ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

for
CgMs Consulting
on behalf of
EnergieKontor

Asserby Wind Farm
Lincolnshire

geophysical survey

report 3274
November 2013

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 the proposed development of a wind farm at Asserby in Lincolnshire. The works comprised the geomagnetic survey of four areas totalling approximately 4ha.

1.2 The works were commissioned by CgMs Consulting, on behalf of EnergieKontor, and conducted by Archaeological Services Durham University.

Results

1.3 The probable course of a former drain has been identified in Area 1.

1.4 Anomalies reflecting probable former ditches and drains have been detected in Area 3, together with a relatively high concentration of ferrous and fired debris. These anomalies are almost certainly associated with the former buildings and other features shown as 'Low Barn' on Ordnance Survey maps until the 1970s.

1.5 No other features of likely archaeological interest have been identified.

2. Project background

Location (Figure 1)

2.1 The survey areas lie to the south of the farming hamlet of Asserby, in the parish of Bilsby, approximately 4km east of Alford and 2km west of Huttoft, East Lindsey district, Lincolnshire (NGR centre: TF 4977 7635).

2.2 Surveys measuring 1ha each were undertaken at four locations either side of the Boy Grift Drain.

Development proposal

2.3 The proposal is to construct a four-turbine wind farm. Each 1ha survey area was centred on a proposed turbine location.

Objective

2.4 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 proposed development.

Methods statement

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

Dates

2.6 Fieldwork was undertaken on the 14th and 15th October 2013. This report was prepared for November 2013.

Personnel

2.7 Fieldwork was conducted by Duncan Hale (the Project Manager) and Jonny Dye. Geophysical data processing and report preparation was by Duncan Hale, with illustrations by Janine Watson.

Archive/OASIS

2.8 The site code is **AWF13**, for **A**sserby **W**ind **F**arm 20**13**. 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 **Acces**S to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-163379**.

3. Historical and archaeological background

3.1 A 'Cultural Heritage Desk-Based Assessment' is in preparation (CgMs forthcoming).

3.2 Earthworks near the hamlet of Asserby indicate that the present settlement may be a shrunken medieval village. However, unlike the nearby settlements of Bilsby and Thurlby, it is not mentioned in the Domesday Book and it did not have its own church.

3.3 Ordnance Survey (OS) map editions from the 1890s to the 1970s indicate that a drain used to cross Area 1, aligned broadly east-west.

3.4 OS map editions from the same period show that 'Low Barn' was present in the north-west part of Area 3; this appeared to comprise buildings, drains and other boundaries.

3.5 Early OS maps do not record any features within Areas 2 or 4.

4. Landuse, topography and geology

4.1 At the time of fieldwork the survey areas were in arable fields with a young cereal crop. It was not possible to collect data in the north-western corner of Area 3 due to the presence of a manure heap and standing water on a concrete platform, surrounded by an earth and rubble bund.

4.2 The land was predominantly level with only gentle topographic variation, at elevations between approximately 3-5m OD.

4.3 The underlying solid geology comprises Late Cretaceous chalk of the Welton Chalk Formation. In Areas 1-3 this is overlain by Holocene tidal flat deposits of clay and silt and in Area 4 the chalk is overlain by Devensian till.

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, it was considered possible that cut features such as ditches and pits could 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 depth 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 20m grid was established across each survey area and related to the Ordnance Survey 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 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.

5.7 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 2-6; the trace plots are provided in Figure 7. In the greyscale image, 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 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 (Areas 1, 3 & 4)
periodic filter	for removing striping effects in the traverse direction and removing grid edge discontinuities (Area 2)
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 A colour-coded archaeological interpretation plan is provided.

5.12 Series of very weak and narrow parallel magnetic anomalies, aligned north-north-east/south-south-west, have been detected across each survey area. These reflect the current plough regime at each location and are not shown on the interpretation drawings.

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 plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

Area 1 (Figure 3)

5.14 A band of positive magnetic anomalies has been detected aligned broadly east-west across the northern part of this area. This band of anomalies corresponds to the former location of a drain shown on OS maps until the 1970s. The anomalies almost certainly reflect materials used in the backfill of the drain.

5.15 With the exception of plough texture and small ferrous items, all the other anomalies detected here are very weak and diffuse and probably reflect natural variation with the tidal flat deposits across the area.

Area 2 (Figure 4)

5.16 With the exception of plough texture and small ferrous items, all the other anomalies detected here are very weak and diffuse and probably reflect natural variation with the tidal flat deposits across the area.

Area 3 (Figure 5)

5.17 Three linear positive magnetic anomalies have been detected in this area. These probably reflect soil-filled features, such as former ditches or drains, and are

probably associated with the former drains and land boundaries shown at 'Low Barn' on OS maps from the 1890s until the 1970s.

5.18 A relatively high concentration of small dipolar anomalies almost certainly reflects the increased presence of brick rubble and ferrous litter here, due to the former presence of the Low Barn buildings. It appears that some of the rubble from the buildings was used to construct the existing bund in the north-west of this survey area.

