Archaeological Services
University of Durham

Joseph Rowntree School, New Earswick, York

geophysical surveys

on behalf of
On-Site Archaeology

Report 1668
2007

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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 The Joseph Rowntree School, New Earswick, York. The works comprised five geomagnetic surveys across a study area of approximately 12ha.

1.2 The works were commissioned by On-Site Archaeology and conducted by Archaeological Services in accordance with instructions provided by On-Site Archaeology.

Results

1.3 Features of potential archaeological interest were detected in Area 1.

1.4 Former gardens and existing land drainage schemes where also detected.

1.5 Identification of features of potential archaeological interest was hampered in other parts of the proposed development area due to landscaping, various ferrous materials and presumed chemical treatments of the northern fields.

2. Project background

Location (Figure 1)

2.1 The study area is located at Joseph Rowentree School, Haxby Road, New Earswick, York (NGR: SE 6106 5614). The study area was divided into four separate playing fields within the school grounds and a separate meadow located to the south of the school.

Development proposal

2.2 The surveys have been carried out in response to proposals for new school buildings to be constructed to the east of the present structures.

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 advance of development.

Methods statement

2.4 The surveys have been undertaken in accordance with instructions provided by On-Site Archaeology.

Dates

2.5 Fieldwork was undertaken between 21st and 30th May 2007. This report was prepared between 31st May and 12th June 2007.

Personnel

2.6 Fieldwork was conducted by Graeme Attwood (Supervisor) and Richie Villis. This report was prepared by Graeme Attwood with illustrations by Janine Wilson. The Project Manager was Duncan Hale.

Archive/OASIS

2.7 The site code is **YJR07**, for **Y**ork **J**oseph **R**owntree School 20**07**. 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 **archaeol3-27591**.

Acknowledgements

2.8 Archaeological Services is grateful for the assistance of the staff of Joseph Rowntree School, and personnel of the Joseph Rowntree Housing Trust in facilitating this scheme of works.

3. Archaeological and historical background

3.1 The site of a possible Roman settlement, approximately 1500m south of the school, was partially excavated in 1926-29.

3.2 Ridge and furrow remains are visible in the field to the south of the school.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised four school playing fields and a meadow to south owned by Joseph Rowntree Housing Trust. The northernmost school playing fields contained several sets of sockets for football goalposts while the other school playing fields contained items such as long-jump pits, all of which are visible in the survey.

4.2 The survey area was predominantly level at a mean elevation of *c*.16m OD.

4.3 The underlying solid geology of the area comprises Permain and Triassic sandstones, which are overlain by lacustrine clays silts and sands.

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 1995); 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 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 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 each survey area and tied-in to known, mapped Ordnance Survey points using a Leica GS50 global positioning system (GPS) with real-time correction.

5.6 Measurements of vertical geomagnetic field gradient were determined using Bartington Grad601-2 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 3-5; the trace plots are provided in Appendix I. 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.
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 Colour-coded geophysical interpretation plans 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.

Interpretation: features

5.11 Colour-coded archaeological interpretation plans are provided.

General comments

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 furrows, ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

5.13 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 plans, however, they have been omitted from the archaeological interpretation plans and the following discussion. Various other items around the school playing fields have been detected as dipolar anomalies; these included amongst others goalpost sockets, the artificial cricket wicket and long-jump pits.

Area 1

5.14 A square of dipolar magnetic anomalies was detected, which may reflect a former sports surface or clinker hard standing, although nothing of this nature was visible from the surface. This 'sports surface' is surrounded by two series of parallel positive magnetic anomalies reflecting an extensive herring-bone field drainage system. This drainage system may be associated with a service which was detected as a chain of dipolar magnetic anomalies orientated northwest-southeast. A second service was detected orientated broadly northeast-southwest; this also corresponds to a field boundary shown on the 1938 Ordnance Survey 1:2500 county series map.

5.15 A row of brick-built garages has caused an area of dipolar magnetic anomalies on the southern edge of the survey area.

