ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
The Northumberland Estates

Lloyds Field
Alnwick
Northumberland

geophysical survey

report 3039
December 2012

Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of a geophysical survey conducted in advance of proposed development at Lloyds Field, Alnwick, Northumberland. The works comprised the geomagnetic survey of 3.8ha of arable farmland.

1.2 The works were commissioned by The Northumberland Estates and conducted by Archaeological Services Durham University.

Results

1.3 Probable traces of former ridge and furrow cultivation were identified across the survey area.

1.4 Probable land drains were detected in the western part of the survey area.

2. Project background

Location (Figure 1)

2.1 The proposed development area was located at Lloyds Field, Alnwick, Northumberland (NGR centre: NU 2036 1240). One survey totalling 3.8ha was conducted in one land parcel. To the north is the line of the dismantled North Eastern Railway, to the west is the Aln Valley Railway Museum and the A1 road. To the east the ground slopes sharply down to the Willow Burn and to the south the area is bounded by mature trees.

Development proposal

2.2 The development proposal is for a static caravan site.

Objective

2.3 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 relation to the development.

Methods statement

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

Dates

2.5 Fieldwork was undertaken on 15th November2012. This report was prepared for 14th December 2012.

Personnel

2.6 Fieldwork was conducted by Ashley Hayes, Natalie Swann (Supervisor) and Nathan Thomas. The geophysical data were processed by Natalie Swann. This report was prepared by Natalie Swann, with illustrations by David Graham, and edited by Duncan Hale, the Project Manager.

Archive/OASIS

2.7 The site code is **ALF12**, for **A**lnwick **L**loyds **F**ield 20**12**. 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 **archaeol3-137870**.

3. Historical and archaeological background

3.1 An archaeological desk-based assessment was conducted for the proposed development area (Archaeological Services 2012); the results of that assessment are summarised here.

3.2 There is no direct evidence for prehistoric or Roman activity within the study area, but the presence of activity in the surrounding vicinity indicates that an as yet unidentified resource has the potential to exist.

3.3 The area lay outside the medieval settlement at Alnwick and there is evidence to suggest it was part of Cawledge Park and also agricultural land during the medieval and post-medieval periods. Archaeological deposits relating to agricultural activity may survive on the site.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised a single field of seeded arable land.

4.2 The area was predominantly level with a mean elevation of approximately 60m OD. The land drops to the east where the valley of the Willow Burn descends to 15m OD. The cutting of a former railway line extends along the north of the site.

4.3 The solid geology of the area comprises Tournaisian and Viséan Lower Carboniferous Middle Limestones, with an intrusive dyke of igneous basalt, dolerite and camptonite rising to the south of Alnwick. The superficial geology comprises Devensian 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 the desk-based assessment, 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) could 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 the survey area and related to known, mapped Ordnance Survey points and the National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm 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 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 a continuous tone greyscale image and a trace plot of the raw (minimally processed) data. The greyscale images and interpretations are presented in Figures 2-5; the trace plot is 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 the geomagnetic 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
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. 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 A series of broad, weak, parallel positive magnetic anomalies has been detected across this survey area aligned approximately north-east/south-west. The slightly curving nature of these anomalies suggests that they are likely to reflect former ridge and furrow cultivation of this area.

5.13 Three linear positive magnetic anomalies have been detected aligned approximately north-east/south-west in the western part of the survey area; these anomalies are likely to reflect land drains.

5.14 Two further linear positive magnetic anomalies were detected on a similar alignment to the ridge and furrow, but much straighter in nature. These anomalies probably also reflect former drainage ditches or land drains.

5.15 The only other anomalies detected here are small, discrete dipolar magnetic anomalies. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments. The concentration of dipolar anomalies in the north-east corner of the survey area reflects a spread of rubble around a gate.

6. Conclusions

6.1 3.8ha of geomagnetic survey was undertaken at Lloyds Field, Alnwick, Northumberland, prior to proposed development.