Area 4 (Figure 6)

5.19 The only anomalies detected in this area almost certainly reflect the current plough regime and a scatter of near-surface ferrous and fired litter.

6. Conclusions

6.1 Geomagnetic surveys have been undertaken at four proposed wind turbine locations near Asserby in Lincolnshire.

6.2 The probable course of a former drain has been identified in Area 1.

6.3 Anomalies reflecting probable former ditches and drains have been detected in Area 3, together with a relatively high concentration of ferrous and fired debris. These anomalies are almost certainly associated with the former buildings and other features shown as 'Low Barn' on Ordnance Survey maps until the 1970s.

6.4 No other features of likely archaeological interest have been identified.

6.5 The current plough regime has been detected in each area.

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 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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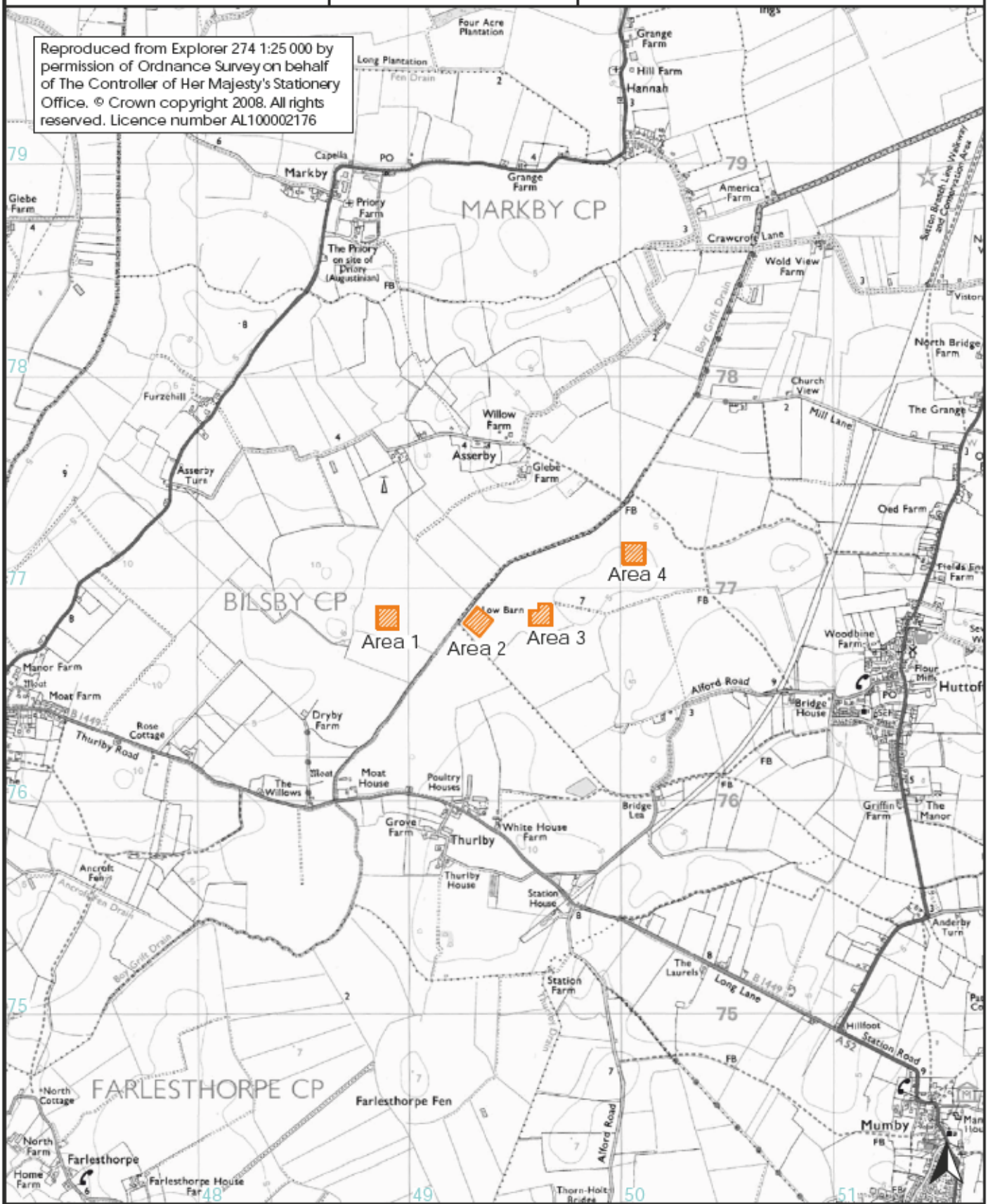
Figure 1: Site location



