ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Swaledale and Arkengarthdale Archaeology Group
and
Yorkshire Dales National Park Authority

Maiden Castle and West Hagg
Swaledale
North Yorkshire

geophysical surveys

report 2631
May 2011

Durham University

Contents

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted at two archaeological sites in Swaledale, North Yorkshire. The works comprised detailed geomagnetic and earth resistance surveys at Maiden Castle and West Hagg, undertaken as part of ongoing research by the Swaledale and Arkengarthdale Archaeology Group (SWAAG).

1.2 The works were commissioned by the Yorkshire Dales National Park Authority, on behalf of the Swaledale and Arkengarthdale Archaeology Group, and conducted by Archaeological Services Durham University and SWAAG members.

Results

1.3 The surveys combined both research and training with members of SWAAG.

1.4 The majority of anomalies detected by the surveys at Maiden Castle are generally very weak, but could indicate the presence of possible roundhouses, cists and other internal features, in addition to those already known. No ditches were detected in association with the two barrows to either side of the main enclosure and it seems likely that they were created by the scraping up of adjacent land.

1.5 A well-defined enclosure was detected at West Hagg, where a number of anomalies complemented previously recorded earthworks. Two 'annexes' were detected to the south-east and south-west of the main enclosure, providing three distinct zones at the settlement which were perhaps used for occupation, some small-scale industrial or craft activity and stock.

2. Project background

Location (Figure 1)

2.1 Geophysical surveys were conducted at two sites in Swaledale, North Yorkshire. The first was Maiden Castle, a Scheduled Ancient Monument on the northern slopes of High Harker Hill, Grinton parish, to the south-west of Reeth (NGR: SE 02150 98125); the second was at West Hagg, below the southern end of Fremington Edge, in the parish of Reeth, Fremington and Healaugh (NGR: SE 05670 99015).

2.2 The Maiden Castle complex comprises a large enclosure cut into the hillside and defined by a substantial ditch and bank; an approach to the enclosure's eastern side defined by parallel stone walls; a large round barrow and a less substantial, 'short' long barrow. Surveys were undertaken over three parts of the complex, totalling approximately 1ha of geomagnetic survey and 0.5ha of earth electrical resistance survey. The larger geomagnetic survey (Area 1) and the resistance survey covered the interior of the enclosure; two smaller geomagnetic surveys were conducted at the long mound (including a possible Bronze Age boundary) to the south-west of the enclosure (Area 2); and to the south of the round barrow, incorporating part of the stone avenue (Area 3).

2.3 An area of earthworks at West Hagg (SWAAG Site 103) was surveyed using both geomagnetic and electrical resistance techniques, over approximately 0.25ha.

Objective

2.4 The principal aim of the surveys was to record and assess the nature and extent of any sub-surface features of potential archaeological significance at each site, as part of ongoing research by the Swaledale and Arkengarthdale Archaeology Group (SWAAG). A secondary aim was to provide geophysical survey training to SWAAG members, which was carried out at the West Hagg site.

Methods statement

2.5 The geophysical surveys were undertaken in accordance with a project design prepared by Archaeological Services Durham University (ref. DH11.02rev1), and with national standards and guidance (below, para. 5.1).

2.6 Since two of the Maiden Castle surveys were within a Scheduled Ancient Monument they were undertaken in accordance with a Section 42 licence granted by English Heritage under of the Ancient Monuments and Areas Act 1979 (as amended by the National Heritage Act 1983).

Dates

2.7 Fieldwork was undertaken between 9th and 14th March 2011. This final version of the report was completed on 19th May 2011.

Personnel

2.8 Fieldwork at Maiden Castle was conducted by Duncan Hale (the Project Manager), Mark Houshold and Richie Villis (Supervisor). Fieldwork and training at West Hagg was conducted by Duncan Hale and Richie Villis with members of SWAAG. This report was prepared by Duncan Hale and Richie Villis, with illustrations by David Graham and Janine Watson.

Archive/OASIS

2.9 The site codes are **SMC11**, for **S**waledale **M**aiden **C**astle 20**11**, and **SHF11**, for **S**waledale **H**agg **F**arm **2011**. 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 **archaeol3-96150**.

Acknowledgements

2.10 Archaeological Services is grateful for the assistance of SWAAG, the Yorkshire Dales National Park Authority (YDNPA), English Heritage and the National Monuments Record in facilitating this scheme of works.

3. Historical and archaeological background

3.1 The Maiden Castle enclosure, its walled approach and adjacent round barrow are protected as a Scheduled Ancient Monument: 'Maiden Castle prehistoric defended settlement and adjacent round barrow, Grinton, Richmondshire, North Yorkshire' (Monument no. 24535), however, it is no longer generally accepted as a defensive site and there are a number of other features on the surrounding hillside which may also be part of the same complex, including a possible 'short' long barrow, several smaller cairns and ancient land boundaries.

3.2 The enclosure at Maiden Castle has traditionally been described as Iron Age and the barrows as Early Bronze Age, though little archaeological investigation has been carried out with the exception of the detailed earthwork survey by the Royal Commission on the Historical Monuments of England (RCHME) in 1996 (Figure 3). It is possible that the barrows at least could have earlier, Neolithic, origins. The remains of wall-footings for two roundhouses and at least one stone-lined cist are visible within the enclosure. Discussions of the site, its background and interpretation are provided elsewhere, for example by Bowden and Blood (2004) and more recently by Luke (2010), who suggests an early, possibly Neolithic, ceremonial use of this part of the landscape.

3.3 SWAAG Site 103 at West Hagg has had little archaeological investigation. SWAAG carried out an earthwork survey in November 2009 and identified a number of potential building platforms and associated structures. A single sherd of black burnished ware was also recovered from a molehill at the site, which has led to the site being interpreted as a possible late Iron Age or Romano-British settlement.

4. Landuse, topography and geology

4.1 At the time of survey the Maiden Castle complex and environs was rough heather moorland used for sheep grazing. The West Hagg Site 103 was improved pasture.

4.2 Maiden Castle is located on a natural terrace on the northern slopes of High Harker Hill, on the south side of Swaledale. The enclosure appears to have been cut back into the hillside with the spoil deposited at the front of the site, to form a larger interior area for the enclosure. The mean elevation of the interior is approximately 310m OD.

4.3 The West Hagg site is on a south-facing hillside beneath Fremington Edge at a mean elevation of approximately 260m OD.

4.4 The underlying solid geology at Maiden Castle comprises Carboniferous Middle Limestone and Alston Formation sandstone, and at West Hagg comprises Carboniferous Alston Formation limestone with subordinate sandstone and argillaceous rocks.

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) *Draft Standard and Guidance for archaeological geophysical survey* (2010); 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* (draft 2nd edition, Schmidt & Ernenwein 2010).