6.2 Probable traces of former ridge and furrow cultivation were identified across the survey area.

6.3 Probable land drains were detected in the western part of the survey area.

7. Sources

Archaeological Services 2012 *Lloyds Field, Alnwick, Northumberland: archaeological desk-based assessment.* Unpublished report **2958**, Archaeological Services Durham University

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 2011 *Standard and Guidance for archaeological geophysical survey*. Institute for Archaeologists

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

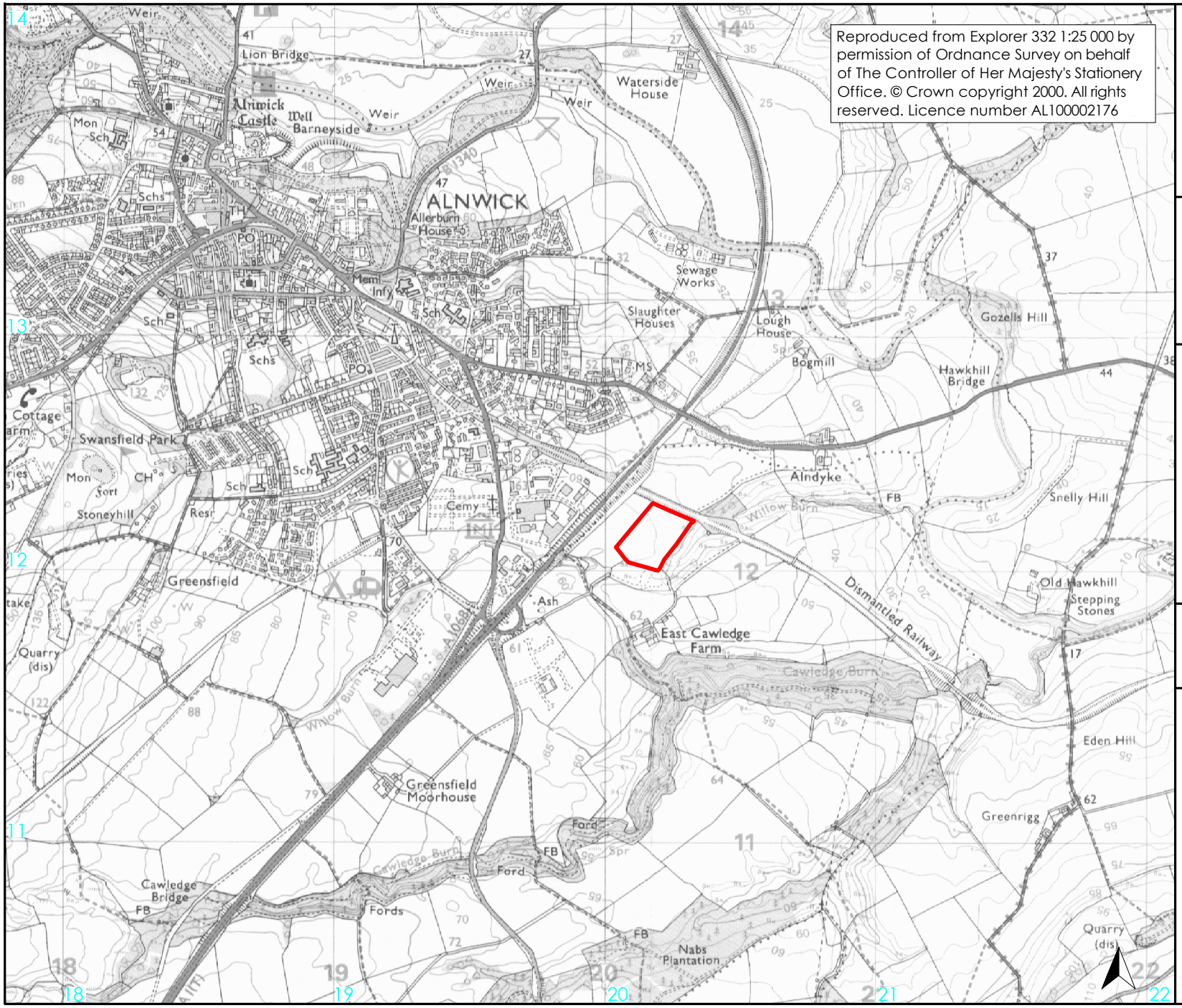

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Figure 1: Site location

0 1km
scale 1:20 000 for A4 plot