survey locations

0 1km
scale 1:25 000 for A4 plot

Farm

Glebe Farm

Mast

Drain

Area 1

Area 2

Area 3

Area 4

Sluice

Track

3m

770

490

500

SBY CP

Boy Grift Drain

South Fen Drain

Larkspur Cottage

0 250m

scale 1:5000 for A3 plot

magnetic survey

-6 nT 8

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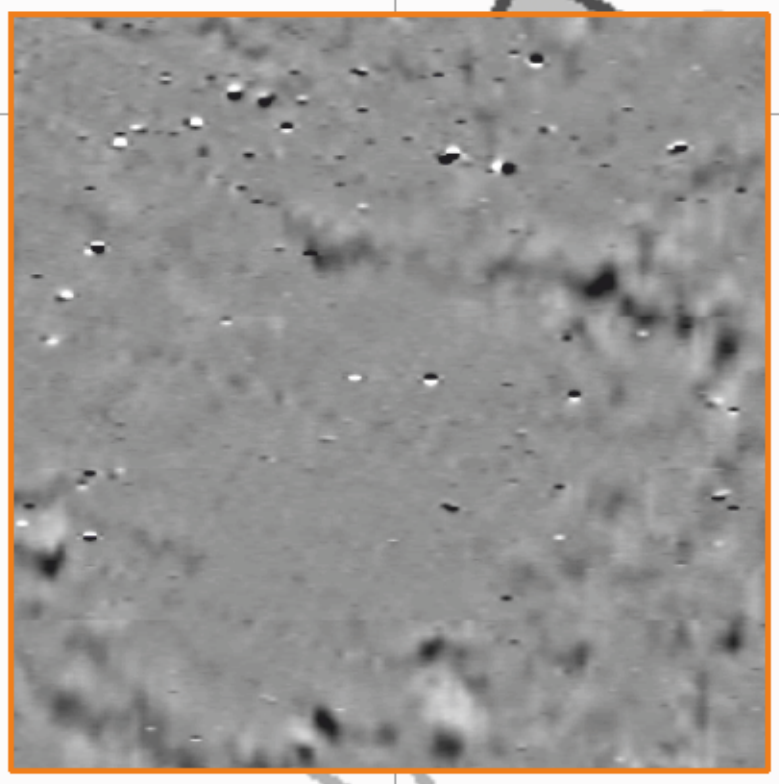
Figure 2: Geophysical survey overview