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 At both sites it was considered likely that cut features such as ditches and pits would 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. Given the anticipated depth of likely targets, and the non-igneous geological environment, both a geomagnetic technique (fluxgate gradiometry) and an earth electrical resistance technique were considered appropriate for detecting the types of feature mentioned above.

5.4 Fluxgate gradiometry 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.

5.5 Earth electrical resistance survey can be particularly useful for mapping stone features. When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone features will typically give relatively high resistance values while soil-filled features, which often retain more moisture, will provide relatively low resistance values.

Field methods

5.6 A 20m 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 with real-time correction.

5.7 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 20m grid units. The instrument sensitivity was nominally 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 1,600 sample measurements per 20m grid unit.

5.8 Measurements of earth electrical resistance were determined using Geoscan RM15D resistance meters with a mobile twin probe separation of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was 0.5ohm, the sample interval was 0.5m and the traverse interval was 1m, thus providing 800 sample measurements per 20m grid unit.

5.9 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.

Field training at West Hagg

5.10 In anticipation that SWAAG may have access to Geoscan instruments in the future, the geophysical training was conducted using Geoscan FM256 fluxgate gradiometers and Geoscan RM15 earth resistance meters. The West Hagg resistance data presented in this report were collected by SWAAG members, however, the geomagnetic data presented here were collected by Archaeological Services on a subsequent visit.

Data processing

5.11 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 and high resistance anomalies are displayed as dark grey, while negative magnetic and low resistance anomalies are shown as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla/ohm, as appropriate.

5.12 The following basic processing functions have been applied to the magnetic 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 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

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

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
add	adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges
destagger	corrects for displacement of anomalies
despike	locates and suppresses spikes in data due to poor contact resistance
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

5.14 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

5.15 Two types of resistance anomaly have been distinguished in the data:

high resistance	regions of anomalously high resistance, which may reflect stone footings, walls, tracks and other concentrations of stone or brick rubble
low resistance	regions of anomalously low resistance, which may be associated with soil-filled features such as pits and ditches

Interpretation: features

General

5.16 Colour-coded archaeological interpretations are provided.

5.17 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.

5.18 Small, discrete dipolar magnetic anomalies have been detected in all the survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris (for example, horseshoes, fence wire and brick fragments), which in many circumstances have little or no archaeological significance. However, given that the surveys cover two known and generally undisturbed sites, such anomalies are more likely to be of archaeological origin. A sample of these anomalies is therefore included on the interpretation plans.

Maiden Castle

5.19 Three geomagnetic surveys and one earth electrical resistance survey were conducted: Area 1 comprised geomagnetic and earth electrical resistance survey of the interior of the ditched enclosure; Area 2 comprised geomagnetic survey of the possible long mound and Bronze Age boundary to the south-west of the monument; Area 3 comprised geomagnetic survey of an area immediately south of the round barrow and included the eastern part of the stone-walled approach.

5.20 Both geomagnetic and resistance techniques have generally detected only very slight contrasts in the properties being measured, with a few notable exceptions. The resulting anomalies are typically very weak and the majority do not appear to form regular, identifiable features. A number of possible and probable features have however been interpreted from the data.

Area 1

5.21 The remains of a few possible roundhouses may have been detected. A weak, sub-circular positive magnetic anomaly, *c*.13m in diameter, has been detected in the central northern part of the interior. Parts of this feature broadly correspond to areas of slightly higher resistance. The anomalies correspond to a circular earthwork platform noted on the ground and included in the RCHME survey. The geophysical anomalies reflect relatively high magnetic susceptibility soils and possibly stone around the edges of the platform; the platform itself appears almost devoid of features except for a small, weak positive magnetic anomaly near the centre which could reflect the location of a soil-filled pit or posthole. A small intense magnetic anomaly in the south-east of the platform could possibly reflect thermoremanent magnetism associated with a small hearth, but could equally reflect a small ferrous item.

5.22 Approximately 10m east of this platform, very weak, concentric positive (outer) and negative (inner) magnetic anomalies have been detected, indicating a possible feature *c*.8m in diameter, again with a possible small pit or posthole near its centre. These anomalies could reflect a soil-filled gully around material with low magnetic susceptibility, almost certainly stone in this instance. This possible roundhouse is also evident as a relatively high resistance anomaly. The southern half of the feature

survives as a slight earthwork and is recorded by the RCHME topographical survey; the geophysical evidence suggests that the remainder of the feature survives sub-surface.

5.23 A number of positive, negative and dipolar magnetic anomalies have been detected in the north-east corner of the geomagnetic survey. Earth electrical resistance data was not collected here due to the large amount of stone present on the surface. The negative magnetic anomalies detected in this area almost certainly reflect the presence of this stone. Some of these anomalies could represent the footings for an additional roundhouse or other stone structure, not recorded by the RCHME earthworks survey.

5.24 Parts of another possible ring-ditch and discrete soil-filled pit features, maybe associated with a roundhouse, have been tentatively identified in the west of the area. These anomalies are very weak.

5.25 Two known roundhouses in the east of the area, visible on the ground and recorded by the RCHME earthwork survey, have been partially detected in the geomagnetic data as irregular positive and negative magnetic anomalies, and in the resistance data as an area of anomalously high resistance. The irregular nature of the anomalies reflects the spread of stone here.

5.26 Two arcuate, weak negative magnetic anomalies have been detected at the base of the slope in the south-east corner of the survey area. These correspond to an area of high resistance and may reflect the location of two more roundhouses, possibly partially covered by soil-slip from the steep bank at the south of the enclosure.

5.27 A stone cist was noted on the ground near the centre of the enclosure. Several other small high resistance anomalies were also detected in this area, which could reflect further small stone structures such as cists.

5.28 A number of other geomagnetic and resistance anomalies can be identified, however, they are generally very weak and amorphous. They could possibly reflect the remains of other stone and soil-filled features.

Area 2

5.29 Two broadly east-west aligned, linear, weak negative and positive magnetic anomalies have been detected across the southern part of this small survey area. These correspond to the location of the possible Bronze Age boundary, and may reflect both linear void and slight upcast bank. The anomalies are much weaker where the feature is less apparent on the ground.

5.30 To the south of the Bronze Age boundary a curvilinear positive magnetic anomaly has been detected. This may reflect the remains of soil-filled ditch feature, not necessarily contemporary with the long boundary.

5.31 The long barrow itself is evident as a relatively noisy area of weak positive and dipolar magnetic anomalies. This is indicative of the mound comprising disturbed ground, possibly scraped up from land to the immediate south, and perhaps not a natural glacial feature. There is no geomagnetic evidence for a ditch around the barrow, but extremely weak anomalies could possibly indicate part of a soil-filled feature near the west end of the mound, and possibly more stone in the east end.

Area 3

5.32 Again, the anomalies here, at the east of the site, are very weak.

5.33 The eastern end of the survey, beyond the end of the stone banks, covers an area of slightly different character and vegetation to the surrounding land, and this is borne out by the geomagnetic data: a mottled array of both positive and negative anomalies, typically indicative of disturbed ground. This may support the notion that earth was scraped from here to create the large barrow to the immediate north-west.