5.16 Both positive and negative magnetic anomalies aligned broadly east-west have been detected, which almost certainly reflect ridge and furrow cultivation of this area.

5.17 A negative magnetic linear anomaly, also evident on aerial photographs has been detected in the eastern half of the survey area aligned northwest-southeast; this may be a service associated with the sewage pump house that lies within the school grounds.

5.18 An 'L' shaped positive magnetic anomaly has been detected in the north-eastern part of the survey; this may reflect a soil-filled feature possibly a ditch.

Area 2

5.19 There are several large areas of dipolar magnetic anomalies around the edge of the survey area, which reflect various magnetic items including a prefabricated classroom, sewage pump house, magnetic fence, long-jump runway and pit, pole vault socket, hammer throw circle and hockey goals.

5.20 Two series of parallel positive magnetic anomalies with a central spine almost certainly reflect an extensive herring-bone field drainage system.

Area 3

5.21 The metal boundary fence and adjacent prefabricated classroom are both evident as dipolar magnetic anomalies.

5.22 A grid of positive magnetic anomalies has been detected in this area. These anomalies correspond to a series of paths associated with former gardens which are shown within the school grounds on the 1:2500, 1968 edition Ordnance Survey Map.

Areas 4 and 5

5.23 Several sets of football goalpost sockets, the boundary fence and the artificial cricket wicket have been detected as dipolar magnetic anomalies.

5.24 Across the rest of the survey areas a positive magnetic texture has been detected. Although this is of unknown origin it is almost certainly modern and associated with the maintenance of the playing fields (such as chemical treatment for the grass), as it seems to respect areas such as the cricket wicket.

6. Conclusions

6.1 Fluxgate gradiometer surveys have been undertaken across the playing fields of the Joseph Rowntree School and the field to the south of the school.

6.2 Features of potential archaeological interest were detected in Area 1.

6.3 Former gardens and existing land drainage schemes where also detected.

6.4 Identification of features of potential archaeological interest was hampered in other parts of the proposed development area due to landscaping, various ferrous materials and presumed chemical treatments of the northern fields.

7. Sources

David, A, 1995 *Geophysical survey in archaeological field evaluation,* 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 surveys

