Archaeological Services
University of Durham

Land off Outgang Road, Malton, North Yorkshire

geophysical survey

on behalf of
Scott Wilson Ltd

Report 1845
March 2008

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Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development of land off Outgang Road, Malton, North Yorkshire. The works comprised the geomagnetic survey of three areas covering 5ha in total.

1.2 The works were commissioned by Scott Wilson and conducted by Archaeological Services in accordance with instructions from Scott Wilson.

Results

1.3 Traces of ridge and furrow cultivation were detected aligned north-south in all three survey areas.

1.4 In Area 1 an anomaly was detected which may reflect an earlier field boundary.

1.5 In Area 2 a number of possible soil-filled features were detected.

1.6 A large amount of ferrous or fired debris, such as horseshoes or bricks, was detected across all three survey areas, which, together with the ridge and furrow traces, could mask potential archaeological features.

2. Project background

Location (Figure 1)

2.1 The study area was located on the north-west side of Malton in North Yorkshire (NGR centre: SE 78150 72430). The site is triangular in shape and measures approximately 14.6ha in size. The site is bounded to the north by the A64, to the east by Outgang Road and to the south by Broughton Road.

Objective

2.2 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 advance of development.

Methods statement

2.3 The surveys have been undertaken in accordance with instructions from Scott Wilson.

Dates

2.4 Fieldwork was undertaken between 28th and 29th February 2008. This report was prepared between 11th and 17th March 2008.

Personnel

2.5 Fieldwork was conducted and by Graeme Attwood (Supervisor), Matthew Claydon and Natalie Swann. This report was prepared by Natalie Swann, with illustrations by Edward Davies and Janine Wilson, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.6 The site code is **MOR08**, for **M**alton **O**utgang **R**oad 20**08**. The survey archive will be supplied on CD to the client for deposition with the project archive in due course. Archaeological Services 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 **archaeol3-39210**.

3. Archaeological and historical background

3.1 A desk-based assessment was undertaken for the proposed development area (Finch 2008). The results of that assessment are summarised here.

3.2 Aerial photographs suggest the presence of possible prehistoric or Romano-British farmsteads and field systems to the north of the proposed development site.

3.3 The area has remained undeveloped through the medieval and post-medieval periods, until the construction of allotment gardens shown on the Ordnance

Survey map of 1938, and the construction of the A64 as shown on the 1984 Ordnance Survey map.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised arable fields with allotment gardens in the east.

4.2 The survey area sloped down from 48m OD in the west to 44m OD in the east and 34m OD in the north.

4.3 The underlying solid geology of the general area comprises Oxfordian Coralline Oolite Formations which are overlain by alluvium and lacustrine deposits in places.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage Research and Professional Services Guideline No.1, *Geophysical survey in archaeological field evaluation 2nd edition* (David forthcoming); the Institute of Field Archaeologists Technical Paper No.6, *The use of geophysical techniques in archaeological evaluations* (Gaffney, Gater & Ovenden 2002); and the Archaeology Data Service *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2001).

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 variety of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar and electromagnetic survey. Some techniques are more suitable than others in particular situations, depending on a variety of 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 a desk-based assessment and aerial photographic cropmark evidence, it was considered likely 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) might 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 tied-in to known, mapped Ordnance Survey points using a Trimble Pathfinder Pro XRS global positioning system (GPS) with real-time correction providing sub-metre 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 set to 0.1nT, the sample interval to 0.25m and the traverse interval to 1.0m, thus providing 3600 sample measurements per 30m grid unit.

5.7 Data were downloaded on site into a laptop computer for initial processing and storage and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Data processing

5.8 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 (unfiltered) data. The greyscale images and interpretations are presented in Figures 2-4; the trace plots are provided in Figure 5. In the greyscale images, positive magnetic anomalies are displayed as dark grey and negative magnetic anomalies as light grey. A palette bar relates the greyscale intensities to anomaly values in nanoTesla.

5.9 The following basic processing functions have been applied to each dataset:

clip	clips, or limits 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 anomalies caused by alternate zig-zag traverses.
despike	locates and suppresses iron spikes in gradiometer data.
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 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided in Figure 3. Two 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.
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

5.11 A colour-coded archaeological interpretation plan is provided in Figure 4.

General comments

5.12 A high concentration of small, discrete dipolar magnetic anomalies has been detected in all of the survey areas. These anomalies 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, however, the high density of these anomalies may have masked potential archaeological features. A sample of these anomalies is shown on the geophysical interpretation plan, though they have been omitted from the archaeological interpretation plan and the following discussion.

