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SOUTH WEST

Timbrelham Extension, Greystone Quarry, Launceston, Cornwall

Geophysical Survey (Magnetic)

by Rebecca Constable and Nick Dawson

Site Code: GQL15/211

(SX 3644 8013)

Timbrelham Extension, Greystone Quarry, Launceston, Cornwall

Geophysical Survey (Magnetic) Report

For Aggregate Industries Ltd

by Rebecca Constable and Nick Dawson

Thames Valley Archaeological Services Ltd

Site Code GQL 15/211

December 2015

Summary

Site name: Timbrelham Extension, Greystone Quarry, Launceston, Cornwall

Grid reference: SX 3644 8013

Site activity: Magnetometer survey

Date and duration of project: 15th - 22nd October 2015

Project manager: Steve Ford

Site supervisor: Rebecca Constable

Site code: GQL 15/211

Area of site: 9.79 ha

Summary of results: The geophysical survey identified several magnetic anomalies across the site area. These are likely to be caused by a range of human activity. Areas of strong positive and negative readings suggest the presence of mine workings, their associated spoil and access tracks while positive linear anomalies in the north-west and central parts of the site may possibly represent archaeological cut features such as pits and ditches.

Location of archive: The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Report edited/checked by:	Steve Ford✓ 08.12.15
	Andrew Mundin✓ 07.12.15

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Timbrelham Extension, Greystone Quarry, Launceston, Cornwall
A Geophysical Survey (Magnetic)

by Rebecca Constable and Nick Dawson

Report 15/211

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at NGR SX 3644 8013 (Fig. 1). The work was commissioned by Aggregate Industries Ltd, Marston House, Frome, Somerset, BA11 5DU.

Planning permission is to be sought for the development of the site as an area for the extraction of dolerite on a plot of land of c. 9.79 ha. Due to potential disturbance of below ground archaeological features an archaeological field evaluation is to be submitted along with the planning application to Cornwall Council. This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012), and the Cornwall Council policies on archaeology. The fieldwork was undertaken by Rebecca Constable, Sophie Frampton and David Sanchez, 15th to 22nd October 2015 and the site code is GQL 15/221.

The archive is presently held at Thames Valley Archaeological Services, Reading in accordance with TVAS digital archiving policies.

Location, topography and geology

The site is located near Timbrelham hamlet, 5.8km south west of the Launceston, Cornwall. The proposal site is 200m west of the hamlet, located on a former saddle between the now quarried hilltop west of Greystone Bridge to the north and Castlepark Hill to the south. The saddle is set on a north to south ridge above an east facing scarp overlooking the River Tamar (Fig. 1). It comprises four individual variously shaped fields distributed over c. 9.79ha (Fig. 2). The site is approached from the north east via a west-established, deeply set road bounded by a hedge and bank. All the fields are surrounded by well-established hedges including young and developed deciduous trees and lie on gently undulating high ground. At the time of the survey all four fields were under grass and the weather stayed warm and dry for the entire period although previous rain had left large areas of standing water in the corners of the fields. In general the proposal area falls from a height of c. 94m above Ordnance Datum on its northern side to c. 93m aOD at its southernmost point over a distance of 350m. From west to east it rises from c. 97m to 98m aOD before falling towards the river to c. 89m aOD.

The underlying geology is recorded as Lezant Slate Formation in the west, Brendon Formation slate in the centre and an Unnamed Igneous Intrusion of the Carboniferous and Devensian periods in the eastern part of the site (BGS 1993). The soil comprises seasonally wet, slowly permeable clays and loams and is of low fertility (NSRI 2015).

Site history and archaeological background

The archaeological background to the site has been highlighted in a previous desktop study (Tabor and Weale 2015). In summary, there are no known archaeological deposits within the site but a variety of sites are recorded in the wider area. These include a row of standing stones to the north that are likely to represent a ceremonial site of earlier Bronze Age date and to the south and south west are several Iron Age hilltop enclosures. It is thought that the site is set within landscape originating in medieval or earlier times and is adjacent to a late medieval manor.