A



Area 1

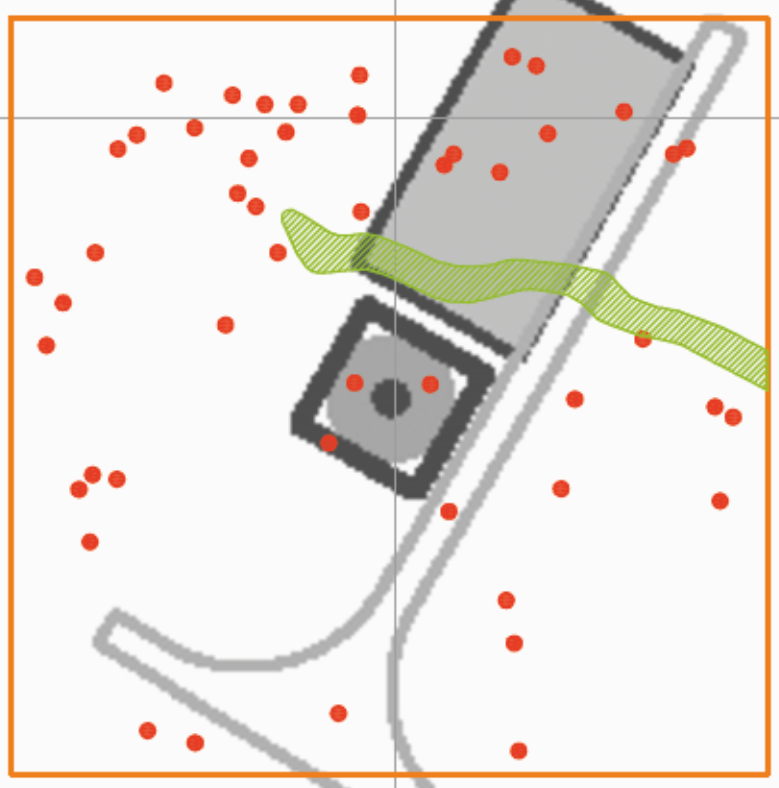
769

768

488

489

B



Area 1

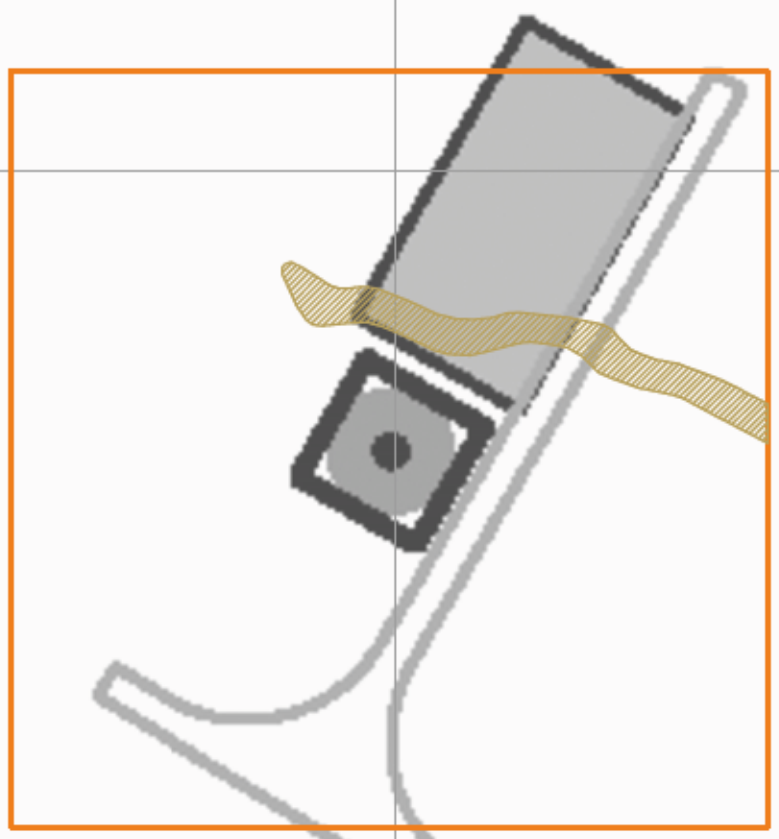
769

768

488

489

C



Area 1

769

768

488

489

magnetic survey

-6 nT 8

dipolar magnetic anomaly (B)

positive magnetic anomaly (B)

former drain (C)

0 50m

scale 1:1000 for A3 plot

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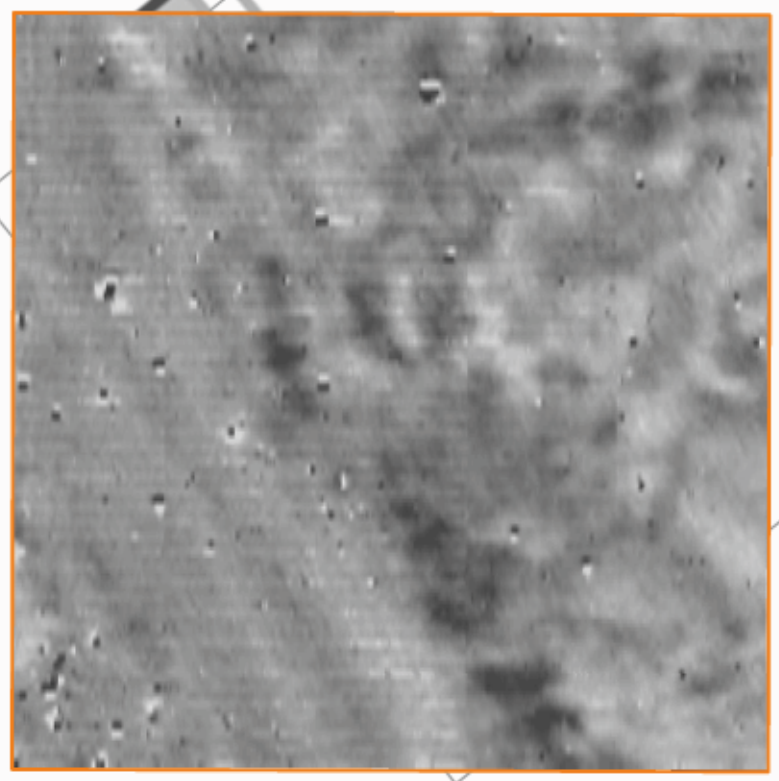
Figure 3: Area 1, geophysical survey and interpretation