Area 1

5.13 A large dipolar magnetic anomaly was detected in the south of this area. This may represent a large ferrous item buried below the surface, or possibly reinforced concrete.

5.14 South of this and aligned parallel to the modern field boundary is a linear positive magnetic anomaly which is likely to reflect a soil-filled feature such as a ditch, and may be the remains of an earlier field boundary.

5.15 Former ridge and furrow cultivation is evident as a series of parallel positive magnetic anomalies aligned north-south across the survey area.

Area 2

5.16 Three linear positive magnetic anomalies have been detected in the north-west corner of this area. Two of these are aligned approximately north-east to south-west and one curves into a semi-circle at the north-eastern end. A short linear positive magnetic anomaly, which is aligned perpendicular to the first two, is situated on the north-west edge of the survey area. These anomalies are likely to represent soil-filled features such as ditches and some may reflect earlier field boundaries on the site.

5.17 Traces of ridge and furrow cultivation were also detected across this area, as a series of parallel positive magnetic anomalies aligned north-south.

Area 3

5.18 Traces of ridge and furrow cultivation were again detected aligned north-south across the southern part of this area.

5.19 The modern plough direction was also detected as a weak magnetic texture aligned north-east/south-west and north-south

6. Conclusions

6.1 Five hectares of geomagnetic survey were undertaken on land off Outgang Road, Malton, prior to development.

6.2 Traces of ridge and furrow cultivation were detected aligned north-south in all three survey areas.

6.3 In Area 1 an anomaly was detected which may reflect an earlier field boundary.

6.4 In Area 2 a number of possible soil-filled features were detected.

6.5 A large amount of ferrous or fired debris, such as horseshoes or bricks, was detected across all three survey areas which, together with the ridge and furrow traces, could mask potential archaeological features.

7. Sources

David, A, forthcoming *Geophysical survey in archaeological field evaluation, 2nd edition,* Research and Professional Services Guideline **1**, English Heritage

Finch, N, 2008 *Land off Outgang Road, Malton, Desk-based Assesment,* unpublished report **D118173** for Taylor Wimpey, Scott Wilson

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

Schmidt, A, 2001 *Geophysical Data in Archaeology: A Guide to Good Practice*, Archaeology Data Service, Arts and Humanities Data Service

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Figure 1
Site location

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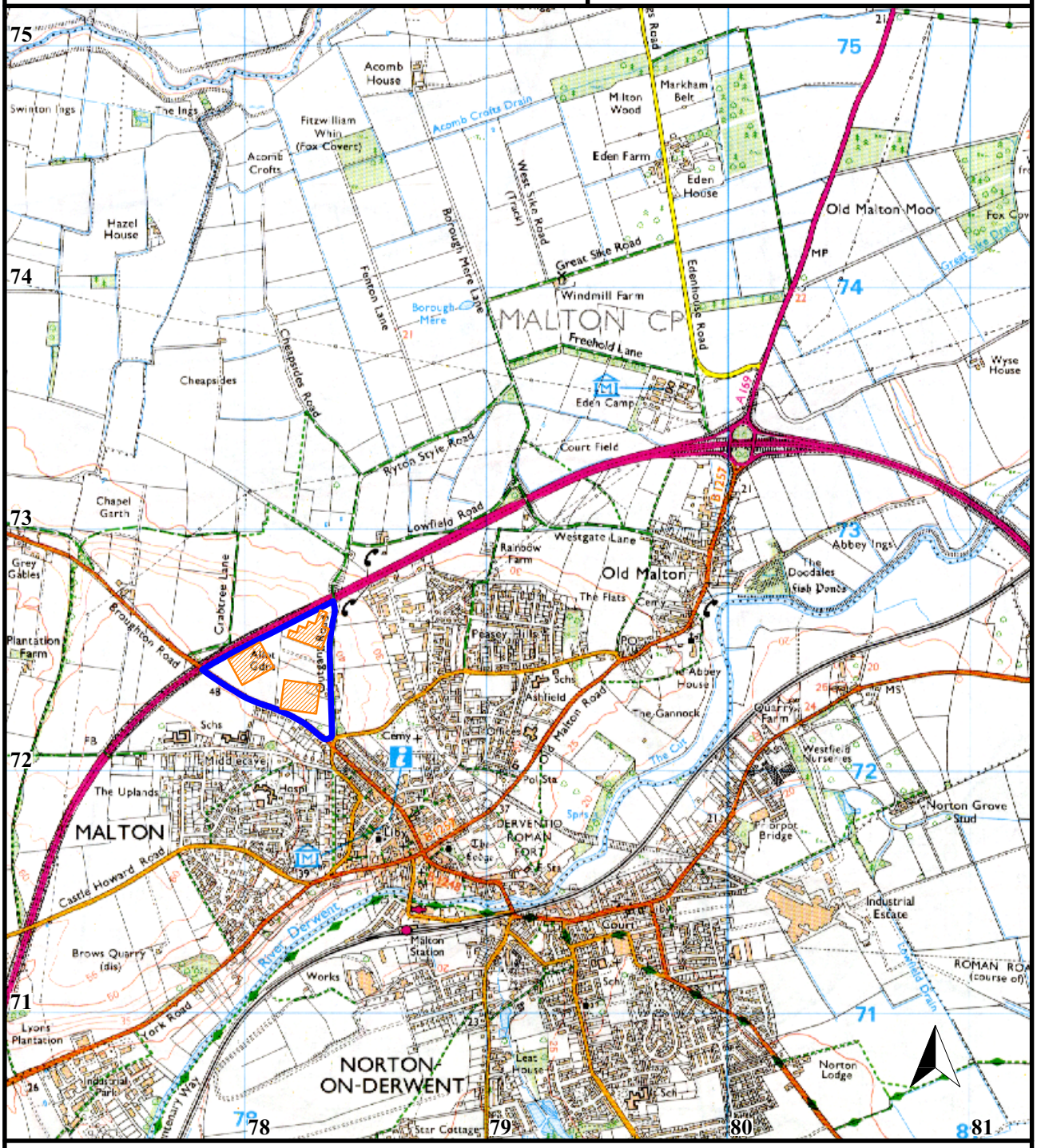