site location

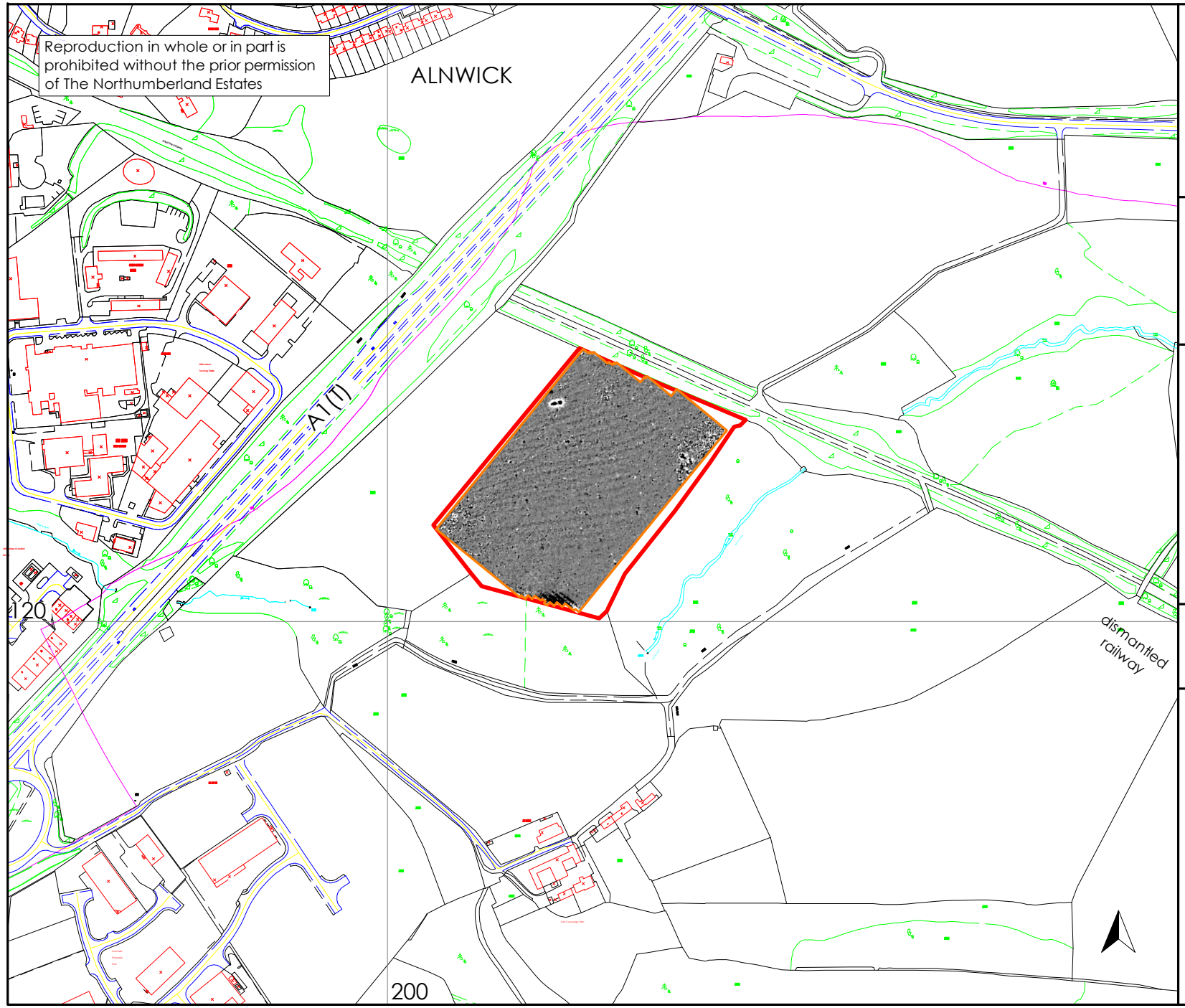

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Figure 2: Survey area

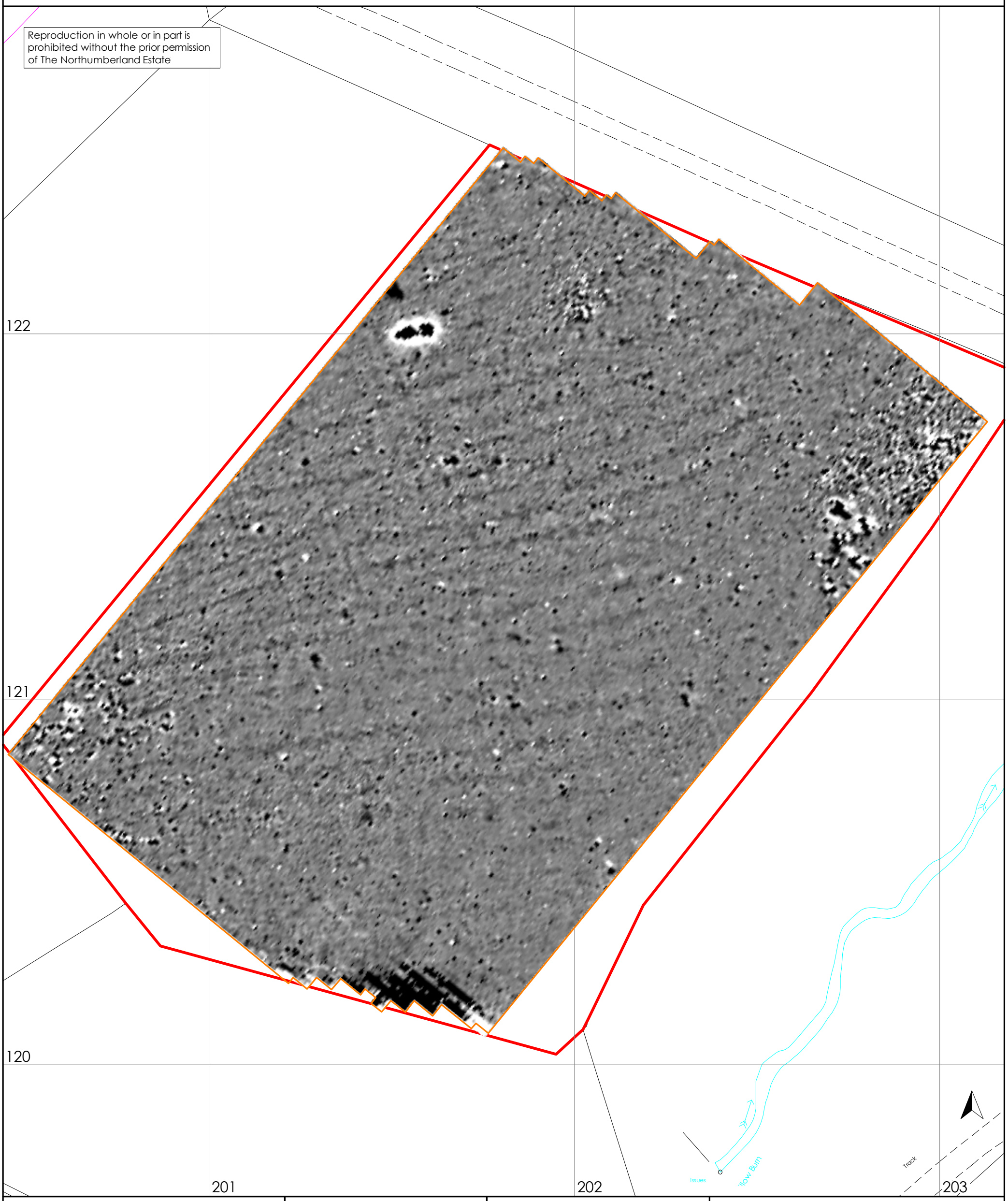
0 250m
scale 1:5000 for A4 plot

proposed development area

survey area

magnetic survey

-8 nT 8



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0 50m
scale 1:1000 for A3 plot

