Archaeological Services
University of Durham

Land at Ryedale Park, Malton, North Yorkshire

geophysical survey

on behalf of
On-Site Archaeology

Report 1803
January 2008

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25A Milton Street, York, North Yorkshire, YO10 3EP

Contents

1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development at Ryedale Park, Malton, North Yorkshire. The works comprised geomagnetic survey of eight hectares.

1.2 The works were commissioned by On-Site Archaeology and conducted by Archaeological Services in accordance with an approved written scheme of investigation prepared by Archaeological Services.

Results

1.3 The survey has detected a number of former boundaries associated with the land's former use as allotments and smaller fields.

1.4 The remains of several other pit and ditch features of possible archaeological origin have been identified.

1.5 There is no clear geomagnetic evidence for the presence of a Roman road across the study area.

2. Project background

Location (Figure 1)

2.1 The study area was located at Ryedale Park, Malton, North Yorkshire (NGR: SE 800 738) on land also known as Old Malton Moor. It consisted of a single parcel of arable land in young crop, bounded by the A169 to the east, Edenhouse Road to the south and west and a strip of woodland to the north. The survey measured approximately 8ha.

Objective

2.2 The principal aim of the survey 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 survey has been undertaken in accordance with instructions provided by On-Site Archaeology and a Written Scheme of Investigation provided by Archaeological Services Durham University.

Dates

2.4 Fieldwork was undertaken between 7th and 9th January 2008. This report was prepared between 10th and 15th January 2008.

Personnel

2.5 Fieldwork was conducted by Graeme Attwood (Supervisor), Edward Davies and Richie Villis. This report was prepared by Graeme Attwood and Duncan Hale (the Project Manager) with illustrations by Janine Wilson.

Archive/OASIS

2.6 The site code is **MRP08**, for **M**alton **R**yedale **P**ark 20**08**. The survey archive will be supplied on CD to On-Site Archaeology for deposition with the project archive. 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 **archaeol3-36371**.

3. Archaeological and historical background

3.1 The site was considered to have the potential to contain archaeological remains since Malton lies in a landscape of known archaeological sites ranging in date from the prehistoric period through Romano-British to medieval.

3.2 Substantial medieval and Roman remains lie just to the south at Old Malton and *Derventio* fort respectively. It has been postulated that the course of a Roman road heading north from the fort may pass through the current study area.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised a field of young cereal. Two small areas of the field were not surveyed due to their waterlogged state at the time of fieldwork.

4.2 The survey area was predominantly level at a mean elevation of *c*.22m OD.

4.3 The underlying solid geology of the study area comprises Upper Jurassic Ampthill Clay and Kimmeridge Clay, which are overlain by a variable sequence of superficial deposits comprising mainly clay and sand overlying glacial till except near the River Derwent where deposits of alluvium overly glacial till.

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* (David 2008 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 surveying enables the relatively rapid and non-invasive identification of potential archaeological features within landscapes and can involve a variety of complementary techniques such as magnetometry, 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 it was considered likely that cut features, such as ditches and pits, might be present and that other types of feature such as roads, 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 each of the types of feature mentioned above. This technique involves the use of hand-held magnetometers to detect and record minute 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 the 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 a continuous tone greyscale image of the raw (unfiltered) data. The greyscale image and interpretations are presented in Figure 2; a trace plot of geomagnetic data has not been provided due to the large survey size, and because there are no significant features here to highlight with this presentation method. In the greyscale image, 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 the data:

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 random 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 gradiometer data have been interpolated to 0.25 x 0.25m intervals.

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is provided. 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.

5.12 The most prominent feature in the data comprises a chain of intense dipolar magnetic anomalies aligned north-east/south-west across the western part of the field, which represents a ferrous gas pipe.

5.13 Another prominent feature is a strong positive magnetic lineation, on broadly the same alignment as above, in the central part of the field. This corresponds to a former field boundary shown on earlier editions of the Ordnance Survey. At least two other, weaker positive magnetic anomalies are associated with this feature, both of which almost certainly reflect former land boundaries. Further similar anomalies have been detected in the western half of the survey, which also probably reflect boundaries from the land's former use as allotments in the mid-20th century. This former landuse may also account for the high concentration of small dipolar magnetic anomalies detected across the site. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as nails, horseshoes and brick fragments.

5.14 Additional positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, typically sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning. Such features include a possible sub-circular ditch and two short lengths of ditch in the centre of the field; a possible alignment of pits and a ditch in the north-eastern corner and remnants of a possible ditch parallel to the gas main.

5.15 The survey has not detected any likely evidence for a Roman road in this field. It is possible however that such a road lies within the magnetic disturbance of the gas pipe and that the possible ditch remains to the east of the pipe are all that remains of the road's eastern ditch. Another possibility is that a strong positive magnetic anomaly along the south-eastern edge of the field represents the road's western ditch, though this anomaly is stronger than would normally be expected of an archaeological ditch, and it is considered more likely that this reflects a utility of some sort.

5.16 The current plough direction has been detected by the survey as a faint east-west texture throughout the data.

6. Conclusions

6.1 Geomagnetic survey has been conducted at Ryedale Park near Malton prior to proposed development.

6.2 The survey has detected a number of former boundaries associated with the land's former use as allotments and smaller fields.

