ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
URS/Scott Wilson

Blyth Road
Worksop
Nottinghamshire

geophysical survey

report 2785
November 2011

Durham University

Contents

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in advance of proposed development at Blyth Road, Worksop, Nottinghamshire. The works comprised approximately 7ha of geomagnetic survey in six areas.

1.2 The works were commissioned by URS/Scott Wilson and conducted by Archaeological Services Durham University.

Results

1.3 A probable dump of fired debris such as clinker/cinder or brick fragments has been detected in Area 2.

1.4 A change in the ground level between the ploughed land and scrubland has been identified in Areas 1 and 2.

1.5 The present ploughing regime has been detected in Areas 1 and 2.

1.6 Changes in the local geology and/or soil conditions have probably given rise to two anomalies in Areas 1 and 5.

2. Project background

Location (Figure 1)

2.1 The survey area was located on land to the west of Blyth Road (B6045), Worksop, Nottinghamshire (NGR centre: SK 5995 8173). Six surveys totalling approximately 7ha were conducted in three land parcels surrounding Thievesdale House. To the north was a small industrial complex, to the west farmland and housing and to the south and east Thievesdale Lane and Blyth Road respectively.

Development proposal

2.2 The proposal is for a residential development and associated access.

Objective

2.3 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

2.4 The surveys have been undertaken in accordance with instructions from the client and to current national standards and guidance (see paragraph 5.1 below).

Dates

2.5 Fieldwork was undertaken on the 9th and 10th November 2011. This report was prepared for 21st November 2011.

Personnel

2.6 Fieldwork was conducted by Lorne Elliott and Andy Platell. The geophysical data were processed by Lorne Elliott. This report was prepared by Lorne Elliott, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **WBR11**, for **W**orksop, **B**lyth **R**oad 20**11**. 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 **archaeol3-113810**.

3. Historical and archaeological background

Previous archaeological works

3.1 No previous archaeological work has been conducted within the proposed development site.

3.2 A detailed archaeological desk-based assessment has been conducted by URS/Scott Wilson. The following is a summary of the results:

Prehistoric – Roman

3.3 Aerial photography undertaken for the National Mapping Programme conducted by the Royal Commission on the Historic Monuments of England in 1999 identified a

number of cropmarks within the site and its close proximity. One of these was recorded within the south-western part of the site, to the west of Thievesdale House. This comprised a small enclosure which may have prehistoric/Roman origins, although this is currently unproven. A cropmark of a further enclosure was noted to the north within the area now occupied by a small industrial complex, which lies immediately to the north of the site's northern boundary. A date for this is unknown but its form may suggest prehistoric/Roman activity. More conclusive evidence for such activity has been identified to the east, south-east of Carlton Forest Farm, from aerial photographs taken in the 1980s. The cropmarks were interpreted as a possible prehistoric field system and associated enclosure.

3.4 Further activity has been found wider afield. Two polished Neolithic axes have been recovered from Worksop, one in Eastgate and one at Kilton on the north side of Windmill Lane. It is also reported that there existed a Bronze Age settlement in the area known as Gateford, which lies to the west of the site. Iron Age and Roman settlements are also recorded near to Raymoth Lane, which lies to the south-west of the site. These were found to be associated with brick plan field systems and were initially observed from aerial photographs. A cropmark enclosure was recently investigated at Raymoth Lane, the results of which suggest that animal husbandry played a greater subsistence role than agriculture in the area. The site also produced a Roman pottery kiln and evidence of metal-working. Further Roman activity in the form of finds has been found in Osberton and Ranby, and included coin hoards and a Roman lead coffin.

Medieval

3.5 Analysis of historic Ordnance Survey maps demonstrates that large portions of the landscape within which the site sits were farmed in the medieval period. This is evidenced by the number of enclosures/modern field boundaries replicating the line of medieval strip fields. Such evidence is particularly prominent to the south-east and north-east of the site. Other than this there is no indication that the area served any other purpose in this period.

3.6 Situated to the south-west of the site is the town of Worksop, which has its origins in the early medieval period. The settlement name derives from *Weorchope,* or *Weorc's valley.* Elsi, son of Cauchin or Kaskin, was the Saxon lord of the manor of Worksop in the late 11th century. Between 1068 and 1070 William the Conqueror took lands from Elsi and gave them to Roger de Busil due to various uprisings. Roger is recorded as having three carculates of land to the geld with one plough. It goes on to state that in the lordship were 22 freemen on 12 bovates of this land and 24 villagers and 8 smallholders who have 22 ploughs and seven acres of meadow. There is also reference to woodland pasture measured at two leagues long and three furlongs broad. Physical evidence for the existence of the settlement in the early medieval period is limited to chance finds including a 9th-century strap end discovered by a metal detectorist.