5.34 Other anomalies here of possible significance comprise one strong and two weak anomalies, which could reflect soil-filled features.

West Hagg, SWAAG Site 103

5.35 In contrast to the Maiden Castle site, the surveys at West Hagg have detected significant contrasts in both magnetism and earth resistance, some of which correspond to earthwork features previously recorded by SWAAG (Laurie *et al*. 2010).

5.36 Some of the most prominent and better defined geomagnetic anomalies form three sides of a rectilinear enclosure, within which are the majority (perhaps seven) of the probable house platforms identified by SWAAG. The positive magnetic anomalies which define the enclosure reflect relative increases in high magnetic susceptibility soils and sediments, often in cut features such as ditches, but also upcast as banks or to create terraces.

5.37 In the magnetic data the enclosure appears to have two possible entrances, both facing south-east and both aligned with possible tracks identified in the SWAAG earthwork survey.

5.38 Within the enclosure, a right-angled magnetic anomaly and several less well defined anomalies appear to reflect internal divisions, some of which broadly correspond to earthwork banks and terraces. Discontinuous geophysical anomalies in the north-central part of the survey correspond to the edges of two probable house platforms.

5.39 To the immediate south-east and south-west of the enclosure, further positive magnetic anomalies suggest the presence of annexes, both of which are evident on the ground. The area to the south-east is cut into the lower slope of the large mound to the east and contains a concentration of intense anomalies, which might indicate some small-scale industrial activity here, outside the main occupation area.

5.40 In contrast, the anomalies to the south-west correspond to a small terrace below the main enclosure which is largely devoid of anomalies except for a possible narrow soil-filled gully which may divide the terrace into separate areas. Perhaps this area had been used for stock, or even as a kitchen garden. A relatively large low resistance anomaly at this end of the terrace would typically reflect a large pit-type feature, however, as there is no corresponding positive magnetic anomaly it is interpreted as a wetter area rather than a feature; it was raining during the resistance survey and standing water was noted in some parts of the area.

5.41 Part of the enclosure outline and some of the internal features are also evident as relatively high resistance anomalies. The majority of such anomalies here correspond

to steep slopes and banks, which may be better drained, and at least in the case of the large mound to the east and the south-western boundary of the main enclosure, contain significant quantities of stone. Areas of low resistance within the enclosure, which do not correspond to geomagnetic anomalies, almost certainly reflect areas where rainfall created wet ground conditions on the day, rather than archaeological features.

6. Conclusions

6.1 Two complementary geophysical survey techniques, fluxgate gradiometry and earth resistance, have been undertaken at two archaeological sites in Swaledale: Maiden Castle Scheduled Monument complex to the south-west of Reeth and an early settlement at West Hagg, east of Reeth.

6.2 The surveys combined both research and training with members of the Swaledale and Arkengarthdale Archaeology Group (SWAAG).

6.3 The majority of anomalies detected by the surveys at Maiden Castle are generally very weak, but could indicate the presence of possible roundhouses, cists and other internal features, in addition to those already known. No ditches were detected in association with the two barrows to either side of the main enclosure and it seems likely that they were created by the scraping up of adjacent land.

6.4 A well-defined enclosure was detected at West Hagg, where a number of anomalies complemented previously recorded earthworks. Two 'annexes' were detected to the south-east and south-west of the main enclosure, providing three distinct zones at the settlement which were perhaps used for occupation, some small-scale industrial or craft activity and stock.

7. Sources

Bowden, M, & Blood, K, 2004 'Reassessment of two late prehistoric sites: Maiden Castle and Greenber Edge' in White, RF, & Wilson, PR, (eds) *Archaeology and Historic Landscapes of the Yorkshire Dales*, Yorkshire Archaeological Society Occasional Papers No.**2** 89-97.

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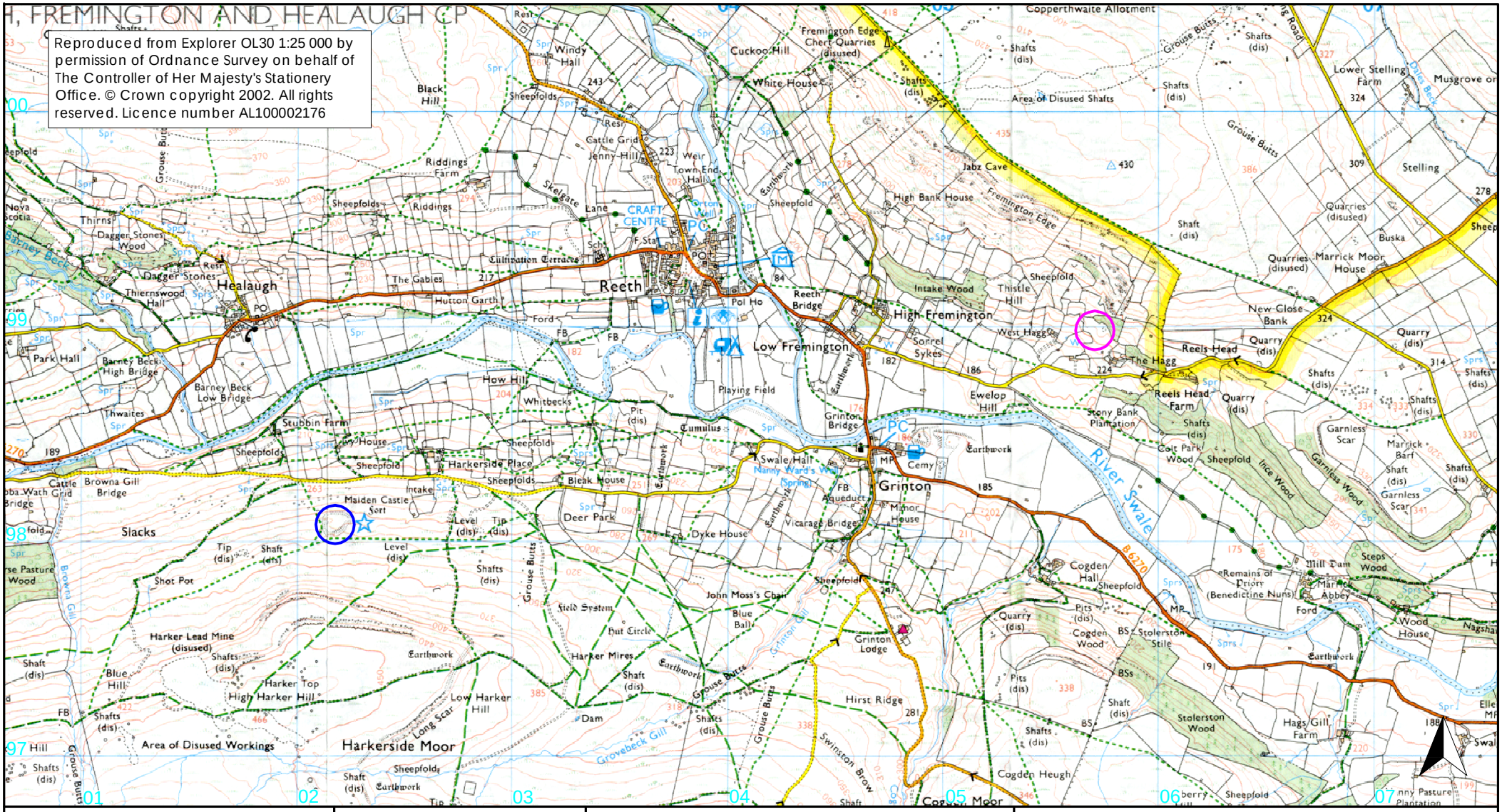

