Archaeological Services
University of Durham

A1(M) Junction 46, Wetherby, North Yorkshire

geophysical surveys

on behalf of
CgMs Consulting

Report 1612
January 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 of a Motorway Service Area on land to the northeast of Junction 46 on the A1(M) at Wetherby.

1.2 The works were commissioned by CgMs Consulting and conducted by Archaeological Services in accordance with a Written Scheme of Investigation (WSI) provided by Archaeological Services Durham University.

Results

1.3 Soil-filled features were detected in all four survey areas. These are likely to reflect former field boundaries or land drains, and possibly some ridge and furrow cultivation.

2. Project background

Location (Figure 1)

2.1 The study area is located adjacent to the A1(M) at Wetherby, North Yorkshire (centred at NGR: SE 4155 5028). The site occupies an area of approximately 11 hectares and is bounded to the west by the A1(M), to the north by a line of trees, to the east by a track leading to Ingmanthorpe Grange and to the south by Sandbeck Lane and Junction 46 on the A1(M).

Development proposal

2.2 The proposed development comprises the construction of a Motorway Service Area on land to the northeast of Junction 46 on the A1(M).

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 works have been undertaken in accordance with a Written Scheme of Investigation prepared by Archaeological Services Durham University.

Dates

2.5 Fieldwork was undertaken between 19th and 22nd January 2007. This report was prepared between 23rd and 31st January 2007.

Personnel

2.6 Fieldwork was conducted by Lorne Elliott (Supervisor) and Louise Robinson. This report was prepared by Lorne Elliott with illustrations by David Graham. The Project Manager was Dan Still.

Archive/OASIS

2.7 The site code is **WNY07**, for A1(M) **W**etherby, **N**orth **Y**orkshire 20**07**. The survey archive will be supplied on CD to CgMs Consulting 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 **archaeol3-23180**.

3. Archaeological and historical background

3.1 The archaeological interest in the area lies in the possibility that late prehistoric and/or Romano-British remains survive around the proposed development area. The SMR holds aerial photographs of the general area, though not the area targeted for the present surveys. These aerial photographs have shown possible traces of ridge and furrow in the surrounding land.

3.2 Two phases of geophysical evaluation were undertaken prior to the new A1(M) Darrington to Dishforth motorway route (Archaeological Services 2001, 2002). These comprised sixteen surveys that were conducted along the proposed route of the A1(M) at the time of the evaluation. Six of these survey areas were located in the immediate surroundings, north, south and east of the proposed Motorway Service Area (Figure1). Generally, the results of these surveys detected no probable archaeological features, apart from a curvilinear ditch feature in one area and ridge and furrow remains in another.

4. Landuse, topography and geology

4.1 At the time of survey the proposed development area comprised two fields of arable land divided by an open drain approximately two metres wide. The land was heavily waterlogged with surface water in places and crop stubble up to 0.3m in height across the study area. The present plough regime was aligned approximately northeast-southwest in both fields. Several geotechnical boreholes were noted throughout the site.

4.2 The survey area was predominantly level at a mean elevation of *c*.25m OD.

4.3 The underlying solid geology of the area comprises Permian Mudstones and Magnesian Limestone, which is overlain by glacial clays.

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 possible 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 The study area comprised two land parcels measuring *c*.11ha in total, of which 50% was surveyed along four 50m wide transects (Figure 2).

5.6 A 30m grid was established across each survey area and tied-in to known, mapped Ordnance Survey points using a Leica TR307 total survey station instrument equipped with a datalogger and *Penmap* software.

5.7 Measurements of vertical geomagnetic field gradient were determined using a Bartington Grad601-2 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.

5.8 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

5.9 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 Figure 2; 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/ohm.

5.10 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

5.11 Colour-coded geophysical interpretation plans are provided for each survey area. 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

General comments

5.12 The study area is divided into four parts, as shown on Figure 2. In the drawings and the following discussion, discrete survey transects are prefixed with 'T', eg T4. Colour-coded archaeological interpretation plans are provided for all survey areas.