3.7 A focal point of the settlement was the castle which was originally founded in the 11th century as a motte and bailey. The motte later formed the foundation for a large stone shell keep, which included a gatehouse, chapel and great hall. Documents state that by the late 12th century the castle and manor passed by marriage to the Furnivall family. By the mid-sixteenth century the castle had been completely demolished. The manor of Worksop passed to William de Lovetot by the early 12th century and in the 1120s he founded and endowed a priory of the Augustinian order.

The priory closed in 1539 and all the buildings except for the nave and west towers of the church were demolished. By the late 16th century the land associated with the priory, as well as property within the town were granted to the 5th Earl of Shrewsbury.

Post-medieval - Early Modern

3.8 In the early 16th century Worksop passed to the Earl of Arundel who commissioned a survey of the property within his estate. This was undertaken by John Harrison who described it in detail. He states that the manor house was set within in an extensive park comprising of 2,300 acres. The survey makes reference to early industry in the town including Bracebridge Mill, a corn-grinding water mill, a mill near to Castle Hill and a kiln and malthouse. Despite these industries much of the population will have been employed in farming the surrounding land, which included those fields which make up the site.

3.9 The 18th century brought about important changes to the town in part due to the doubling of the population between the mid-18th and late 18th century. By 1801, the population had more than doubled to 3,391. The town started to expand and new streets lined with brick and tile houses were developed to accommodate the growing population. William Toplis of Cuckney attempted to introduce manufacturing industry to the town in 1792. Two textile mills were erected, one of the mills was on the south side of the canal at Bridge Place, and the other was most likely situated on Mansfield Road. The enterprise was short-lived as the mills both closed within three years of operation and were converted to mill corn.

3.10 The 1887-1899 historic Ordnance Survey maps demonstrate that in the mid- late 19th century the site comprised three fields with no properties or features shown within their curtilage. It is not until the production of the 1968 Ordnance Survey map that the rural landscape began to change with the encroachment of industrial works and quarrying immediately to the north of the site's northern boundary. Further activity is seen within the centre of the site's southernmost field. This comprises the erection of Thievesdale House.

3.11 The population of Worksop increased dramatically in the 19th century, from 3,291 to 16,455. The period also saw a fundamental change in the nature of the local economy. At the start of the 19th century the economy was largely agricultural in nature. However, by 1900 the majority of the workforce was employed in the mining industry. The first colliery to be sunk in the area was the Shireoaks Colliery in 1854. In 1861 over 200 men were employed at the colliery and 'within two years of raising its first saleable coal it was already the largest single source of employment in the district'. By 1871 over 600 worked at the pit. Other collieries followed including Steetley Colliery which started producing coal in 1876.

3.12 The railway station opened in 1849, which subsequently prompted further building on the north side of the town. This expansion is evident from analysis of historic Ordnance Survey maps, which demonstrate its encroachment within the former agricultural fields to the south-west of the site.

4. Landuse, topography and geology

4.1 At the time of fieldwork the proposed development area comprised three land parcels, containing six survey areas, as follows:

Area	Size (ha)	Landuse	Topography	NGR
1	1.1	arable, cereal (young)	sloping from N to S, 65-60m OD	SK 5980 8164
2	1.2	scrubland (disturbed)	undulating, 60m OD	SK 5999 8157
3	0.7	arable, cereal (young)	generally flat, 60m OD	SK 6005 8171
4	1.9	arable, cereal (young)	generally flat, 60m OD	SK 6009 8186
5	0.9	arable, cereal (young)	sloping from S to N, 65-60m OD	SK 5984 8175
6	1.4	arable, cereal (young)	sloping from S to N, 60-55m OD	SK 5984 8189

4.2 The underlying solid geology of the area comprises Permian and Triassic Sandstone, which is overlain by areas of glaciofluvial deposits.

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 desktop 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 Leica GS15 global navigation satellite system (GNSS) with real time kinematic (RTK) corrections.

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.

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 (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. 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 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
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 0.25m x 0.25m intervals

Interpretation: anomaly types

5.10 A colour-coded geophysical interpretation plan is 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

5.11 Colour-coded archaeological interpretation plans are provided.

5.12 Except where stated otherwise in the text below, 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.

5.13 Series of parallel, weak positive magnetic anomalies have been detected as a magnetic 'texture' across some areas, most notably Areas 1 and 2. These anomalies correspond to the current plough direction but could also reflect earlier plough regimes.

5.14 Small, discrete dipolar magnetic anomalies have been detected in all 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.

Area 1

5.15 A weak positive magnetic anomaly has been detected in the north-east corner of the survey area, aligned broadly north/south. This anomaly reflects the change in the ground level between the ploughed land to the west and scrubland to the east of the survey area (a height difference of approximately 0.3m).

5.16 A broad and diffuse positive magnetic anomaly has been detected in the south of the survey area. This possibly reflects the local geology and/or changes in soil conditions due to slope processes, as the survey area slopes over 5m from north to south.