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Figure 1: Site locations

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magnetic survey
scheduled area
RCHME survey

0 50m
scale 1:1250 for A3 plot

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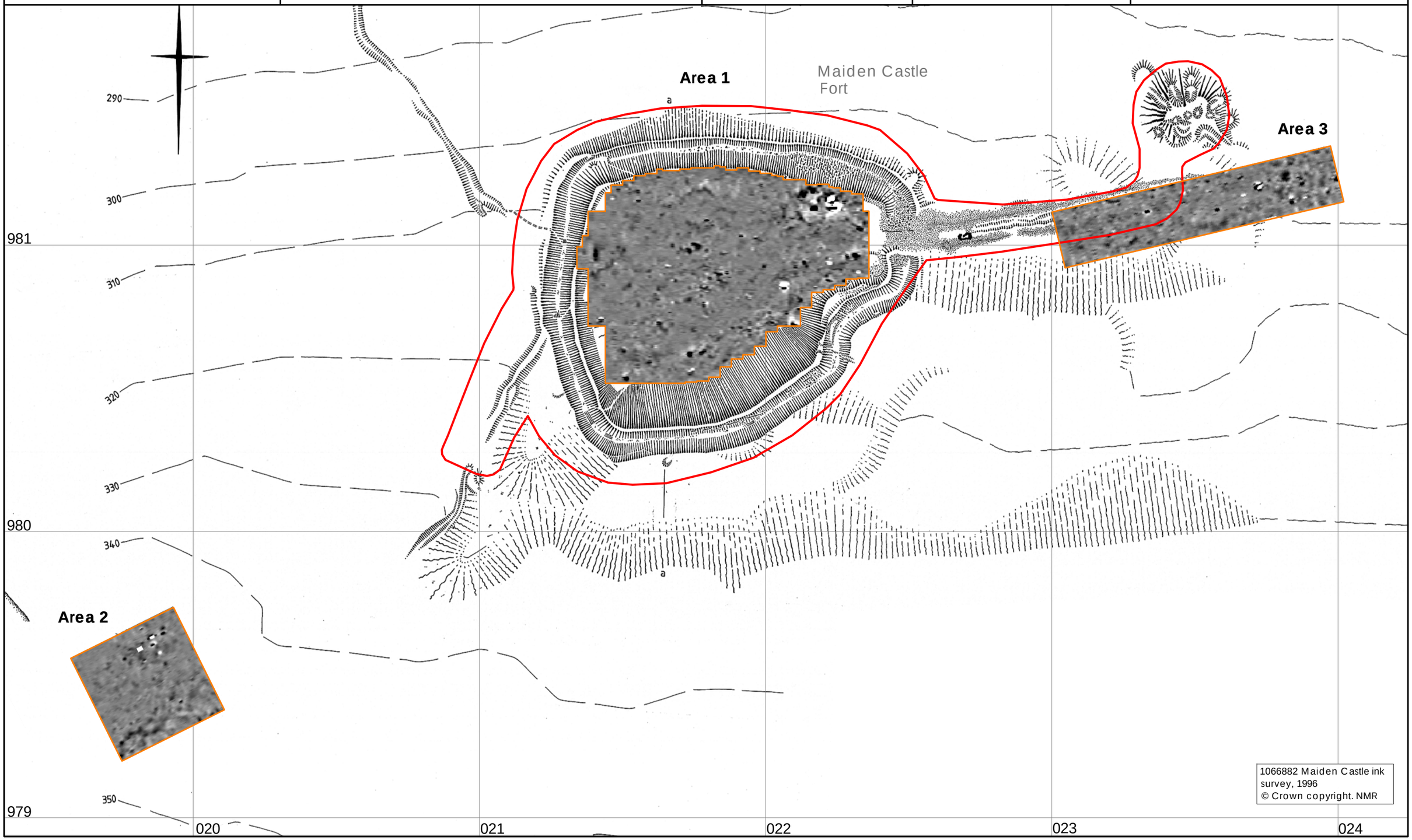
Figure 2: Maiden Castle overview with RCHME earthwork survey



1066882 Maiden Castle ink survey, 1996

A

981

022

A

981

022

B

981

022

B

981

022

C

981

022

C

981

cist

022

A - geophysical survey

magnetic survey

-1.5 nT 2

resistance survey

200 ohm 420

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

high resistance anomaly

low resistance anomaly

C - archaeological interpretation

possible soil-filled feature

possible stone

possible ferrous/fired material

0 25m

scale 1:500 for A1 plot

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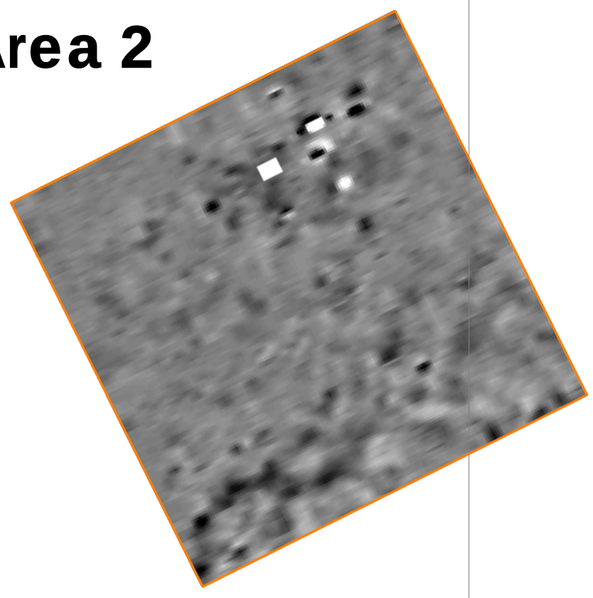
Figure 3: Maiden Castle Area 1 surveys and interpretations