5.13 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.

5.14 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.

Transect 1 (Figure 2)

5.15 A series of weak parallel positive magnetic anomalies on approximate northwest-southeast and perpendicular alignments were detected in this area. These almost certainly reflect land drains, given the waterlogged nature of the study area. Three of these linear features, approximately 100m apart, have a slightly stronger positive magnetic anomaly, possibly reflecting former field boundaries which are recorded on the first edition Ordnance Survey map.

5.16 A relatively strong linear positive magnetic anomaly also aligned northeast-southwest in the northern half of the survey may reflect a soil-filled ditch or land drain.

5.17 Weak linear positive magnetic anomalies aligned north-south in the northern part of the survey almost certainly reflect land drains.

5.18 A weak linear positive magnetic anomaly detected at the northern boundary reflects the present day change in land use from arable crop to grassland.

Transect 2 (Figure 2)

5.19 A linear positive magnetic anomaly aligned northwest-southeast was detected in the southern half of the survey area. This probably reflects a former field boundary which was also noted in Transect 1.

5.20 A very weak 'texture' which occurred in this survey area with a northeast-southwest orientation reflects the current plough regime.

5.21 A strong dipolar magnetic anomaly, detected in the northeast corner of the survey, represents a geotechnical borehole evident in the field.

5.22 A weak linear positive magnetic anomaly detected at the northern boundary reflects the present day change in land use from arable crop to grassland.

Transect 3 (Figure 2)

5.23 A series of weak parallel positive magnetic anomalies on an approximate northwest-southeast alignment were detected in the southern half of the survey; these almost certainly represent land drains.

5.24 A weak linear positive magnetic anomaly detected with a broadly northeast-southwest alignment in the southern half of the survey reflects a soil-filled feature, possibly another former field boundary.

5.25 A scatter of dipolar magnetic anomalies was detected in the northern half of the survey area. The size and orientation of these anomalies suggests they are unlikely to reflect insitu structures of archaeological significance. They almost certainly reflect items of near-surface ferrous litter, possibly due to the clearance of Little Wood shown on the O.S. first edition map. Several of these dipolar anomalies appear to be aligned with a weak positive magnetic anomaly on an approximate northwest-southeast orientation, which corresponds to the former boundary of Little Wood. These dipolar anomalies, therefore, may reflect pieces of wire fencing or nails.

Transect 4 (Figure 2)

5.26 A series of parallel weak positive magnetic anomalies on an approximate northwest-southeast alignment were detected throughout this survey area; these almost certainly reflect land drains, although their uniform spacing at approximately 7m intervals possibly indicates traces of ridge and furrow cultivation.

5.27 A linear positive magnetic anomaly aligned northeast-southwest was detected traversing the southern half of this survey area. Again this almost certainly represents a former field boundary noted on the first edition Ordnance Survey map.

5.28 Two further linear positive magnetic anomalies, detected here may also reflect soil-filled features such as ditches or former field boundaries.

6. Conclusions

6.1 Fluxgate gradiometer surveys have been undertaken on land to the northeast of Junction 46 on the A1(M) at Wetherby, North Yorkshire, in order to determine the nature and extent of features of potential archaeological significance prior to proposed development.

6.2 A series of parallel linear positive anomalies on northwest-southeast and northeast-southwest alignments have been detected in all four survey areas. These almost certainly reflect land drains, although in Transect 4 these may reflect traces of ridge and furrow cultivation.

6.3 A number of soil-filled features in all transects almost certainly correspond to former field boundaries shown on the O.S. first edition map.

6.4 A scatter of dipolar magnetic anomalies in the northern half of Transect 3, almost certainly reflect items of near-surface ferrous litter, such as pieces of wire fencing and nails, due to the clearance of a small wooded area shown on the O.S. first edition map.