6.3 The remains of several other pit and ditch features of possible archaeological origin have been identified.

6.4 There is no clear geomagnetic evidence for the presence of a Roman road across the study area.

7. Sources

David, A, 2008 forthcoming, *Geophysical survey in archaeological field evaluation*, 2nd edition. Research and Professional Services Guideline **1**, English Heritage

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
Location of geophysical survey

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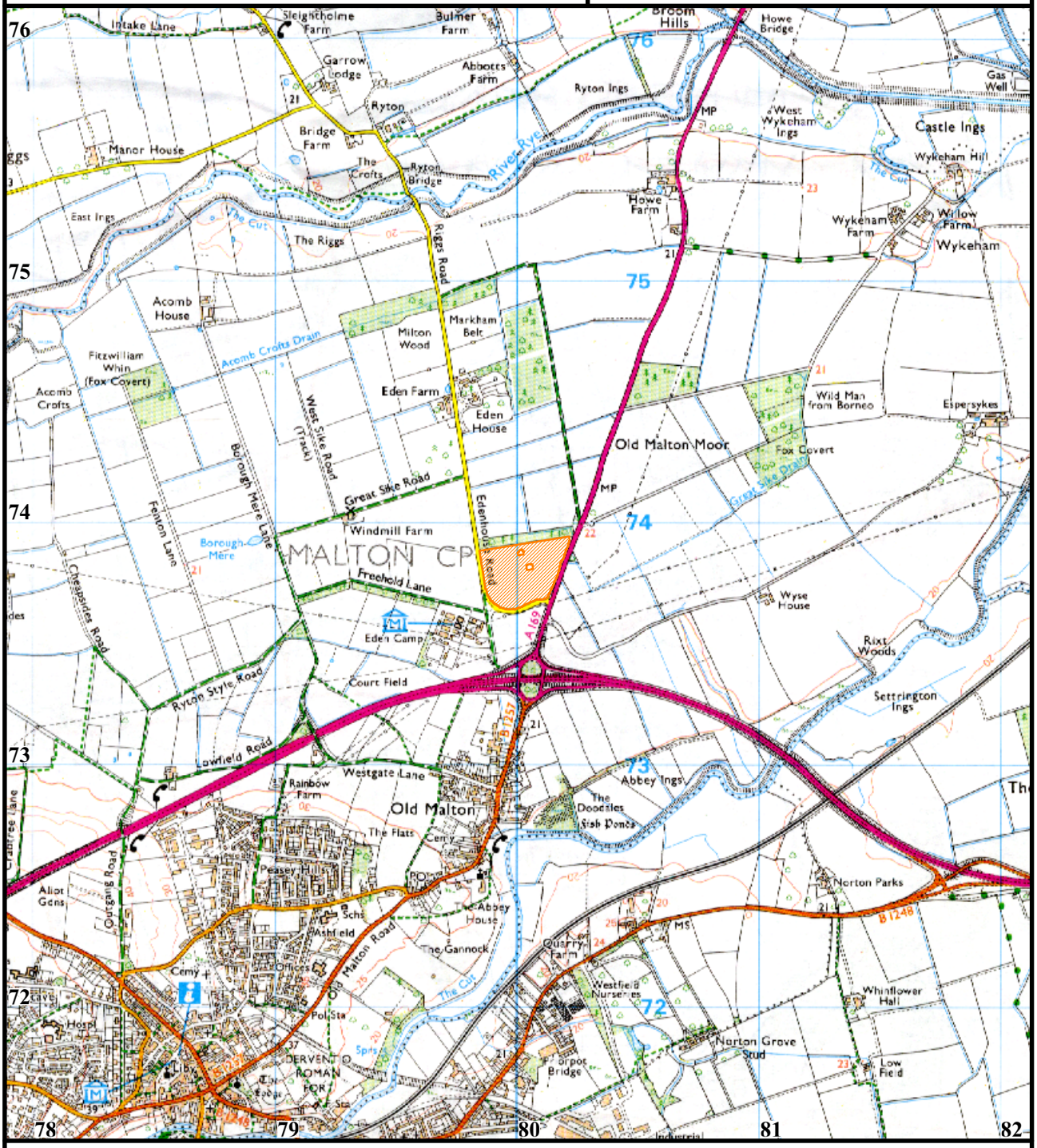

location of geophysical survey

0 1km

scale 1:25 000 - for A4 plot

a

738

737

799

800

801

802

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b

738

737

799

800

801

802

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c

waterlogged area

waterlogged area

possible utility

738

737

799

800

801

802

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a) Geophysical survey

outline of survey area

2.00
1.67
1.33
1.00
0.67
0.33
0
-0.33
-0.67
-1.00
-1.33
-1.67
-2.00 nT

b) Geophysical interpretation

positive magnetic anomalies

dipolar magnetic anomalies

c) Archaeological interpretation

soil-filled features

service pipes

0 50m

scale 1:1000 - for A1 plot

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Figure 2

Geophysical survey, geophysical and archaeological interpretations