A

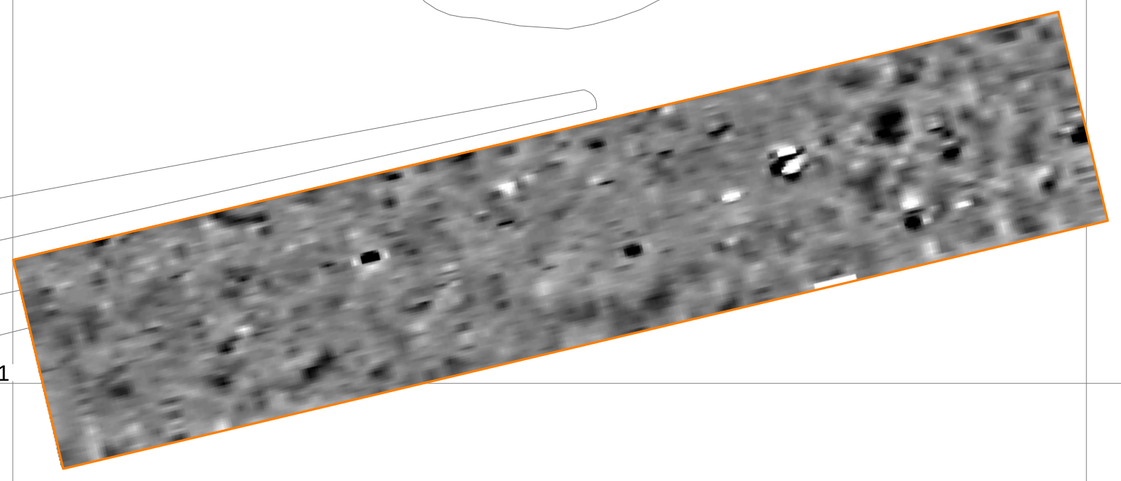
Area 2



020

A

Area 3



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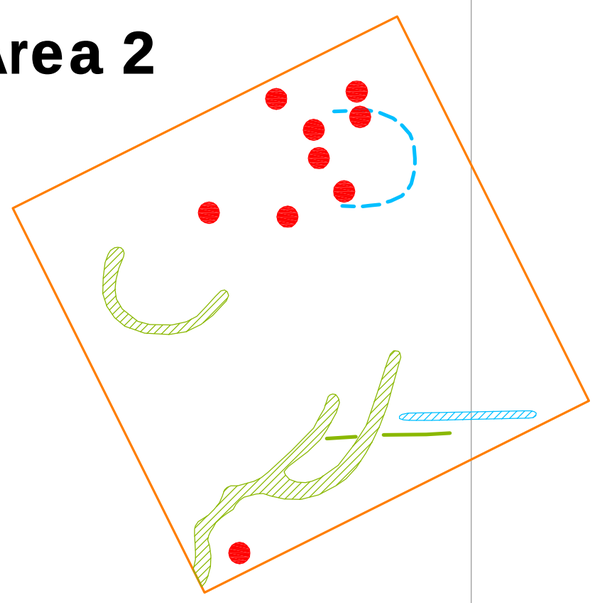
B

Area 2



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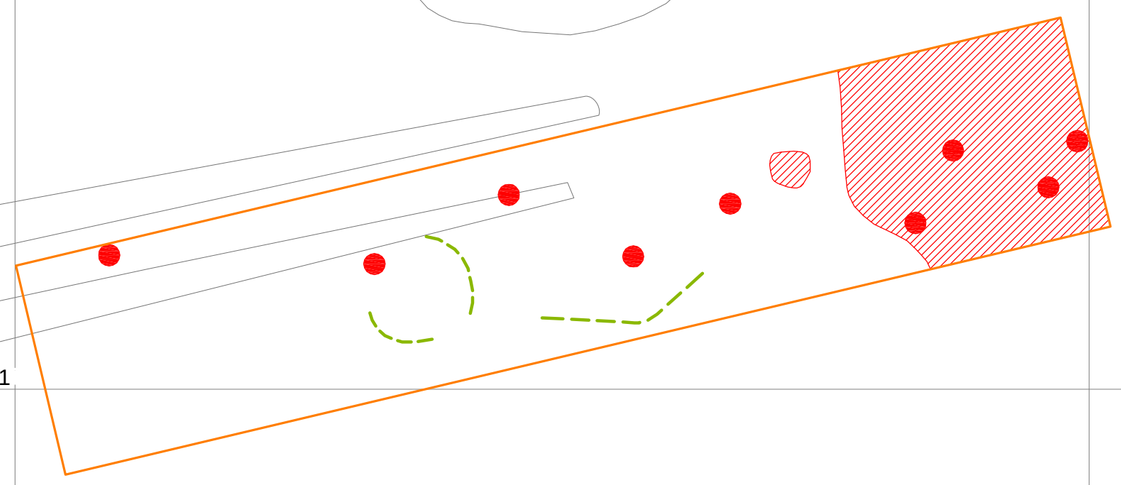
B

Area 3



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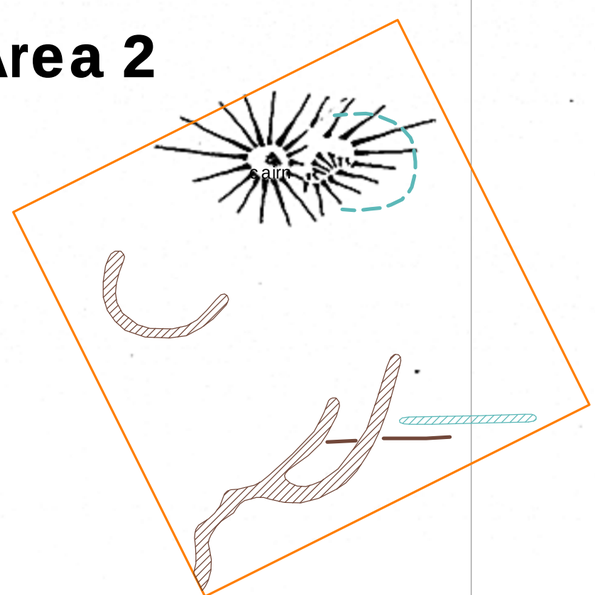
023