A

Area 2



769

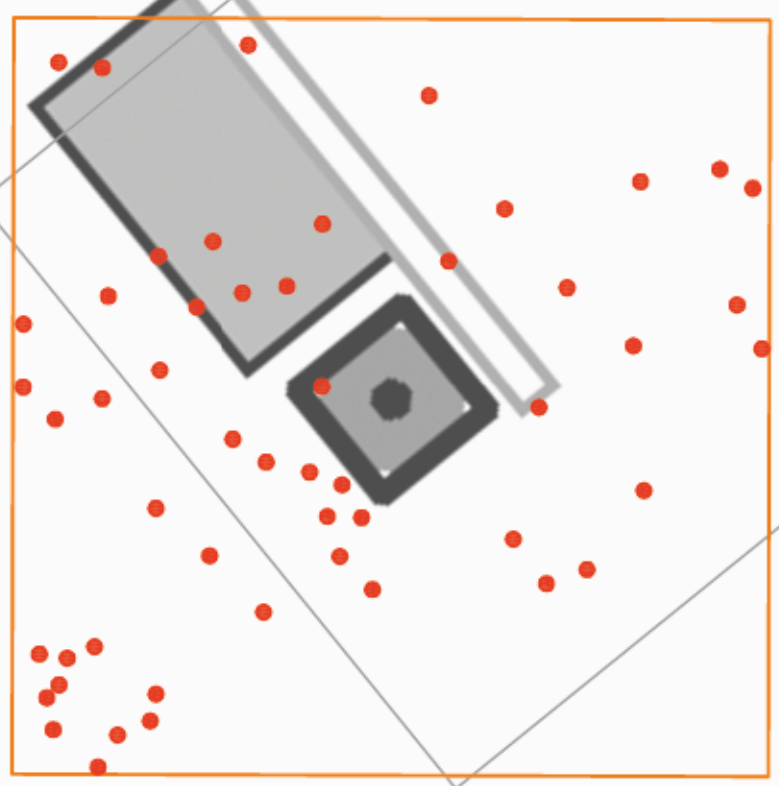
494

768

493

B

Area 2



769

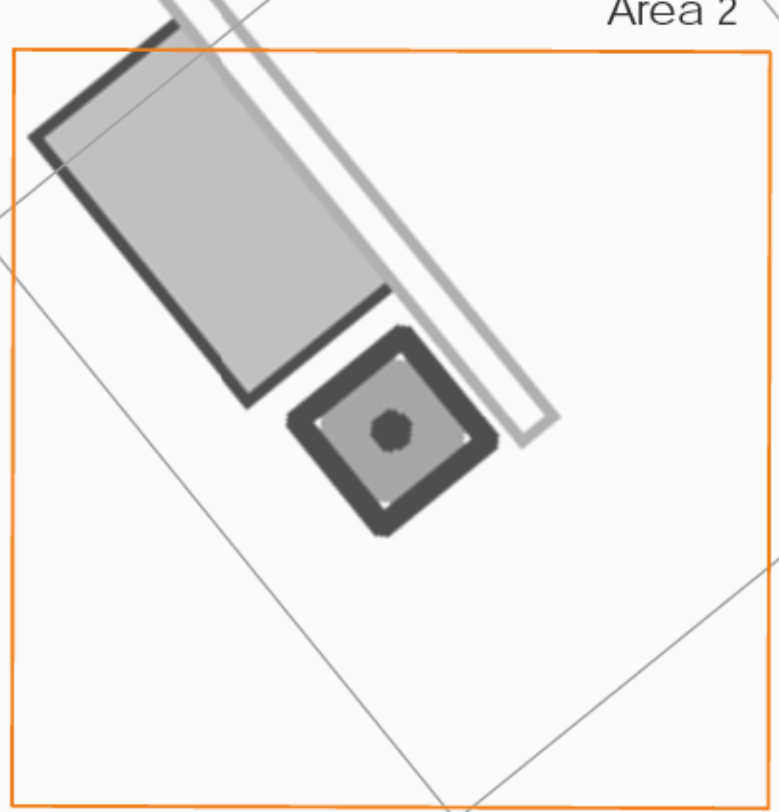
494

768

493

C

Area 2



769

494

768

493

magnetic survey

-6 nT 8

dipolar magnetic anomaly (B)

0 50m

scale 1:1000 for A3 plot

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Figure 4: Area 2, geophysical survey and interpretation

A

Area 3

769

496

497

B

Area 3

769

496

497

C

Area 3

769

496

497

magnetic survey

-6 nT 8

dipolar magnetic anomaly (B)

positive magnetic anomaly (B)

possible soil-filled ditch or drain (C)