Area 2

5.17 A concentration of dipolar magnetic anomalies has been detected in the north-eastern part of the survey. These anomalies were within scrubland and corresponded to a patch of low vegetation growth. The poor soil conditions and relatively strong magnetic measurements indicate these anomalies are likely to represent disturbed ground due to the dumping of fired debris such as clinker/cinder or brick fragments.

5.18 A weak positive magnetic anomaly aligned broadly north-west/south-east has been identified in the west of the area. This anomaly reflects a change in the ground level between the ploughed crop and scrubland as previously noted in Area 1.

Area 3

5.19 No features of likely archaeological origin have been identified in this survey area.

Area 4

5.20 No features of likely archaeological origin have been identified in this survey area.

Area 5

5.21 No features of likely archaeological origin have been identified in this survey area.

5.22 A very weak, diffuse positive magnetic anomaly detected in the eastern part of the survey may reflect local geological variation or changes in soil depth due to slope processes, as the survey area slopes over 5m from south to north.

Area 6

5.23 No features of likely archaeological origin have been identified in this survey area. The strong dipolar magnetic anomaly detected in the western half of the survey almost certainly reflects a larger fragment of ferrous litter.

6. Conclusions

6.1 Approximately 7ha of geomagnetic survey were undertaken on land to the west of Blyth Road, Worksop, Nottinghamshire, prior to proposed development.

6.2 A probable dump of fired debris such as clinker/cinder or brick fragments has been detected in Area 2.

6.3 A change in the ground level between the ploughed land and scrubland has been identified in Areas 1 and 2.

6.4 The present ploughing regime has been detected in Areas 1 and 2.

6.5 Changes in the local geology and/or soil conditions have probably given rise to two anomalies in Areas 1 and 5.

7. Sources

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 2010 *Draft Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

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

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Figure 1: Site location

site location

0 1km

scale 1:25 000 for A4 plot

382

Woodland Grove Farm

58m

Area 6

Area 4

Area 5

Area 3

Area 1

61m

Area 2

Thievesdale House

COLSTERDALE

GLAISDALE

B6045

B6045

Thievesdale Lane (Pa

460

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Figure 2: Geophysical survey overview

0 100m
scale 1:2500 for A3 plot

magnetic survey

-5 nT 5

Area 6

Area 4

Area 5

Area 3

Area 1

Area 2

61m

B6045

Thievesdale House

Thievesdale

819
818
817
816
815
814

598
599
600
601
602

magnetic survey

-5 nT 5

0 50m

scale 1:1000 for A1 plot

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Figure 3: Geophysical survey

Area 6

Area 4

Area 5

Area 3

Area 2

Area 1

Thievesdale House

61m

B6045

Thievesdale

819
818
817
816
815
814
598
599
600
601
602

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

Area 6

Area 4

Area 5

Area 3

Area 2

Area 1

scrub

scrub

scrub

Thievesdale House

61m

B6045

B6045

Thievesdale

819
818
817
816
815
814
598
599
600
601
602

magnetic survey
disturbed area
geological feature
change in land use

0 50m
scale 1:1000 for A1 plot

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Figure 5: Archaeological interpretation

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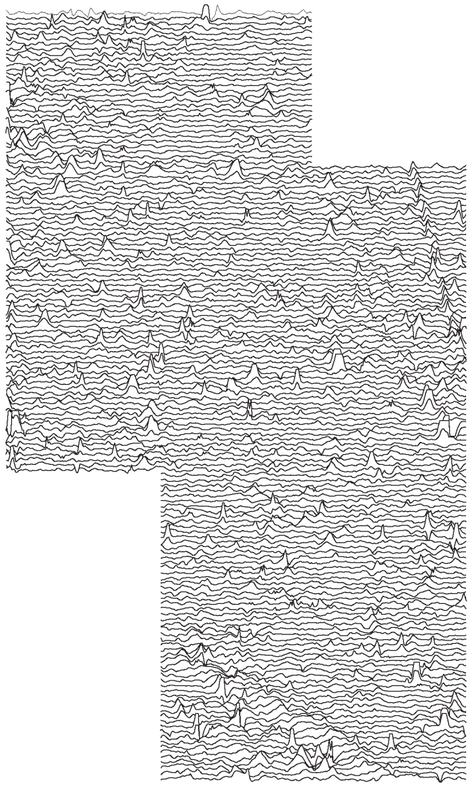
Figure 6:
Trace plots of geomagnetic data

