Archaeological Services
University of Durham

Land at Great Ayton, near Middlesbrough, North Yorkshire

geophysical surveys

on behalf of
Great Ayton Community Archaeology Project

Report 2186
May 2009

Archaeological Services
Durham University
South Road
Durham DH1 3LE
Tel: 0191 334 1121
Fax: 0191 334 1126
archaeological.services@durham.ac.uk
www.durham.ac.uk/archaeological.services

Land at Great Ayton, near Middlesbrough, North Yorkshire

geophysical surveys

Report 2186

May 2009

Archaeological Services Durham University

on behalf of

Great Ayton Community Archaeology Project

% Robert de Wardt, 3 Station Road, Great Ayton, Middlesbrough TS9 6HA

Contents

1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted in Great Ayton for research purposes. The works comprised two geomagnetic surveys near Ayton Hall.

1.2 The works were commissioned by Great Ayton Community Archaeology Project and conducted by Archaeological Services Durham University.

Results

1.3 Several possible ditch and pit features have been identified in Area 1, south of Ayton Hall, two of which could possibly be associated with a former trackway.

1.4 Upstanding ridge and furrow earthworks and possible headlands have been detected in Area 2.

2. Project background

Location (Figure 1)

2.1 Surveys were undertaken at two locations in Great Ayton, south-east of Middlesbrough, in the Hambleton District of North Yorkshire. Area 1 comprised land between Ayton Hall in the north and the River Leven in the south (NGR centre: NZ 5557 1077) and Area 2 was approximately 100m east of Ayton Hall (NGR centre: NZ 5568 1088).

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 survey areas, in order to inform research on the early history of the village.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions from the Great Ayton Community Archaeology Project (GACAP), following discussions with Kevin Cale of Community Archaeology Ltd.

Dates

2.5 Fieldwork was undertaken on 15th April 2009. This report was prepared between 28th April and 5th May 2009.

Personnel

2.6 Fieldwork was conducted by Edward Davies (Supervisor) and Matt Claydon. This report was prepared by Duncan Hale, the Project Manager, with illustrations by David Graham.

Archive/OASIS

2.7 The site code is **GAP09**, for **G**reat **A**yton Community Archaeology **P**roject 20**09**. The survey archive will be supplied on CD to the GACAP 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 **archaeol3-59037**.

3. Archaeological and historical background

3.1 In the western part of the village, on the north side of Low Green, are the Manor House, Ayton Hall and All Saints' Church. It has been suggested that these buildings could have been part of the original settlement of the village and so the present surveys targeted land there. The history of the village is being researched by the Great Ayton Community Archaeology Project, which was set up in 2002. The following background information is taken from their website.

3.2 The village of Great Ayton is centred on the banks of the River Leven. It is ancient in origin, having several Neolithic sites within the parish boundary, and is mentioned in the Domesday Book. In former times its industries included linen making, tanning and brewing, and the mining industries of whinstone,

ironstone, alum and jet were important locally. Roseberry Topping and the adjacent whinstone outcrop are of geological importance.

3.3 The navigator and explorer Captain James Cook spent his boyhood in the village. He attended the Postgate School, now converted into the Captain Cook Schoolroom Museum, and worshipped in the 12th-century All Saints' Church (situated between the two survey areas in this report).

4. Landuse, topography and geology

4.1 At the time of fieldwork both survey areas comprised pasture.

4.2 The study area occupied a very gentle south-facing slope down to the river, at a mean elevation of approximately 80m OD.

4.3 The site lies on strata of the Redcar Mudstone Formation, which are overlain by alluvium and sand and gravel.

5. Geophysical survey

Standards

5.1 The surveys and reporting were conducted in accordance with English Heritage guidelines, *Geophysical survey in archaeological field evaluation, 2nd edition* (David, Linford & Linford 2008); the Institute for 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 2002).

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 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 palaeochannels, 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 GS50 global positioning system and post-processing correction software.

5.6 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 dual fluxgate gradiometer. 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 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.
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

5.11 A colour-coded archaeological interpretation plan is provided.

5.12 Several positive magnetic anomalies have been detected throughout the surveys. These anomalies reflect relative increases in high magnetic susceptibility materials, typically sediments in cut archaeological features (such as furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning. Various types of possible soil-filled feature have been identified here.