Records for the post medieval, Victorian and modern periods comprise extant buildings, some listed, documented features and most notably associated with mining, quarrying. Mining has had an impact close to the proposal site. A counting house and smithy was marked as 'North Tamar Mine Yard' on the tithe map to the immediate northeast of site and immediately to the west of the site earthworks and a trackway leading to Timbrelham Farm may be associated with a shaft for a possible lead/silver mine with a related adit. The similar Greystone Mine 300m west of the site began extraction in 1831. To the south, in Greystone Wood, another silver mine was re-used as a bunker during World War 2 and there was an adit for a manganese mine nearby dating to the late 19th century. Manganese mine washing floors recorded at Lowley in the tithe apportionment and a possible counting house may have treated material extracted from an area with earthworks northwest of the settlement.

Methodology

Sample interval

Data collection required a temporary grid to be established across the survey area using wooden pegs at 20m intervals with further subdivision where necessary. Readings were taken at 0.25m intervals along traverses 1m apart. This provides 1600 sampling points across a full 20m × 20m grid (English Heritage 2008), providing an appropriate methodology balancing cost and time with resolution. Separate grids were laid out for the four

individual fields with no obstructions being encountered. Only in the south-western field did the northern two rows have to be re-laid due to farming activity.

The Grad 601-2 has a typical depth of penetration of 0.5m to 1.0m. This would be increased if strongly magnetic objects have been buried in the site. Under normal operating conditions it can be expected to identify buried features >0.5m in diameter. Features which can be detected include disturbed soil, such as the fill of a ditch, structures that have been heated to high temperatures (magnetic thermoremnance) and objects made from ferro-magnetic materials. The strength of the magnetic field is measured in nano Tesla (nT), equivalent to 10^{-9} Tesla, the SI unit of magnetic flux density.

Equipment

The purpose of the survey was to identify geophysical anomalies that may be archaeological in origin in order to inform a targeted archaeological investigation of the site prior to development. The survey and report generally follow the recommendations and standards set out by both English Heritage (2008) and the Chartered Institute *for* Archaeologists (2002, 2011, 2014).

Magnetometry was chosen as a survey method as it offers the most rapid ground coverage and responds to a wide range of anomalies caused by past human activity. These properties make it ideal for fast yet detailed survey of an area.

The detailed magnetometry survey was carried out using a dual sensor Bartington Instruments Grad 601-2 fluxgate gradiometer. The instrument consists of two fluxgates mounted 1m vertically apart with a second set positioned at 1m horizontal distance. This enables readings to be taken of both the general background magnetic field and any localised anomalies with the difference being plotted as either positive or negative buried features. All sensors are calibrated to cancel out the local magnetic field and react only to anomalies above or below this base line. On this basis, strong magnetic anomalies such as burnt features (kilns and hearths) will give a high response as will buried ferrous objects. More subtle anomalies such as pits and ditches, can be seem from their infilling soils containing higher proportions of humic material, rich in ferrous oxides, compared to the undisturbed subsoil. This will stand out in relation to the background magnetic readings and appear in plan following the course of a linear feature or within a discrete area.

A Trimble Geo7x handheld GPS system with sub-decimetre real-time accuracy was used to tie the site grid into the Ordnance Survey national grid. This unit offers both real-time correction and post-survey processing; enabling a high level of accuracy to be obtained both in the field and in the final post-processed data.

Data gathered in the field was processed using the TerraSurveyor software package. This allows the survey data to be collated and manipulated to enhance the visibility of anomalies, particularly those likely to be of archaeological origin. The table below lists the processes applied to this survey, full survey and data information is recorded in Appendix 1.

Process	**Effect**
Clip from -9.80 to 10.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
De-stripe: median, all sensors	Removes the striping effect caused by differences in sensor calibration, enhancing the visibility of potential archaeological anomalies.
De-spike: threshold 1, window size 3×3	Compresses outlying magnetic points caused by interference of metal objects within the survey area.
De-stagger: all grids, both by -1 intervals	Cancels out effects of site's topography on irregularities in the traverse speed.

Once processed, the results are presented as a greyscale plot shown in relation to the site (Fig. 3), followed by a second plan to present the abstraction and interpretation of the magnetic anomalies (Fig. 4). Anomalies are shown as colour-coded lines, points and polygons. The grid layout and georeferencing information (Fig. 2) is prepared in EasyCAD v.7.58.00, producing a .FC7 file format, and printed as a .PDF for inclusion in the final report.

The greyscale plot of the processed data is exported from TerraSurveyor in a georeferenced portable network graphics (.PNG) format, a raster image format chosen for its lossless data compression and support for transparent pixels, enabling it to easily be overlaid onto an existing site plan. The data plot is combined with grid and site plans in QGIS 2.10.1 Pisa and exported again in .PNG format in order to present them in figure templates in Adobe InDesign CS5.5, creating .INDD file formats. Once the figures are finalised they are exported in .PDF format for inclusion within the finished report.