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Figure 3: Geophysical survey

magnetic survey

dipolar magnetic anomaly

negative magnetic anomaly

positive magnetic anomaly

122

121

120

201

202

203

Issues

Track

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0 50m
scale 1:1000 for A3 plot

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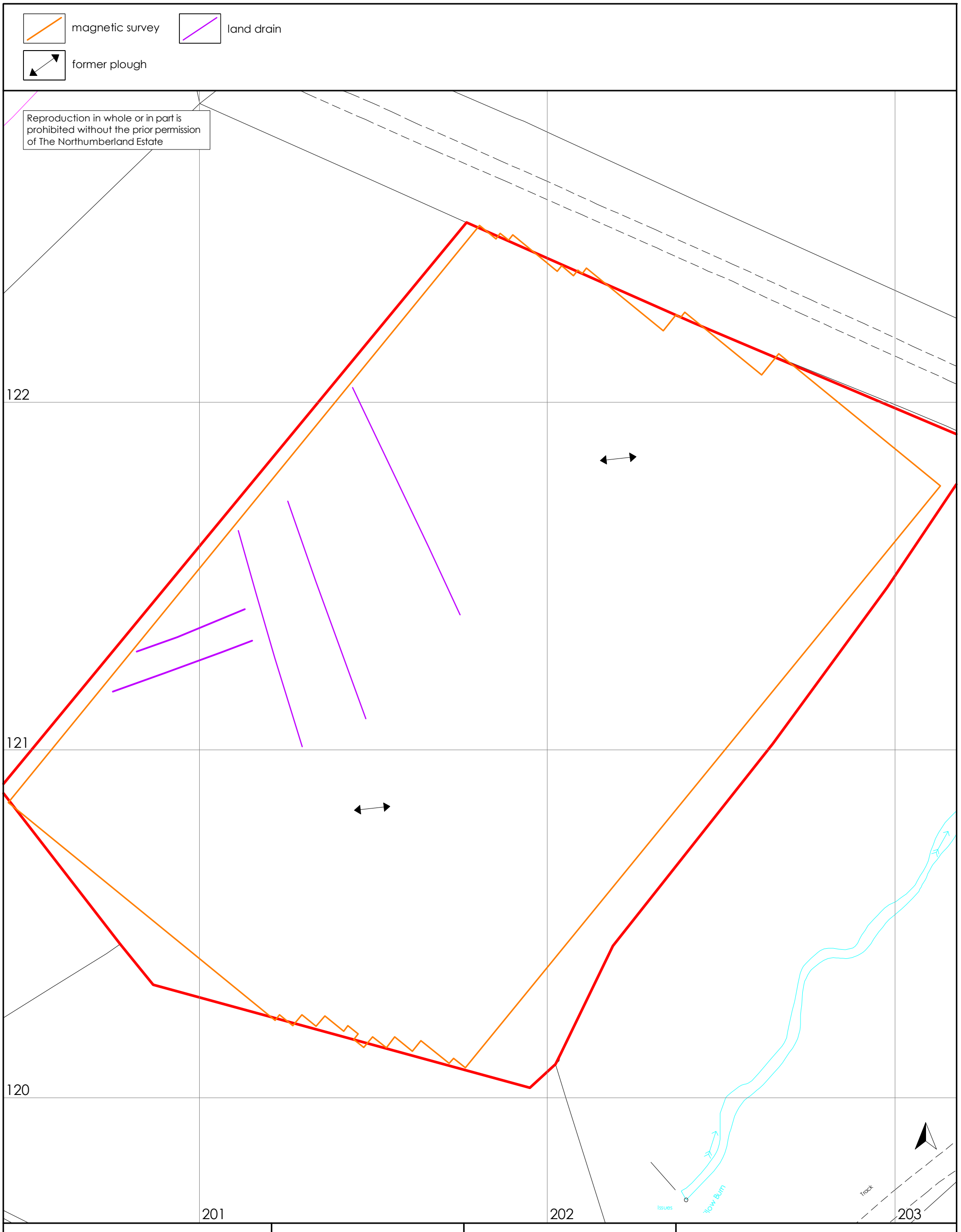
Figure 4: Geophysical interpretation