5.13 The linear positive magnetic anomalies detected in Area 1 are generally extremely weak but could possibly reflect the remains of ditch features.

5.14 The partial remains of two possible curvilinear ditches in the central part of the area appear to flank a negative magnetic anomaly; the latter could reflect stone rubble or hardcore. Such arrangements of anomalies can reflect former trackways.

5.15 A number of isolated, discrete positive magnetic anomalies throughout Area 1 could reflect soil-filled pits. In this instance many of these anomalies are particularly strong.

5.16 Wire fences on some sides of both survey areas are evident as intense dipolar magnetic anomalies along those survey edges. Buildings adjacent to the Area 2 survey have also given rise to large intense anomalies there.

5.17 A series of strong, parallel, positive magnetic anomalies has been detected aligned broadly north-south across Area 2. These anomalies correspond to upstanding remains of former ridge and furrow cultivation.

5.18 Two linear positive magnetic anomalies aligned broadly east-west in Area 2 may reflect soil-filled features, or in this instance, former plough headlands.

5.19 Small, discrete dipolar magnetic anomalies have been detected in both 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.

6. Conclusions

6.1 Detailed geomagnetic surveys have been conducted on land near Ayton Hall in Great Ayton, south-east of Middlesbrough.

6.2 Several possible ditch and pit features have been identified in Area 1, south of Ayton Hall, two of which could possibly be associated with a former trackway.

6.3 Upstanding ridge and furrow earthworks and possible headlands have been detected in Area 2.

7. Sources

David, A, Linford, N, & Linford, P, 2008 *Geophysical Survey in Archaeological Field Evaluation, 2nd edition*. English Heritage

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

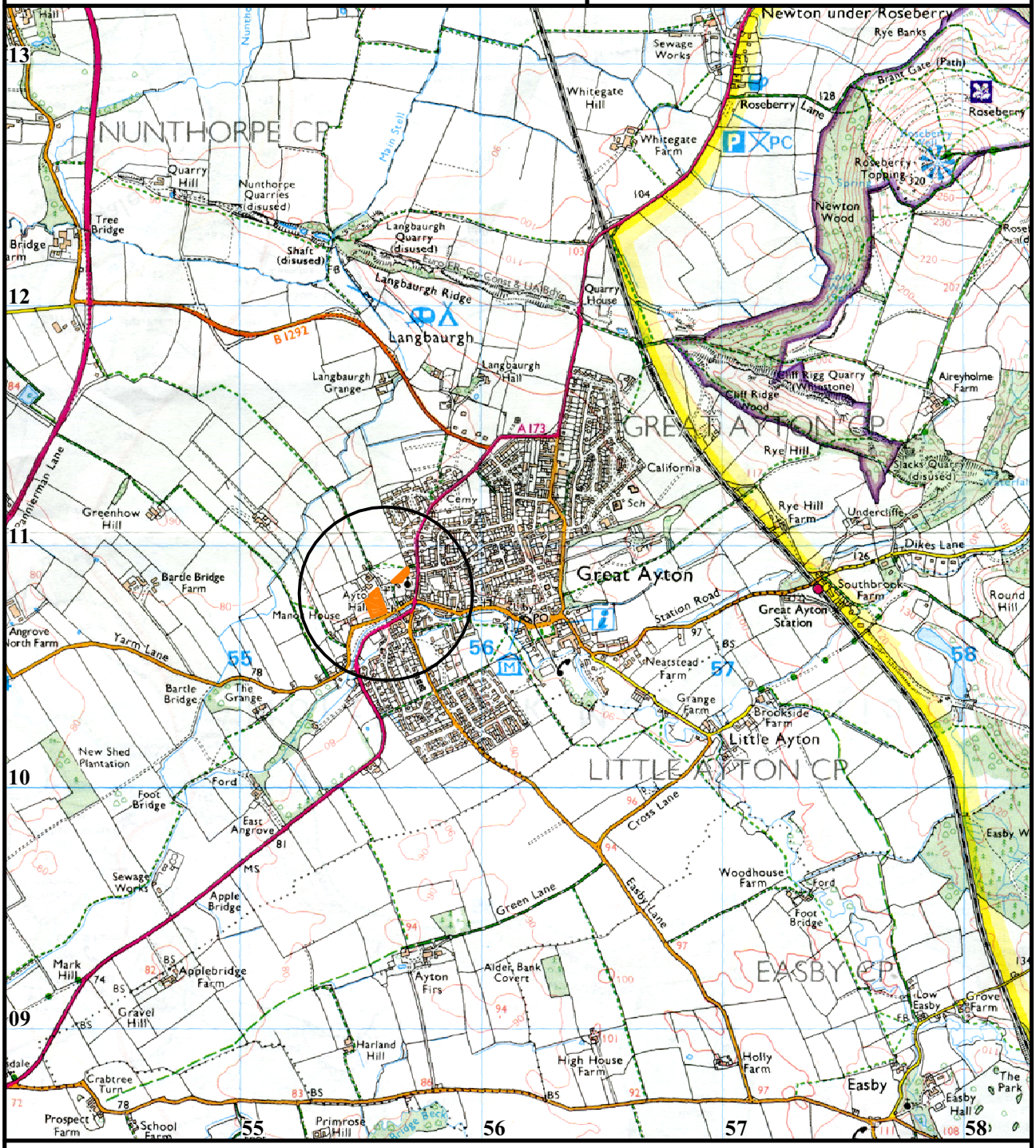
Schmidt, A, 2002 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service, Arts and Humanities Data Service