0 50m

scale 1:1000 for A3 plot

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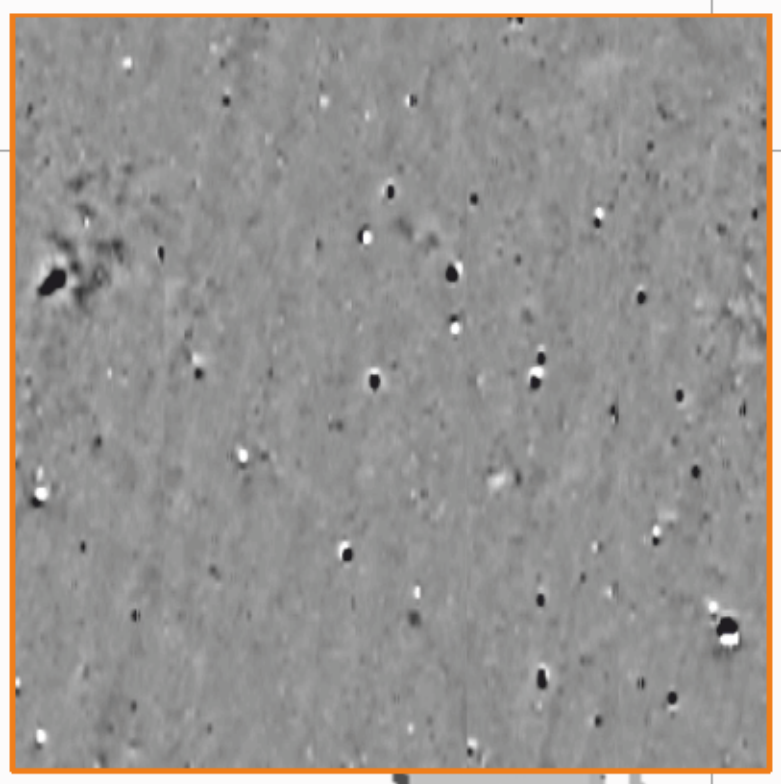
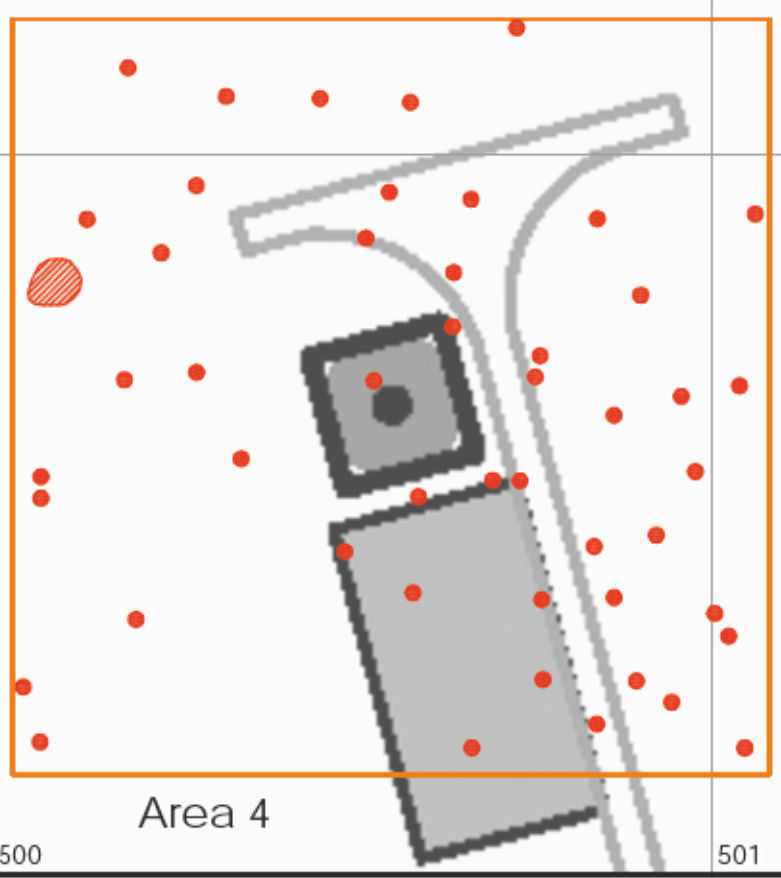
Figure 5: Area 3, geophysical survey and interpretation

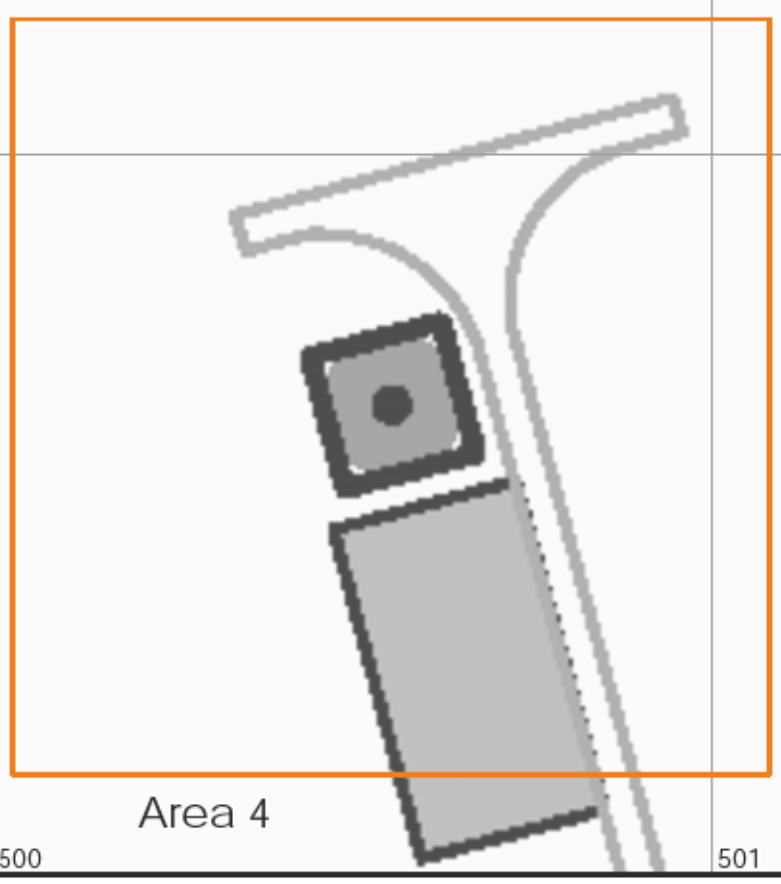
A



B



C



magnetic survey

-6 nT 8

dipolar magnetic anomaly (B)