024

C

Area 2



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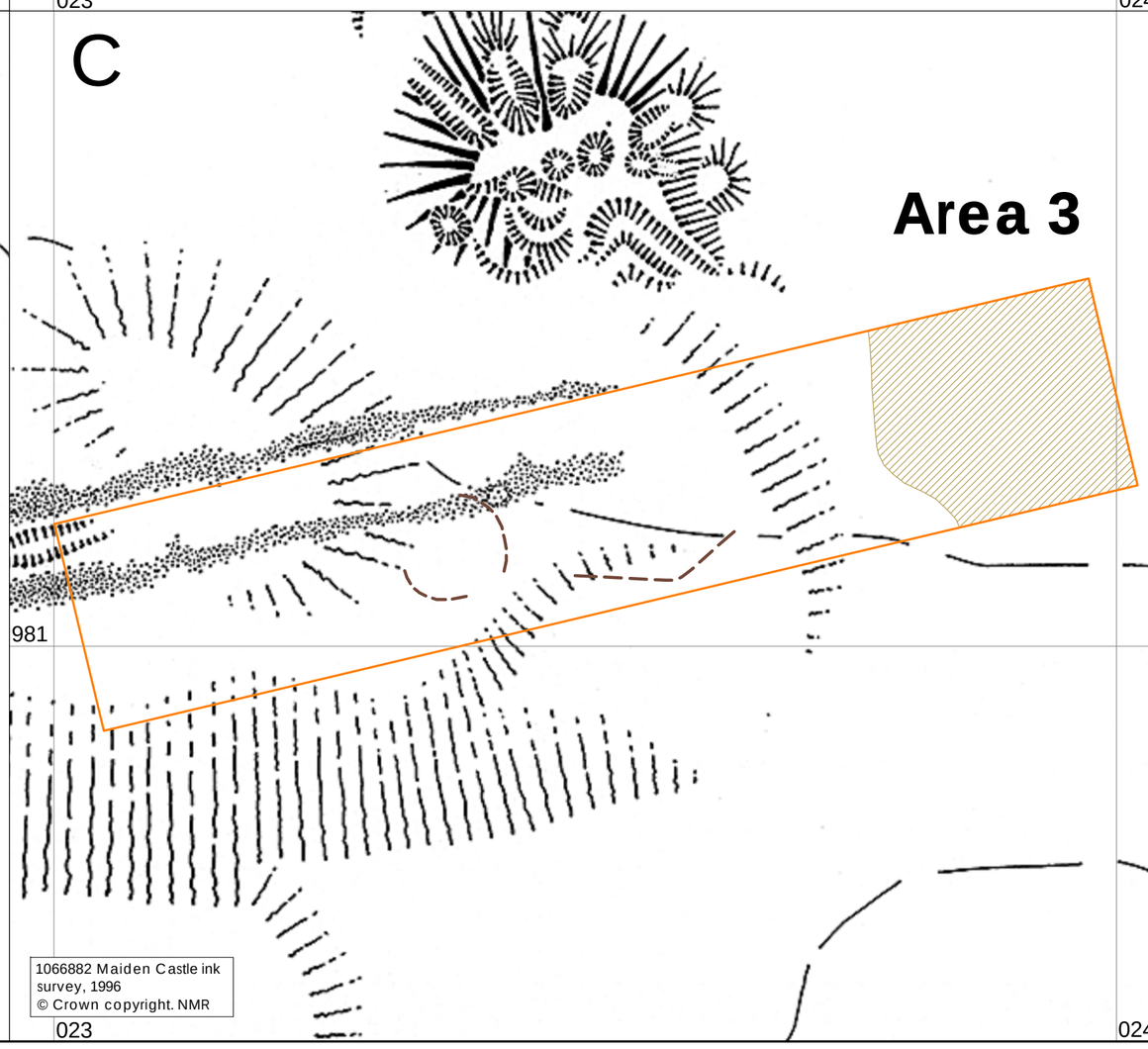
C

Area 3



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023

024

A - geophysical survey

magnetic survey

-2 nT 2

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

C - archaeological interpretation

possible soil-filled feature

possible stone

disturbed area

0 25m

scale 1:500 for A1 plot

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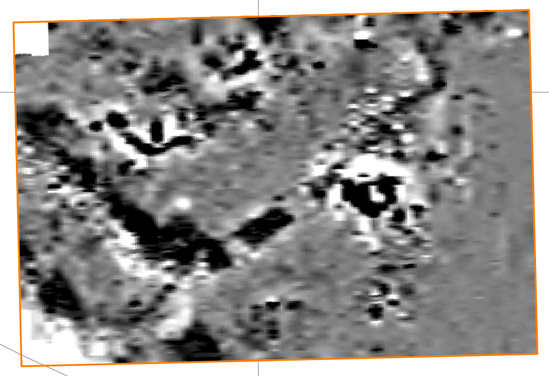
Figure 4: Maiden Castle Areas 2 & 3 surveys and interpretations

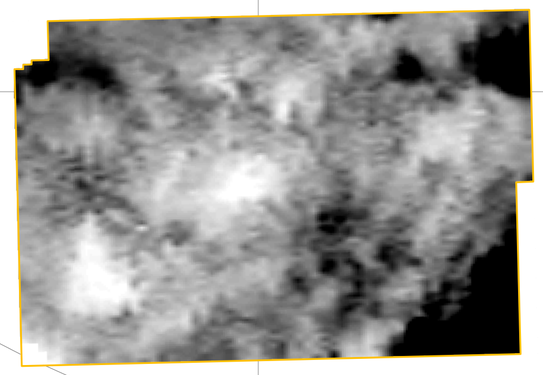
A



990

057

A



990

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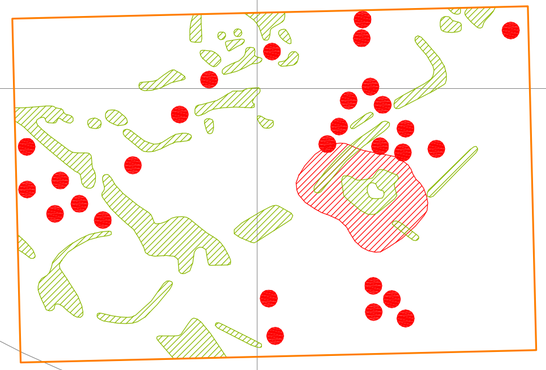
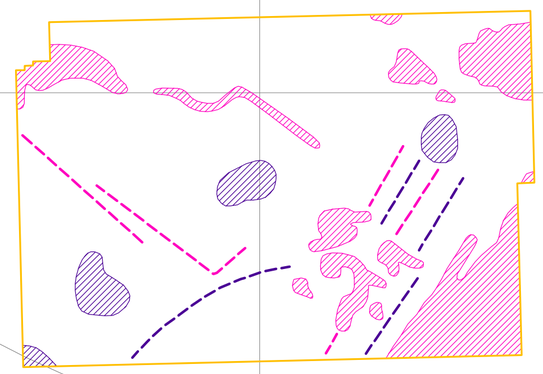
B



990

057

B



990

057

C

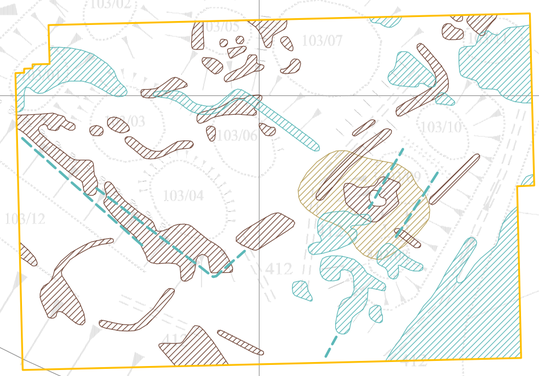
Hagg Plantation

990

057

C

Hagg Plantation



990

057

A - geophysical survey

magnetic survey

-8 nT 8

resistance survey

30 ohm 90

B - geophysical interpretation

dipolar magnetic anomaly

positive magnetic anomaly

negative magnetic anomaly

high resistance anomaly

low resistance anomaly

C - archaeological interpretation

possible soil-filled feature

possible stone

disturbed area

0 25m

scale 1:500 for A1 plot

ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Swaledale and Arkengarthdale Archaeology Group
and
Yorkshire Dales National Park Authority