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Figure 2

Geophysical surveys

Area 3

Area 2

Area 1

Allot Gdns

OUTGANG ROAD

48m

726
725
724
723
779
781
782
783
784

outline of survey area

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

0 50m

scale 1:1250 - for A2 plot

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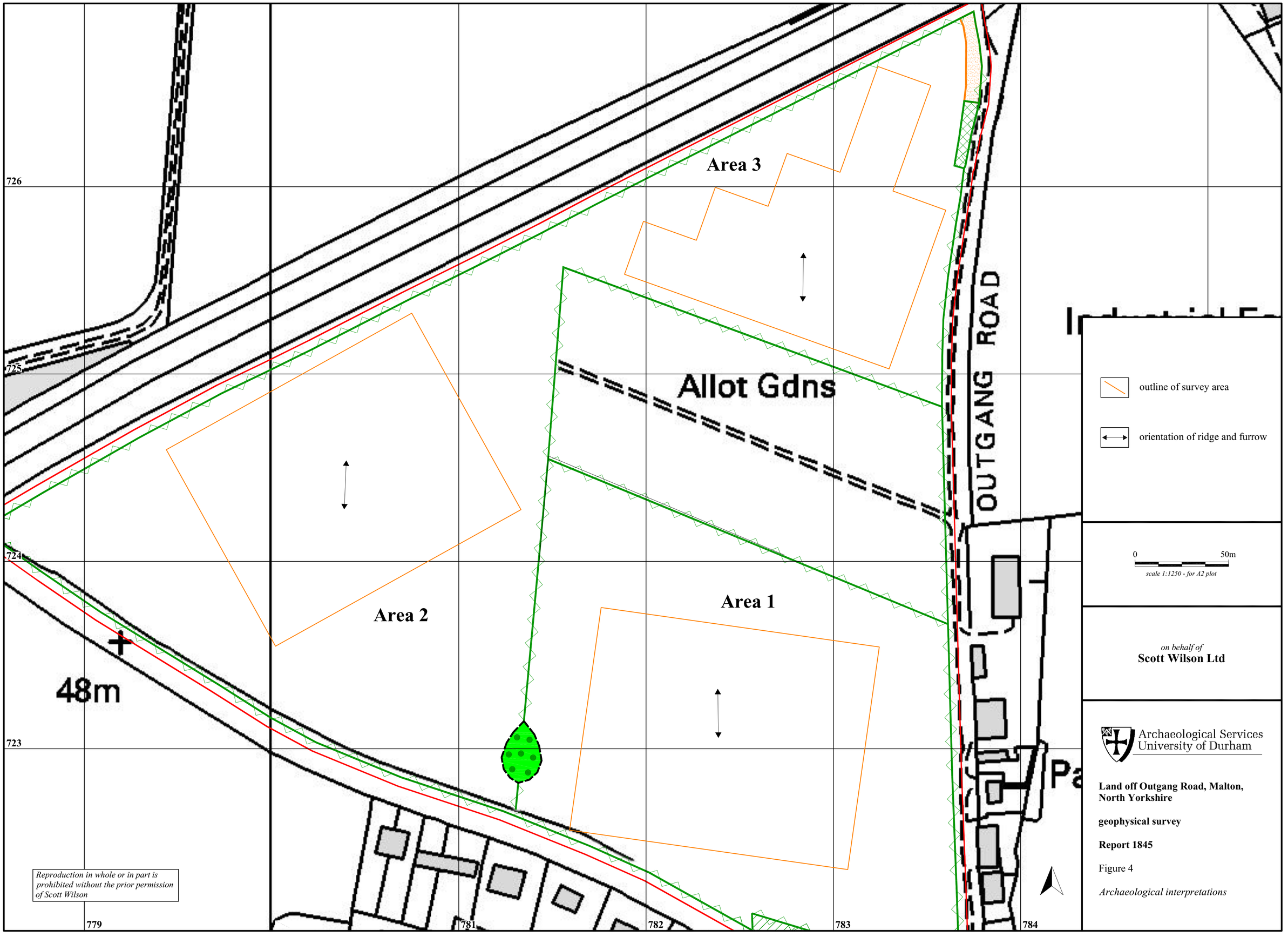
Figure 3