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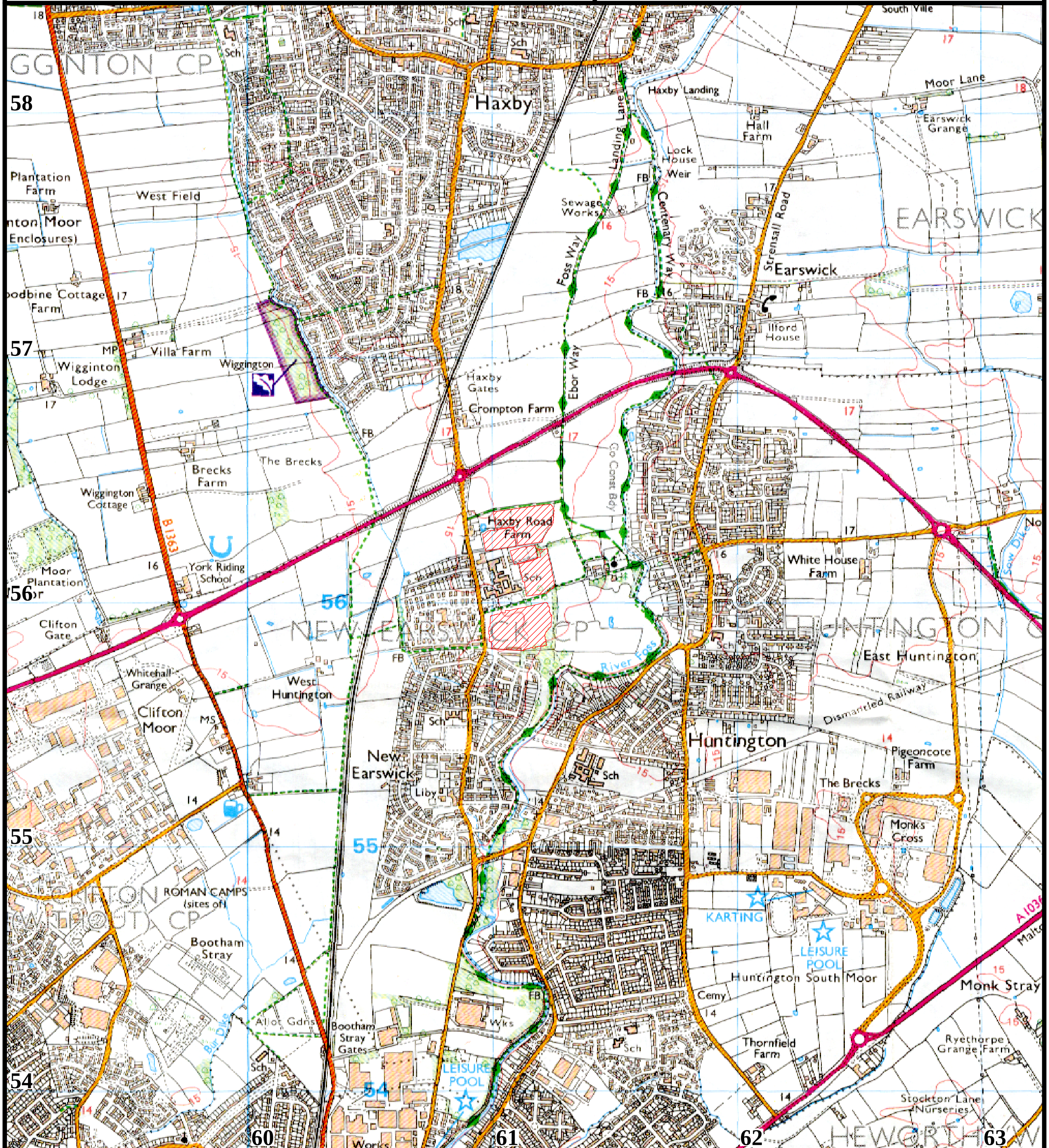

geophysical survey areas

0 1km

scale 1:25 000 - for A4 plot

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Figure 2
Location of geophysical surveys

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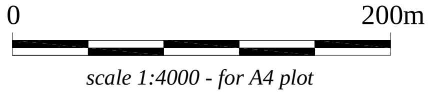