Archaeological Services
University of Durham

Land at Great Ayton, near Middlesbrough, North Yorkshire
geophysical surveys

Report 2186
Figure 1
Location map

on behalf of
Great Ayton Community Archaeology Project



survey area

0 1km

scale 1:25 000 - for A4 plot

Path (um)

Tel Ex

The Granary

109

Ayton Hall Farm

Area 2

Path (um)

The Dovecote

Hall

All Saints' Church

Vicarage

Ayton Hall

Area 1

108

Marwood's C of E Sch

Club

Southview

Molyneux House

Weir

FB

79.6m

107

Weir

LOW GREEN

Buck Hotel (PH)

BRIDGE STREET

555

556

557

Archaeological Services
University of Durham

Land at Great Ayton, near Middlesbrough, North Yorkshire

geophysical surveys

Report 2186

Figure 2

Geophysical surveys

on behalf of
Great Ayton Community Archaeology Project

0 50m

scale 1:1000 - for A3 plot

outline of survey area

8.00
6.67
5.33
4.00
2.67
1.33
0.00
-1.33
-2.67
-4.00
-5.33
-6.67
-8.00 nT

Path (um)

Tel Ex

109

The Granary

Ayton Hall Farm

Area 2

Path (um)

The Dovecote

Hall

All Saints' Church

Vicarage

Ayton Hall

108

Area 1

Marwood's C of E Sch

Club

Southview

Molyneux House

Weir

FB

79.6m

Weir

LOW GREEN

Buck Hotel (PH)

BRIDGE STREET

555

556

557

Archaeological Services
University of Durham

Land at Great Ayton, near Middlesbrough, North Yorkshire

geophysical surveys

Report 2186

Figure 3

Geophysical interpretation

on behalf of
Great Ayton Community Archaeology Project

0 50m

scale 1:1000 - for A3 plot

outline of survey area

positive magnetic anomalies

negative magnetic anomalies

dipolar magnetic anomalies

Path (um)

Tel Ex

109

The Granary

Ayton Hall Farm

Area 2

Path (um)

The Dovecote

Hall

All Saints' Church

Vicarage

Ayton Hall

108

Area 1

Marwood's C of E Sch

Club

Southview

Molyneux House

Weir

FB

79.6m

Weir

LOW GREEN

Buck Hotel (PH)

BRIDGE STREET

555

556

557

Archaeological Services
University of Durham

Land at Great Ayton, near Middlesbrough, North Yorkshire

geophysical surveys

Report 2186

Figure 4

Archaeological interpretation

on behalf of
Great Ayton Community Archaeology Project

0 50m

scale 1:1000 - for A3 plot

outline of survey area

soil-filled features

orientation of ridge and furrow

stone/rubble

Figure 5: Trace plots of geomagnetic data