7. Sources

Archaeological Services 2001 *A1 Darrington to Dishforth; geophysical surveying and reporting (Stage 2a),* unpublished report **745** for Bullen Consultants, Archaeological Services Durham University

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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 the geophysical survey

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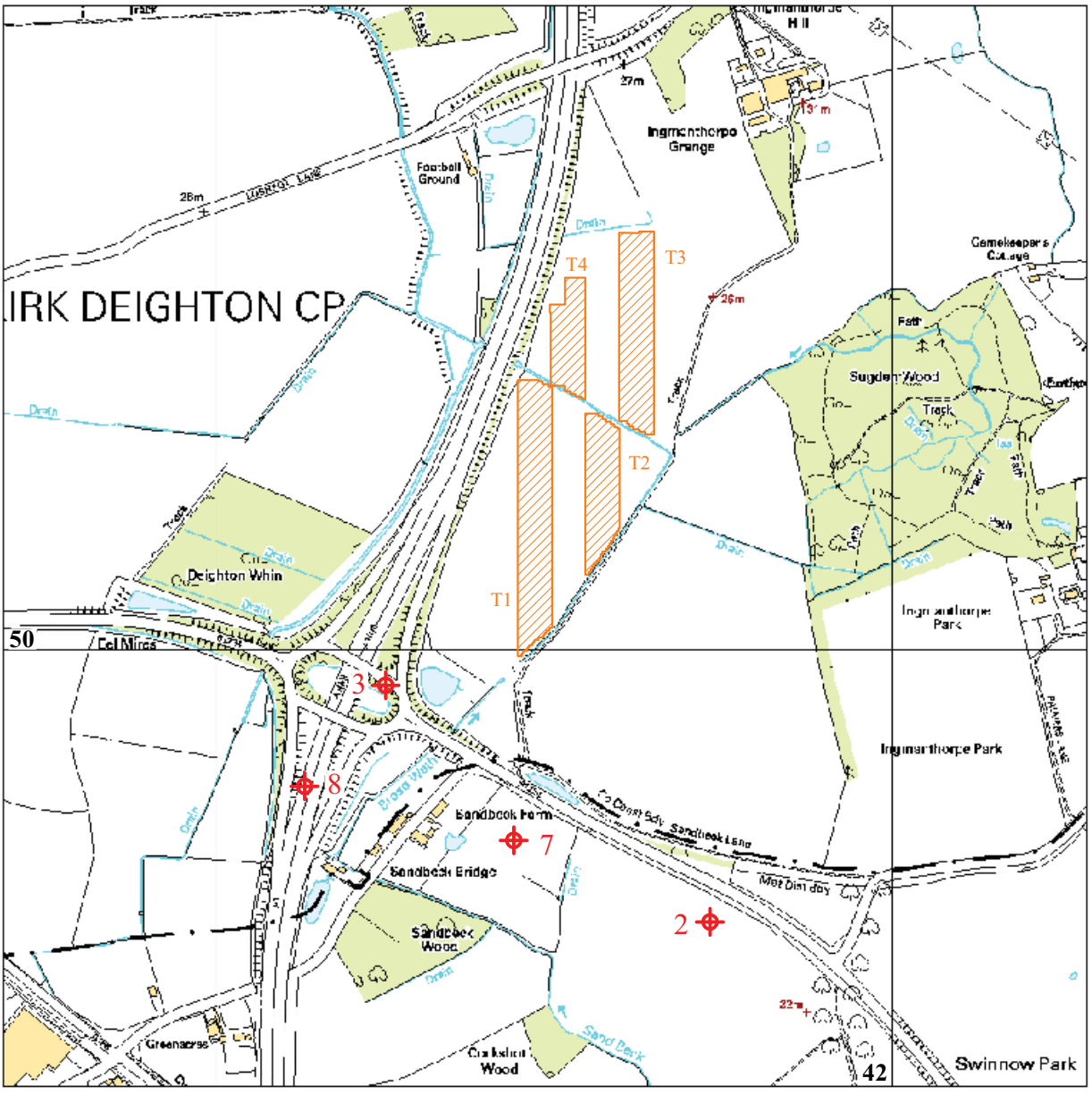

survey areas

previous surveys

0 500m

scale 1:10 000 - for A4 plot

A1(M)