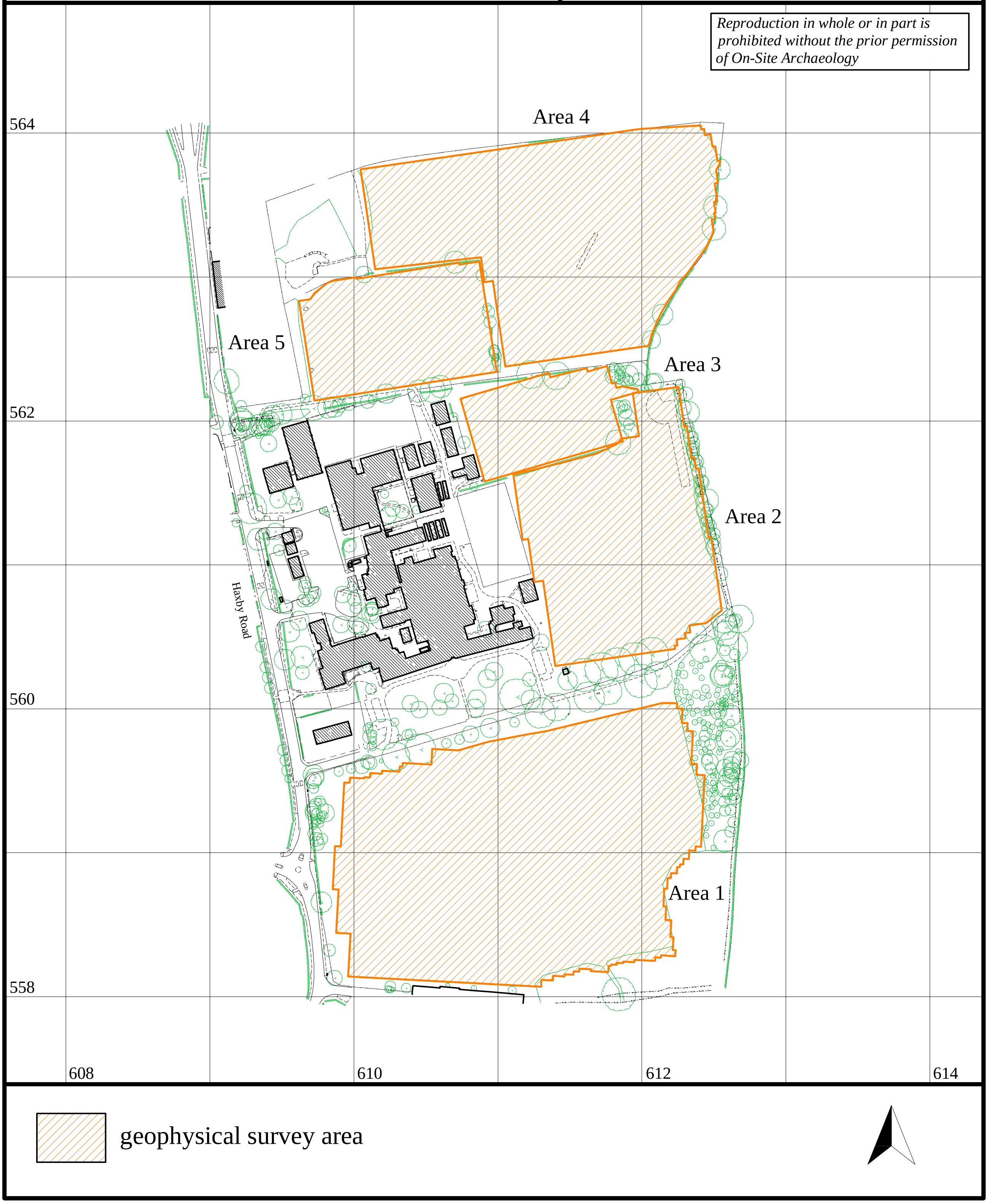

3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
-1.00
-1.50
-2.00
-2.50
-3.00 nT