Maiden Castle & West Hagg
Swaledale
North Yorkshire

geophysical survey
report 2631

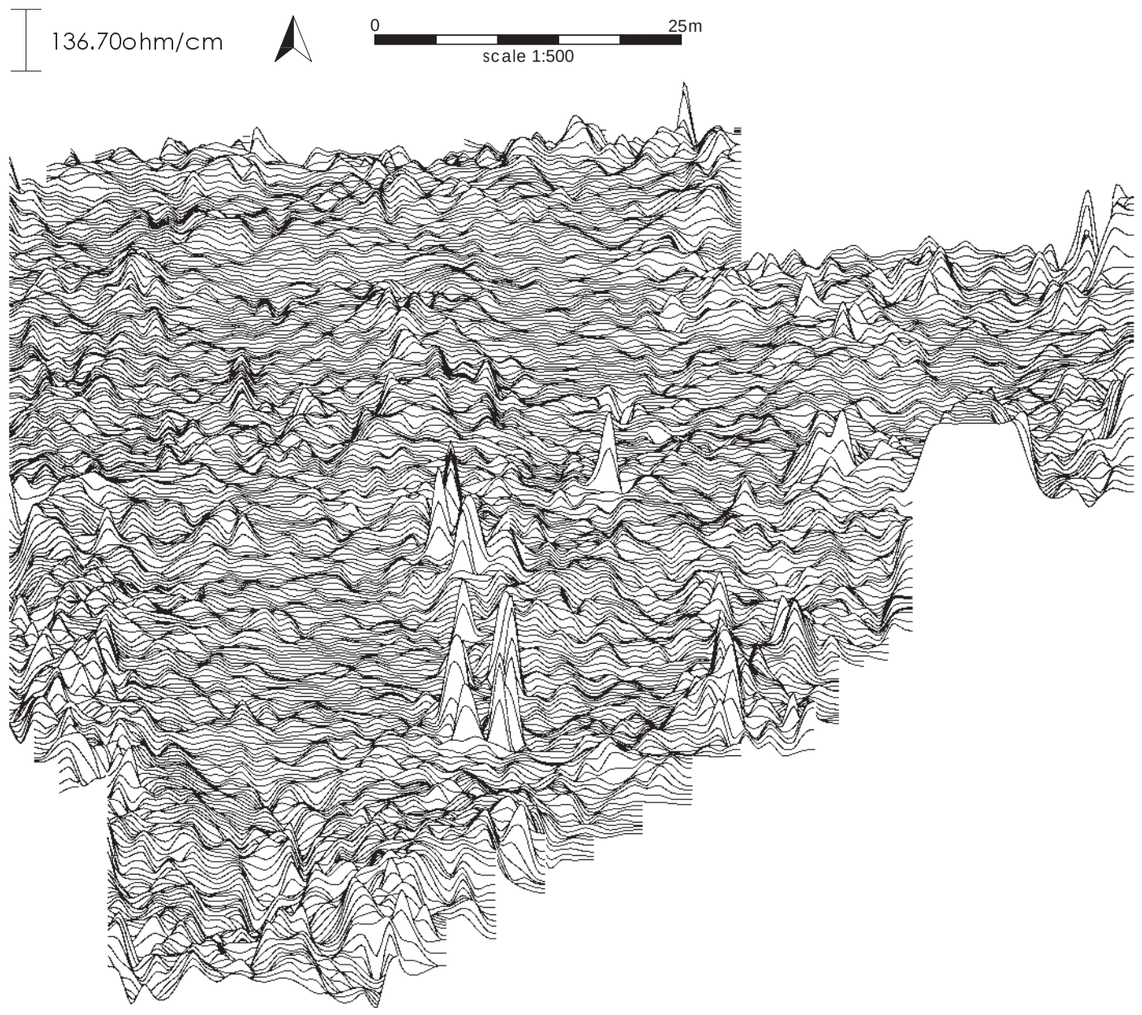
Figure 5: West Hagg surveys and interpretations

