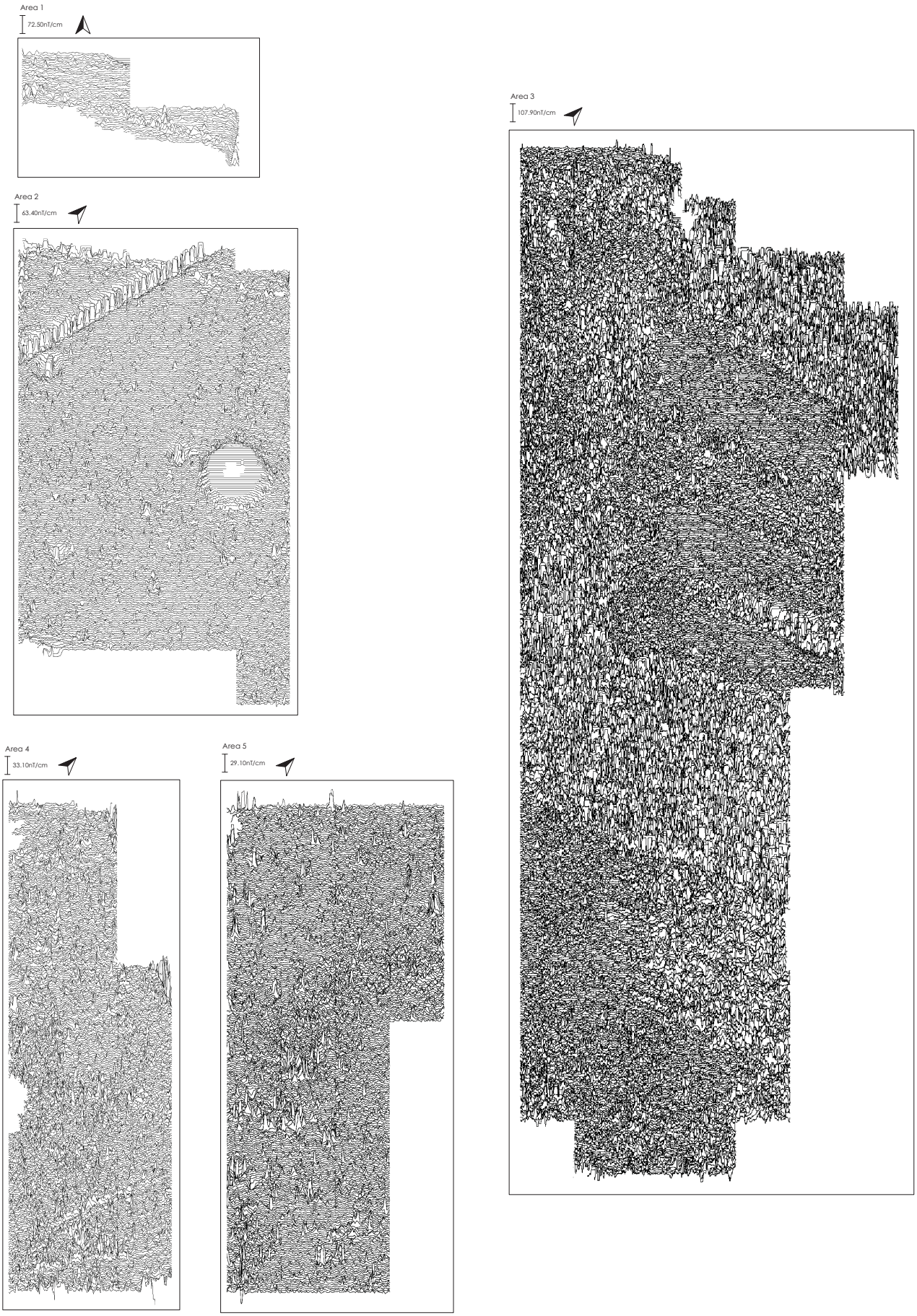
Figure 5: Archaeological interpretation



0 50m
scale 1:1000 for A1 plot

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Figure 6: Trace plots of geomagnetic data