Geophysical interpretations



outline of survey area

orientation of ridge and furrow

0 50m

scale 1:1250 - for A2 plot

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Figure 4

Archaeological interpretations

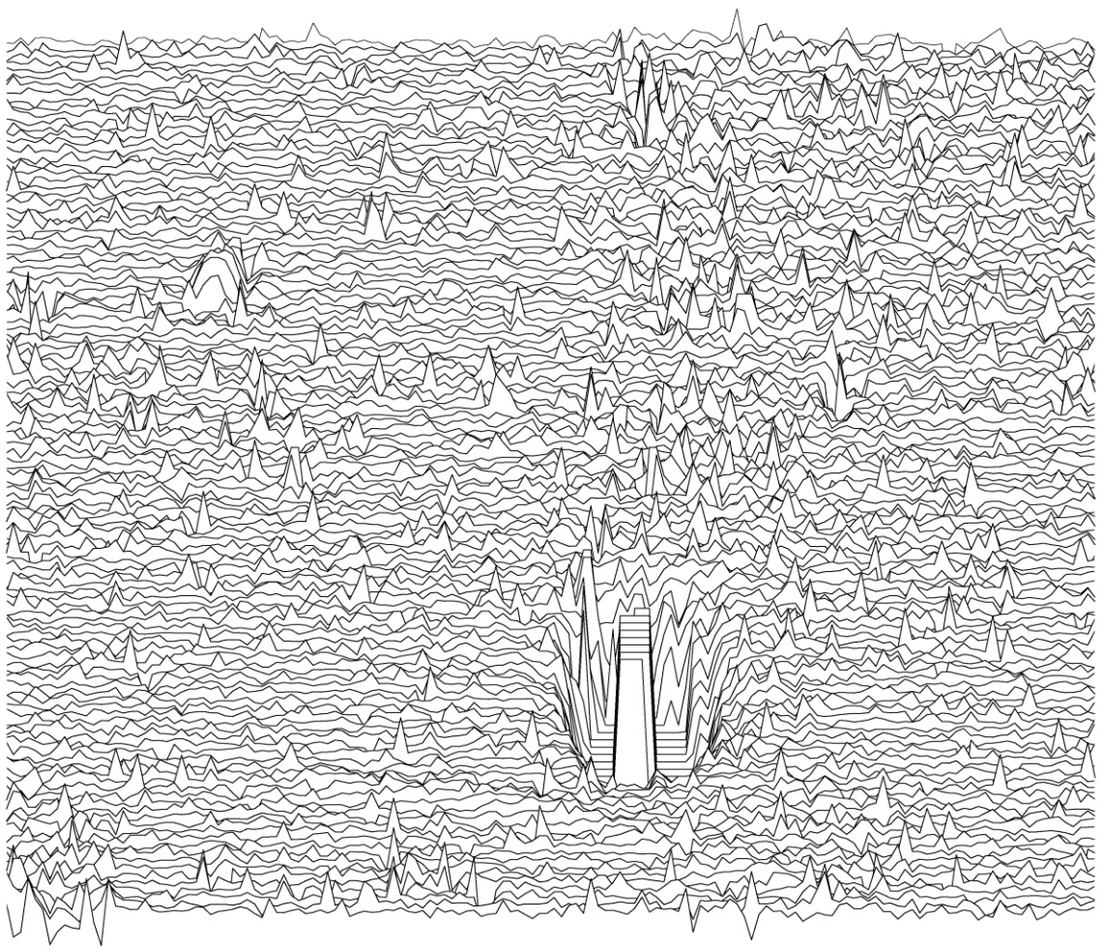
Figure 5: Trace plots of geophysical data