Area 1

20.70nT/cm

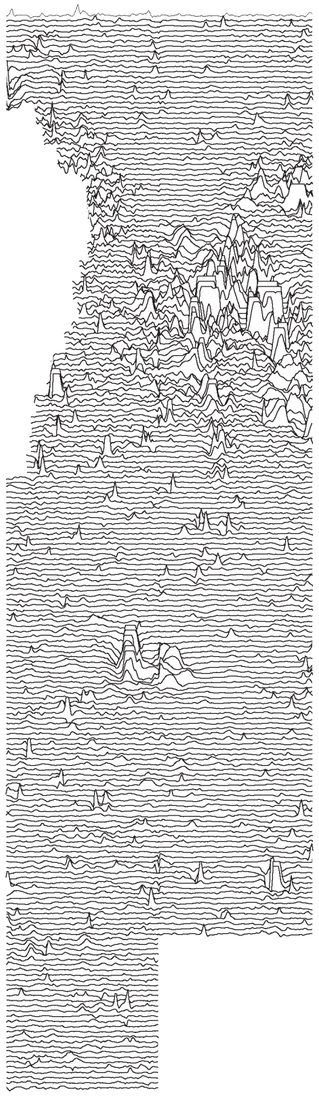
0 50m
scale 1:1000



Area 2

43.50nT/cm

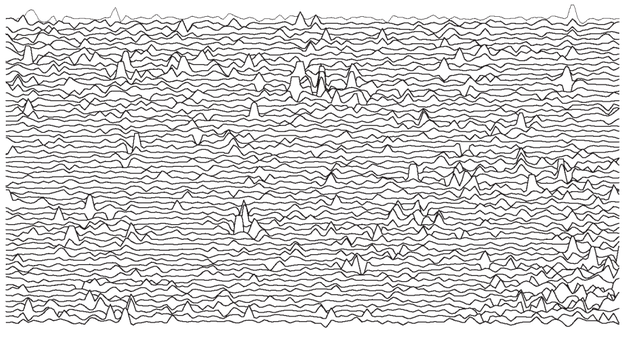
0 50m
scale 1:1000



Area 3

24.90nT/cm

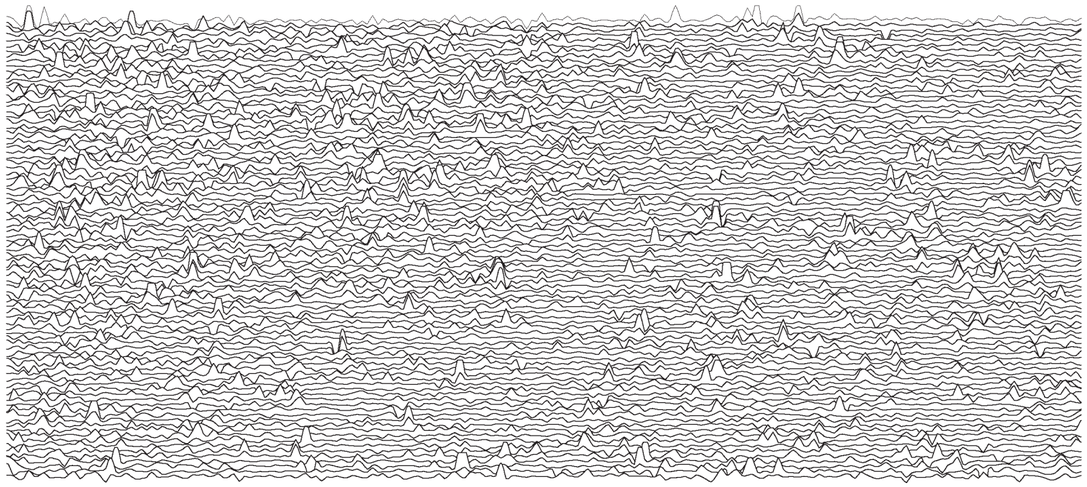
0 50m
scale 1:1000



Area 4

17.30nT/cm

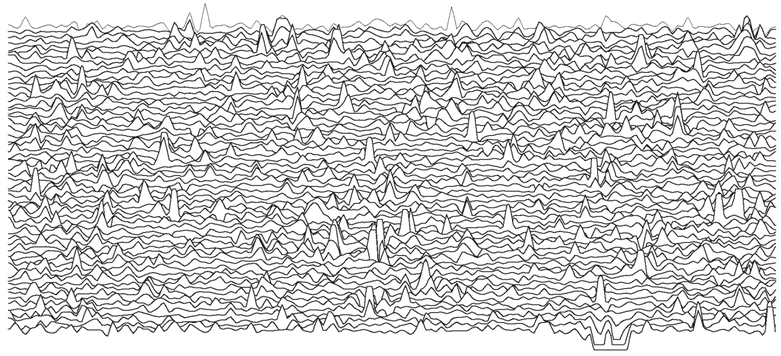
0 50m
scale 1:1000



Area 5

9.50nT/cm

0 50m
scale 1:1000



Area 6

16.10nT/cm

0 50m
scale 1:1000