0 50m

scale 1:1000 - for A1 plot

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Figure 3

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Figure 4

Geophysical interpretations

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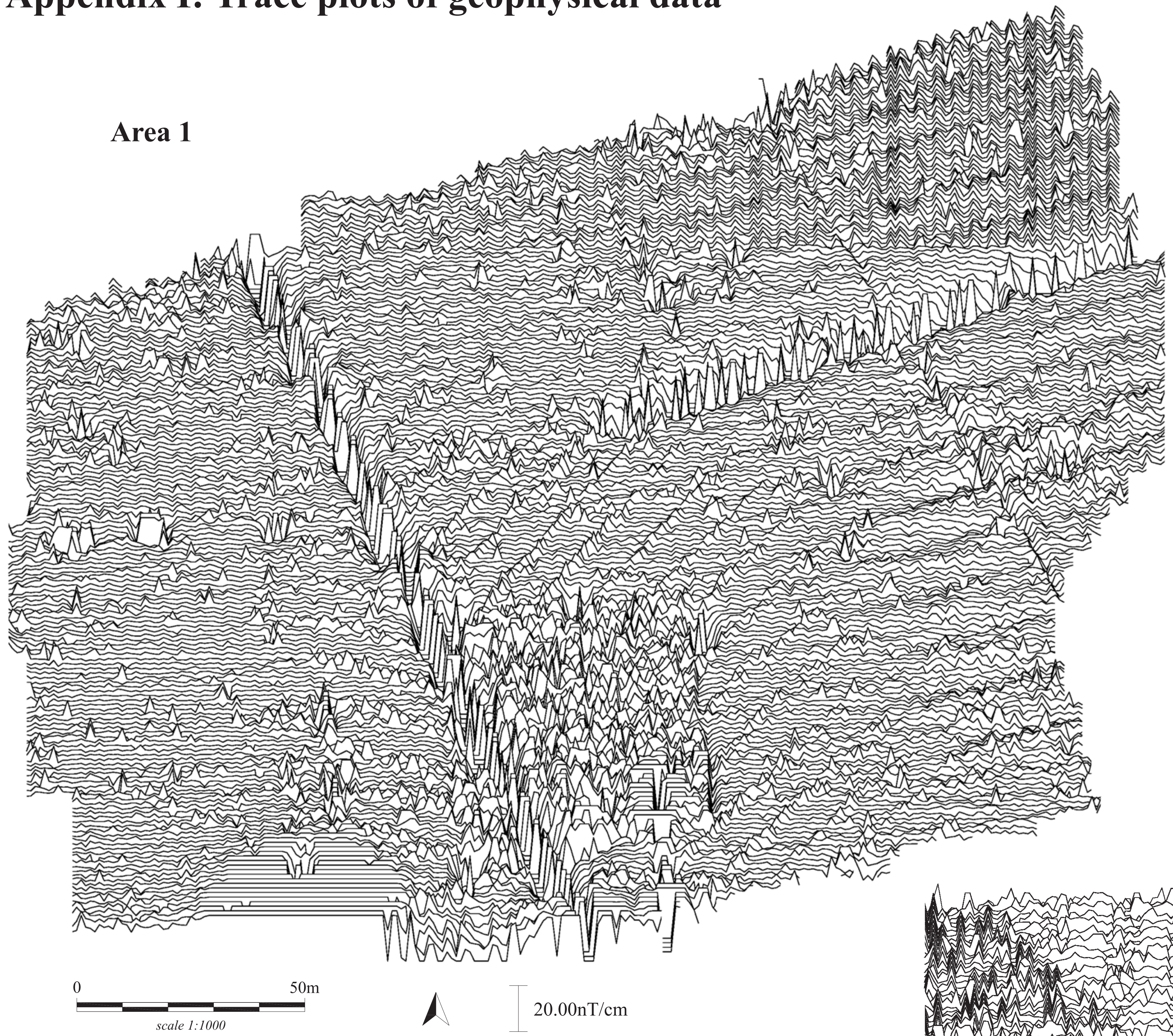
Figure 5