Area 1

20.00nT/cm

0 50m

scale 1:1000

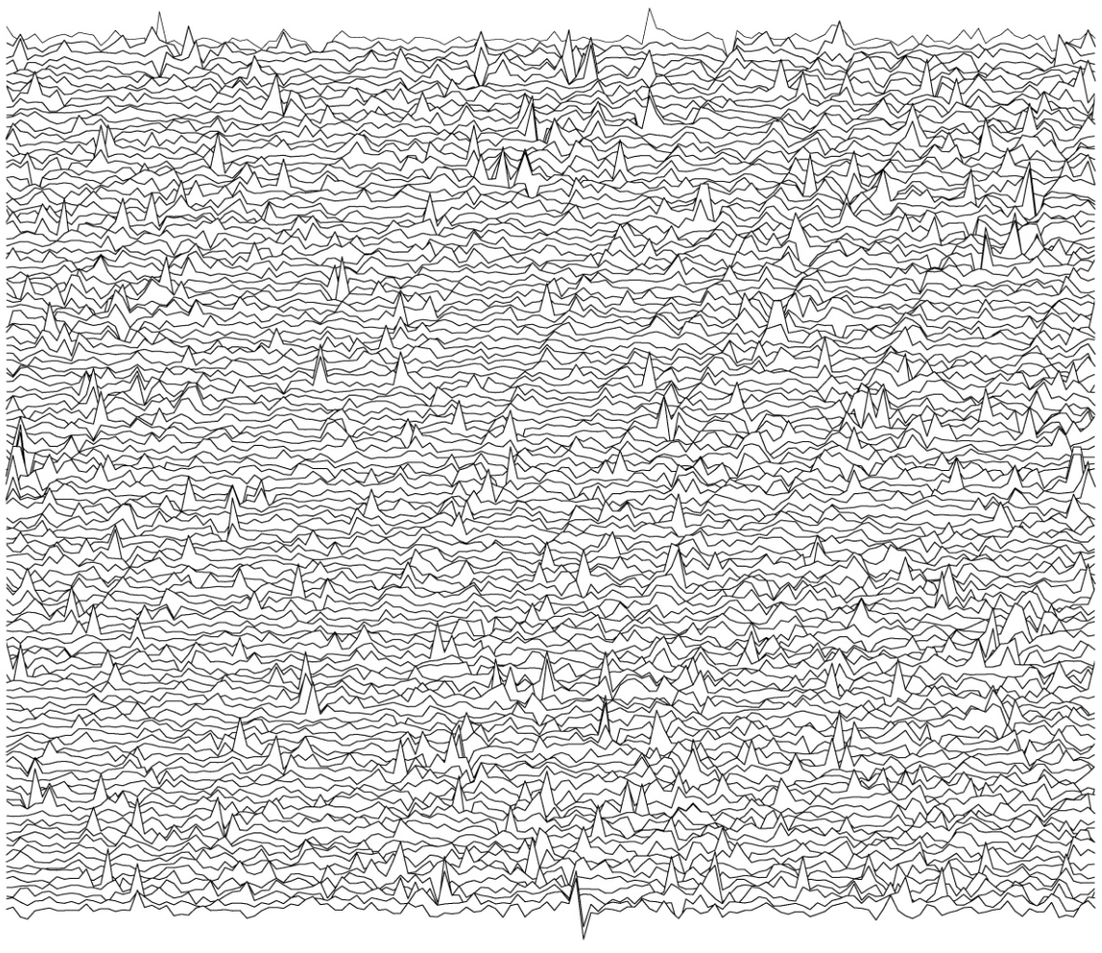


Area 2

12.00nT/cm

0 50m

scale 1:1000



Area 3

0 50m

scale 1:1000

20.00nT/cm