T1

T2

T3

T4

06

05

04

03

02

01

00

14

15

16

A

B

C

A

outline of survey area

5.00
4.17
3.33
2.50
1.67
0.83
0.00
-0.83
-1.67
-2.50
-3.33
-4.17
-5.00 nT

B

positive magnetic anomalies

dipolar magnetic anomalies

C

soil-filled features

?land drains

former field boundaries

land use change

0 50m

scale 1:1250 - for A1 plot

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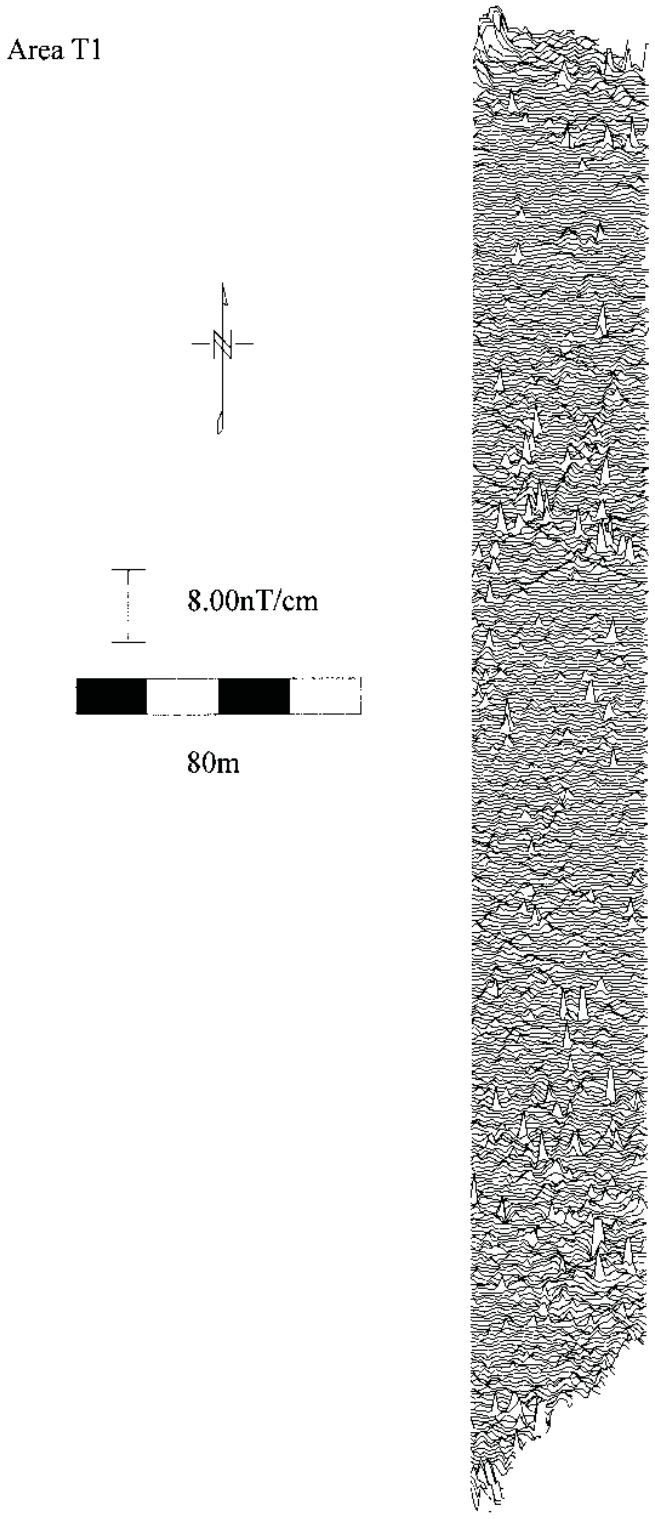
Figure 2