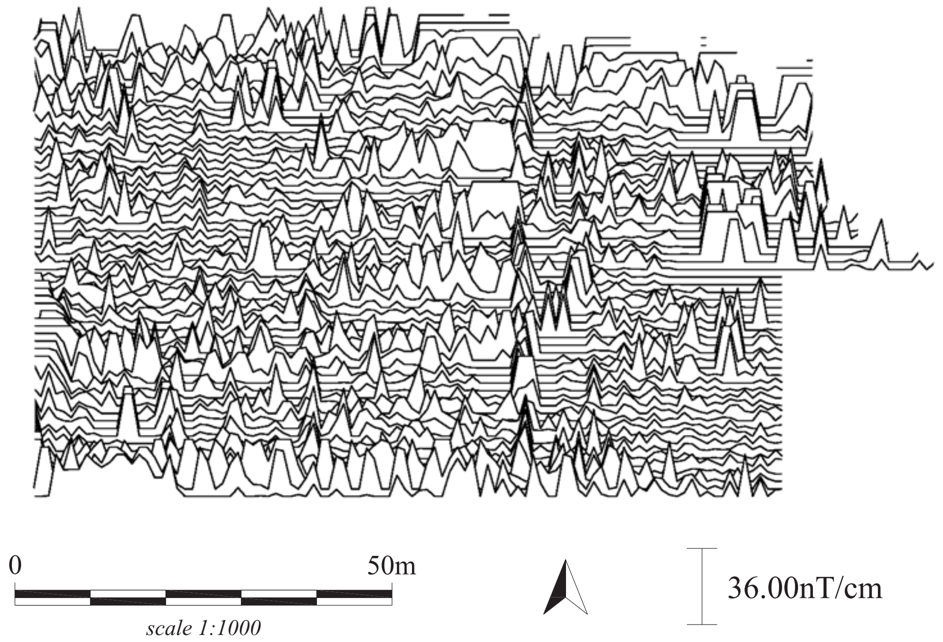
Archaeological interpretations

Appendix I: Trace plots of geophysical data