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0 50m
scale 1:1000 for A3 plot

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Figure 5: Archaeological interpretation

28.70nT/cm

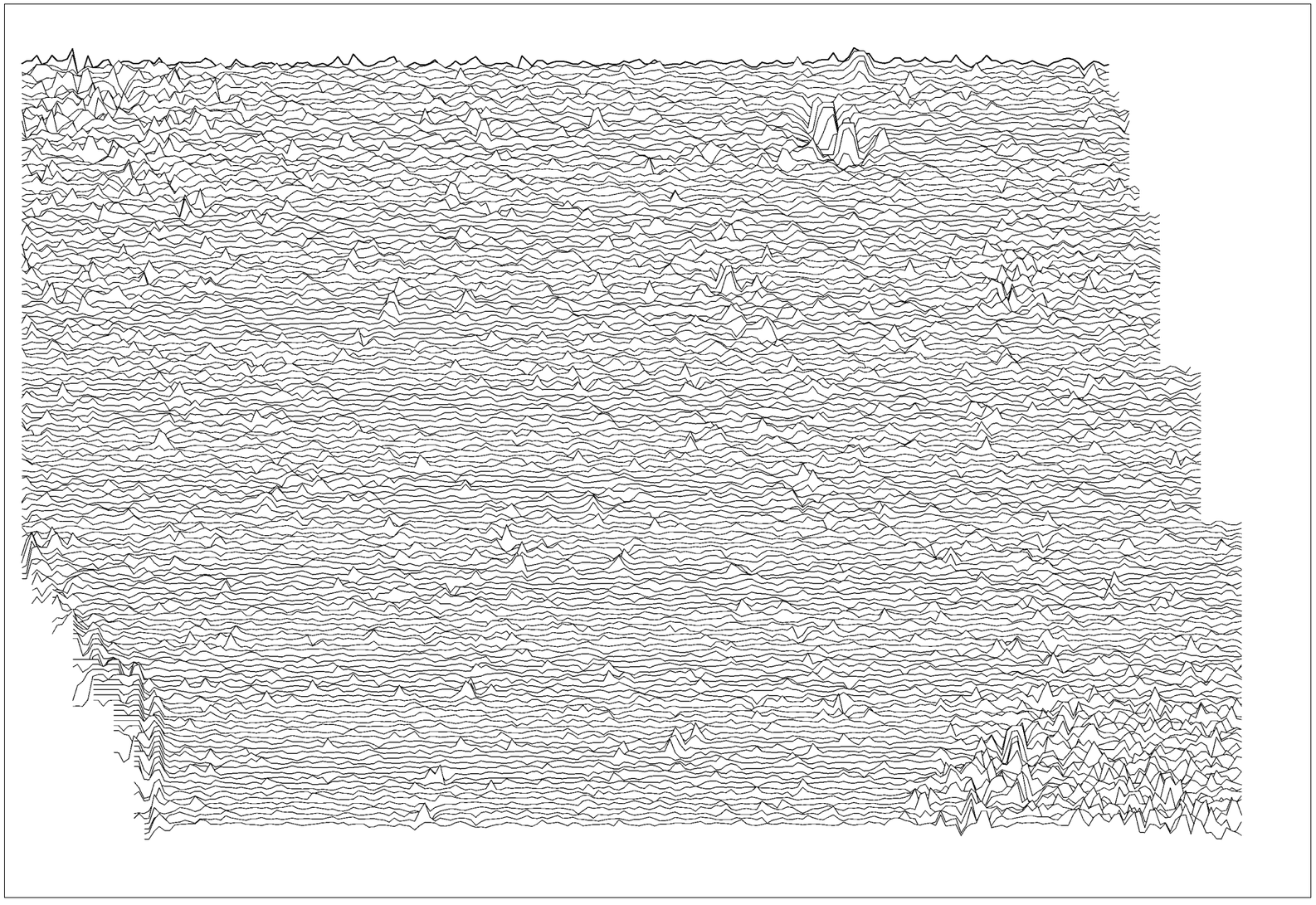

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Figure 6: Trace plot of geomagnetic data

0 50m
scale 1:1000 for A3 plot