A transects 1-4, geophysical surveys

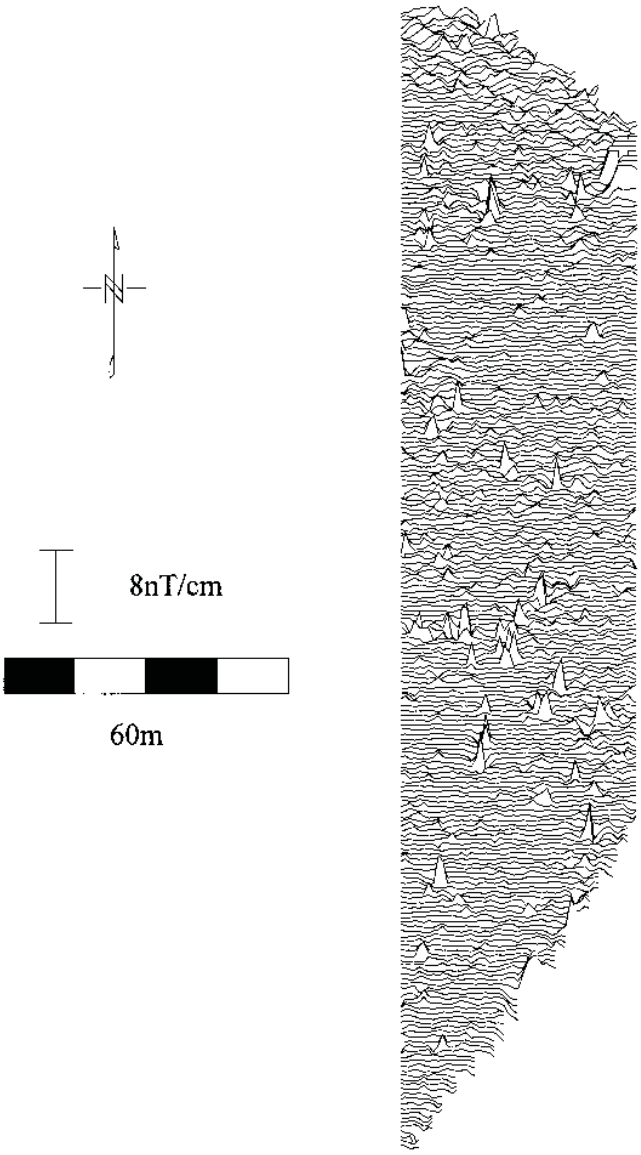
B geophysical interpretation

C archaeological interpretation

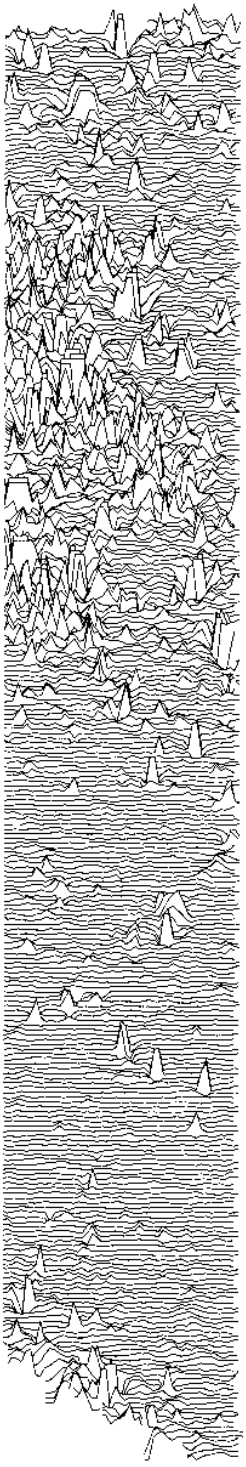
Appendix I: Trace plots of geophysical data



Area T2



Area T3



9nT/cm

60m

Area T4