0 50m

scale 1:1000 for A3 plot

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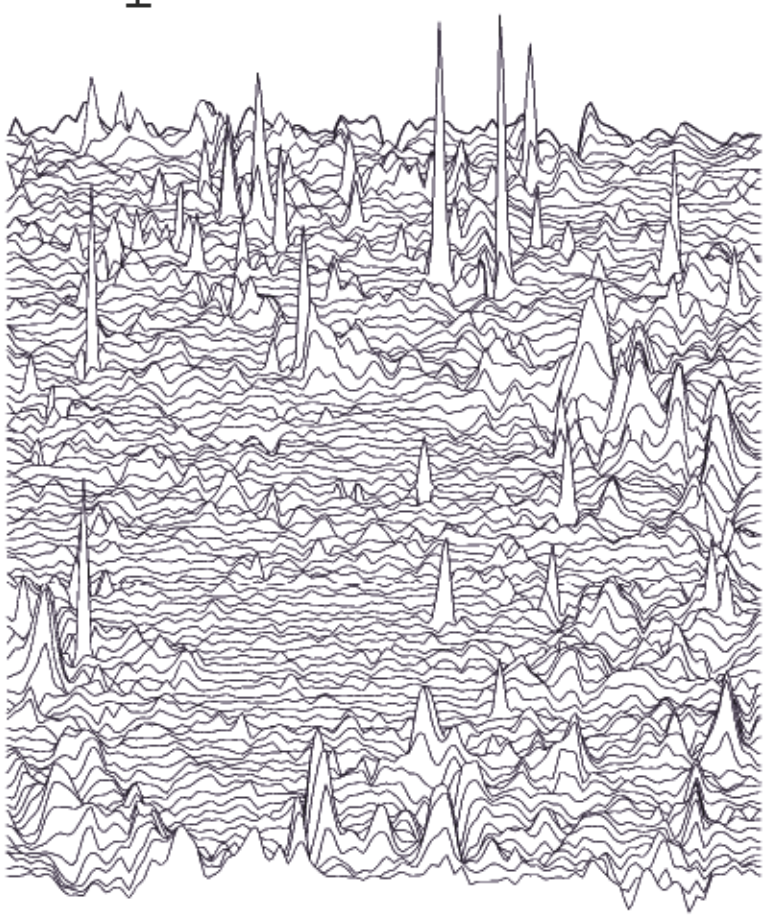
Figure 6: Area 4, geophysical survey and interpretation