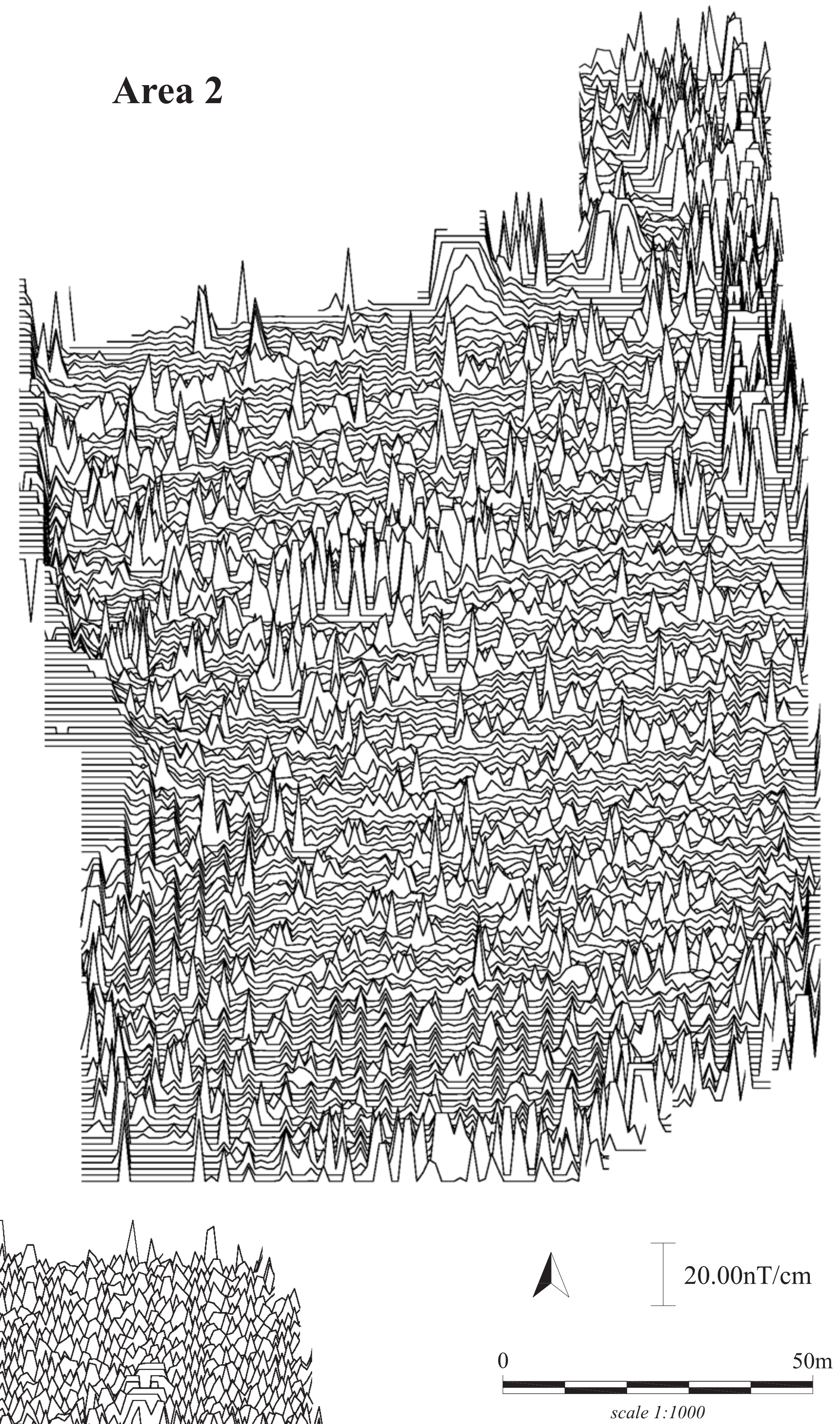
Area 1



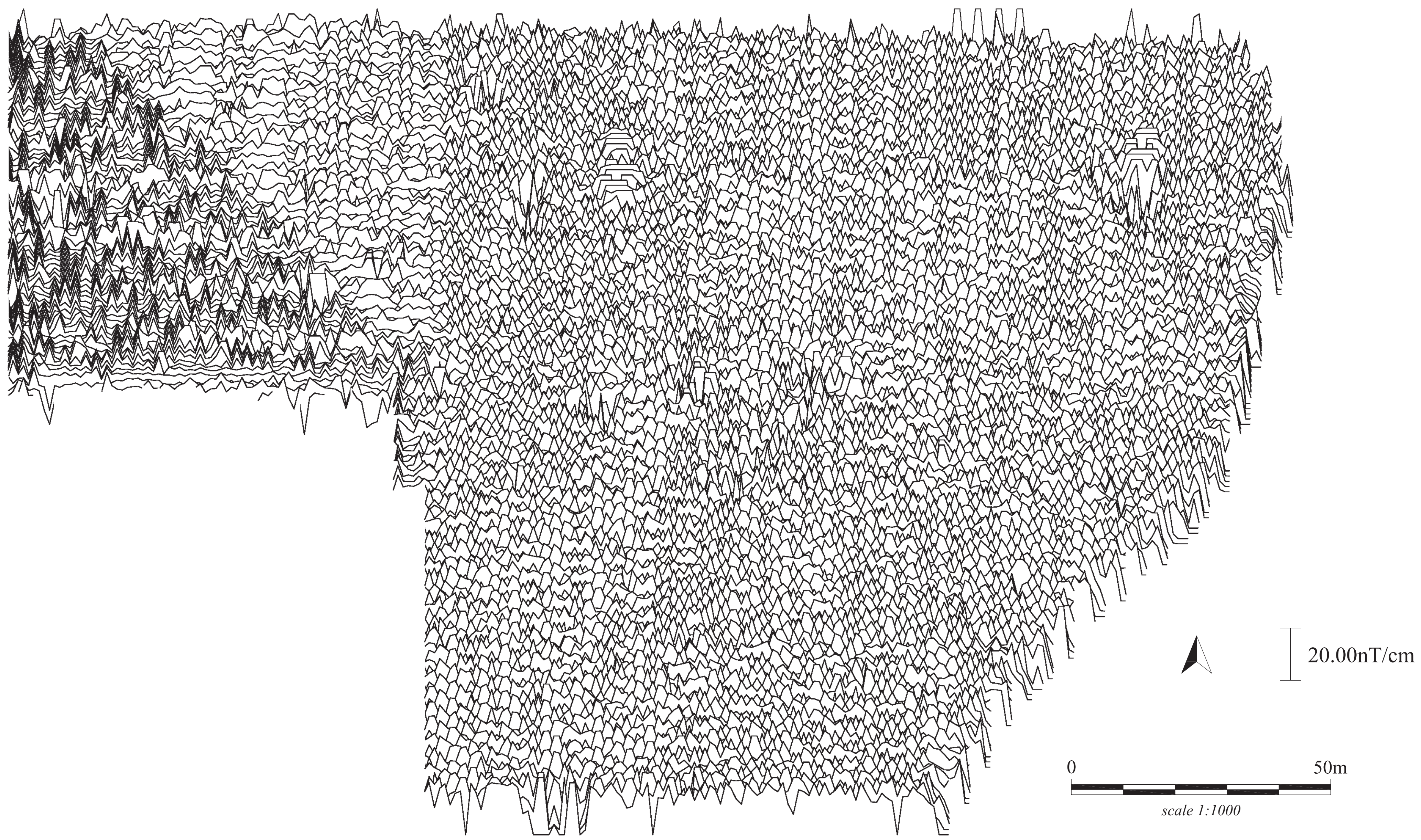
Area 3



Area 2



Area 5



Area 4