Maiden Castle & West Hagg
Swaledale
North Yorkshire

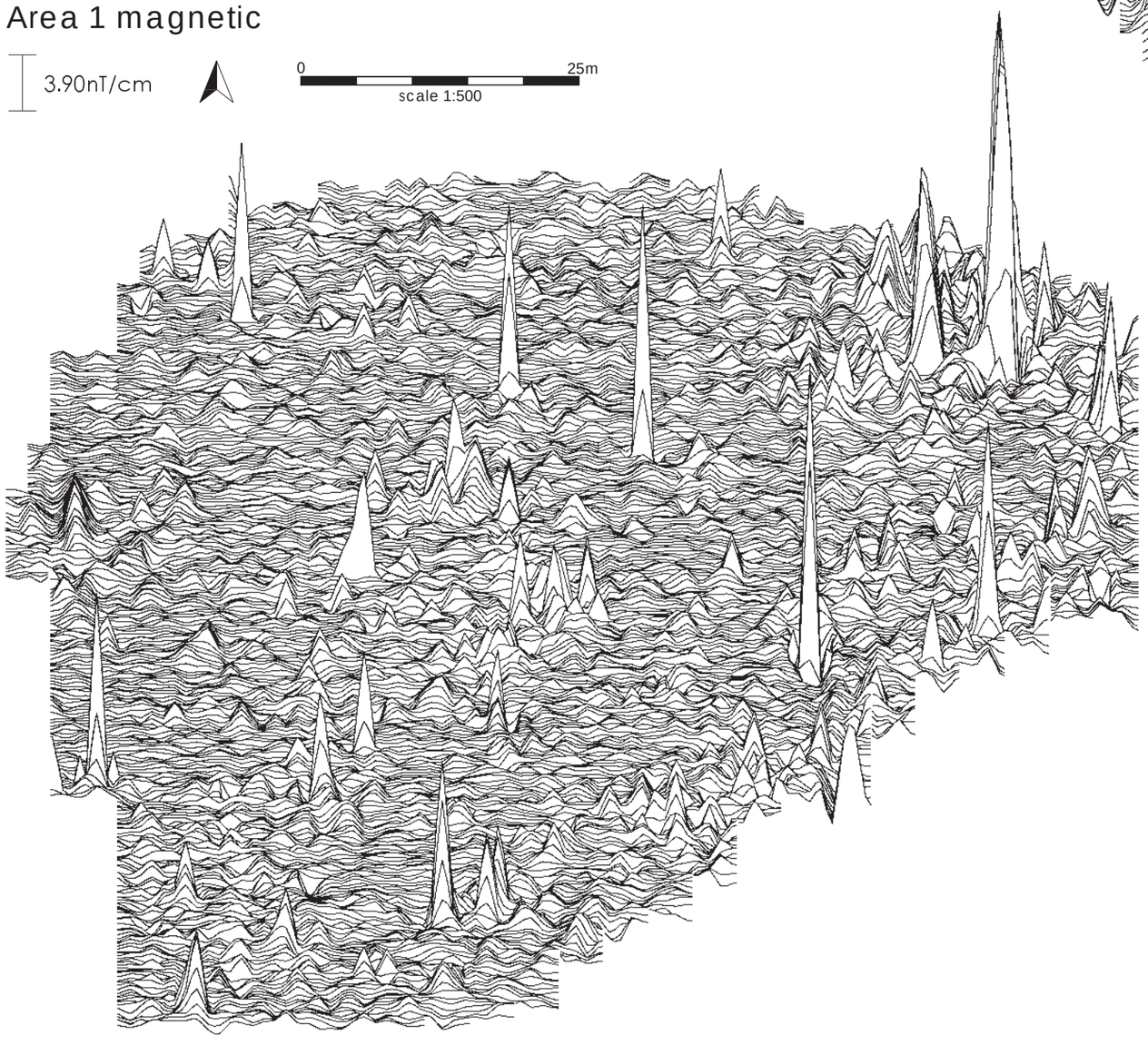
geophysical survey
report 2631

Figure 6:
Trace plots of geophysical data

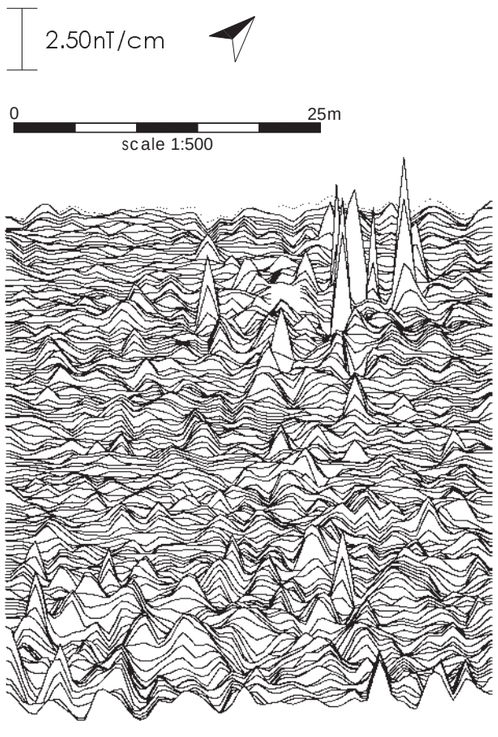
Area 1 resistance



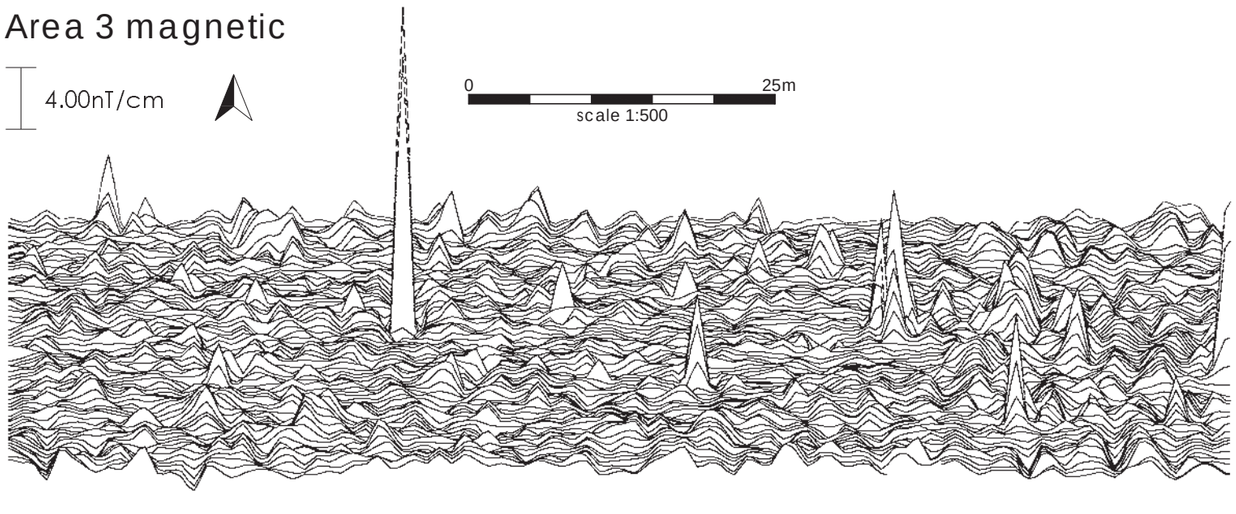
Area 1 magnetic



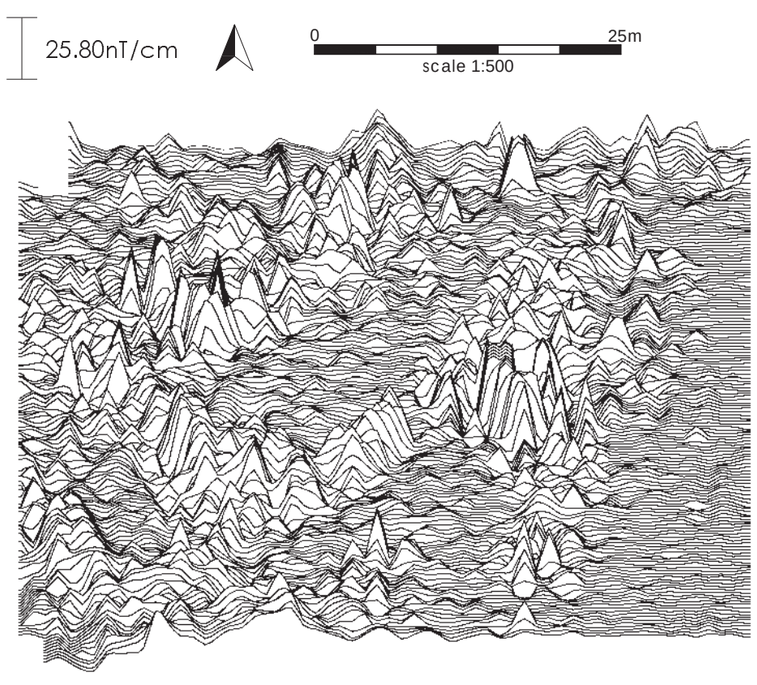
Area 2 magnetic



Area 3 magnetic



West Hagg magnetic



West Hagg resistance