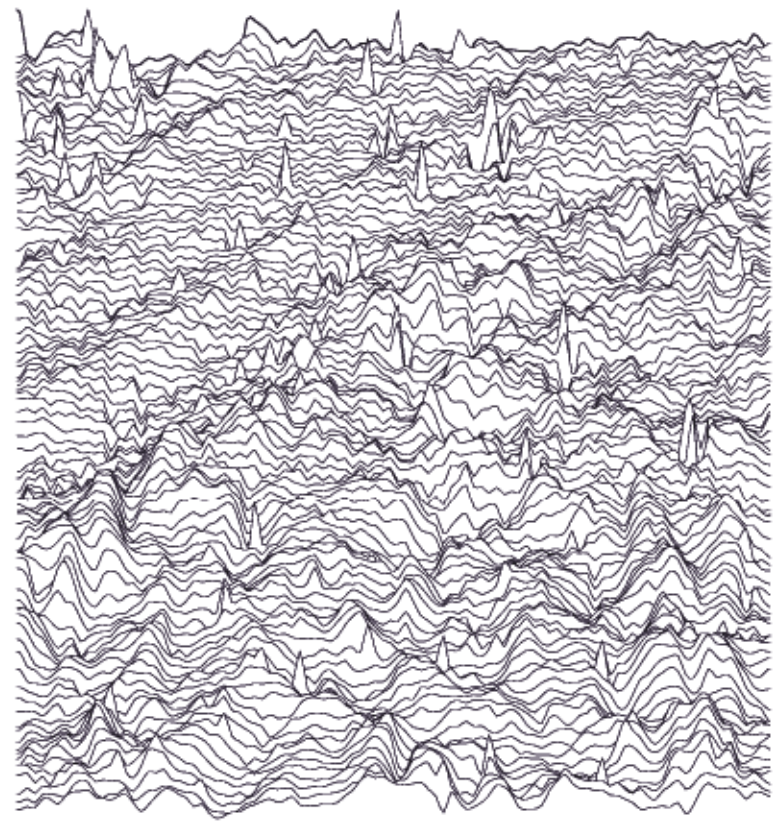
Area 1

5.40n /cm



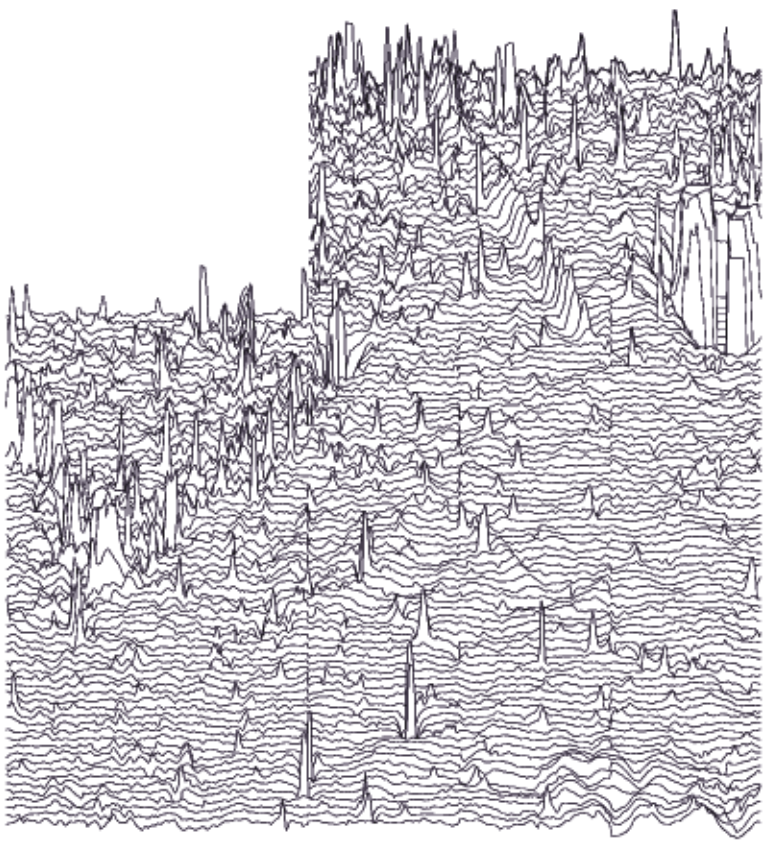
Area 2

.90n /cm



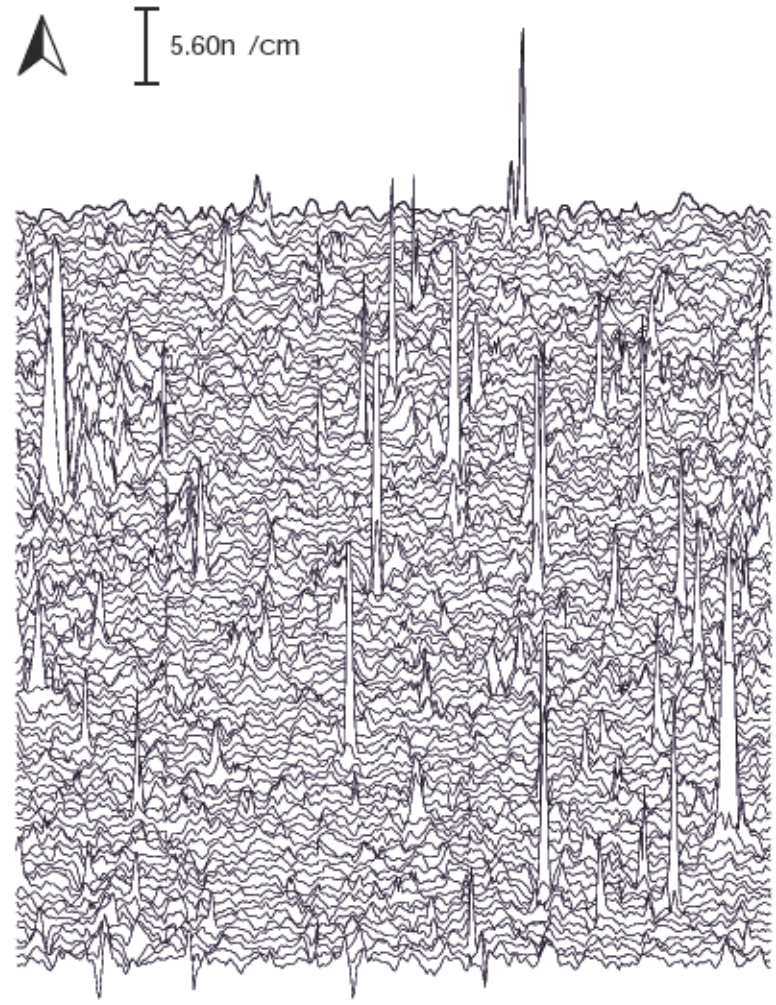
Area 3

20.00n /cm



Area 4

5.60n /cm



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0 50m
scale 1 1000 for A3 plot

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Figure 7 race plots of geomagnetic data