Results

North-west Field

Located to the west of centre of the field there are five positive anomalies, four with a weaker signature, which usually indicate the presence of buried cut features, such as pits or ditches, possibly of archaeological origin. Two of the weaker ones appear to form a north-west to south-east linear **[Fig. 4: 1, 2]**. Branching off from the most north-westerly **[1]** is a linear anomaly heading east were it disappears then reappears as a second section of linear **[3]** for c.20m. Slightly to the south of this the fourth weak positive anomaly appears to form a circular

enclosure **[4]**. The stronger positive linear **[5]** is at the south centre of the field and runs just over 20m south-east into the southern field boundary. Running north to south through centre of field lies a positive linear **[6]** matching the location of a field boundary last seen on the Ordnance Survey map of 1907 (Tabor and Weale 2015) and that once split the field into two. At the eastern end of the field a large area of strong positive negative readings, likely relating to mining works **[7]**.

South-west Field

The survey plot of the south-west field identified two positive linear anomalies **[8, 9]** both running parallel to one another from west to east. These two linears lead to the central area of the field which for the most part shows as an area of strong positive negative readings **[12]**, again likely the result of mining works. They could be related to the potential mining works, or possibly a holloway connecting to the road or some form of drainage taking water down the hill to the river. Also potentially relating to the mining activity is a discrete area of positive readings with a minimal negative response **[13]** that may represent a mine shaft. Towards the western end of the field is a group of four positive discrete circular anomalies **[10]** ranging from c.5m in diameter to c2.5m and possibly indicating the presence of buried pit-type features. A further two **[11]** are located amongst the area of positive and negative readings.

North-east Field

The two positive linear anomalies running east to west and parallel to one another in the south-west field are picked up and continue across the northeast field into the east field boundary **[14, 15, 17]**. These are joined by two other linears **[16, 18]** all converging on the same area of the eastern field boundary. Comparison with LiDAR data and Ordnance Survey mapping (Tabor and Weale 2015) shows that the anomalies follow a slight valley down towards the river to the east. In the two southerly corners of the field are two separate areas of strong negative and positive readings **[19, 20]**. Both are possibly related to mining works. The survey identified a line of magnetic disturbance **[26]** running north-east to south-west across the north corner of the field appears to be a modern service pipe.

South-east Field

The survey plot of the south-east field identified an area of up to five positive linear anomalies, two **[21, 23]** running north-west to south-east and the other two being north to south **[22]**. The third a much shorter anomaly runs north-east to south-west. It is unclear if these are the result of archaeological activity or geological in origin. In the east half of the field more evidence for mining activity is present in the form of further three larger areas **[24, 25]** of strong positive and negative readings.

Conclusion

The geophysical survey of the four fields that comprise the site at Land south of Greystone Quarry, Lawhitton was completed successfully, recording a variety of magnetic anomalies. The main features of archaeological potential being the several large areas of possible mining works. Though no mining work has been recorded within the site area there are several known mining sites nearby that share the same geology. There are also the linear anomalies running from the main area of the mining down into the river valley potentially connecting to the road that runs along the northern edge of site or down to the river itself and possibly representing a transport or drainage system for the mine workings. The apparent circular enclosure feature with further linears in the north-west field may be archaeological in origin. The strong readings across the areas of potential mining and a few smaller patches of magnetic disturbance may mask weaker anomalies of possible archaeological origin in the same areas.

References

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NPPF, 2012, *National Planning Policy Framework*, Dept Communities and Local Government, London

Tabor, R and Weale, A, 2015, 'Timbrelham Extension, Greystone Quarry, Launceston, Cornwall: an Archaeological Desk-based Assessment', Thames Valley Archaeological Services (South West) Report 15/211, Taunton

Williams, A and Martin, G H, 2002, *Domesday Book: A Complete Translation,* London

Appendix 1. Survey and data information

PROGRAMME
Name: TerraSurveyor
Version: 3.0.25.0

North-west Field
Raw data
Northwest corner: 236516.77, 80243.84 m
Southeast corner: 236636.77, 79943.84 m
Direction of 1st Traverse: 191.97 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 480 x 300
Survey Size (meters): 120 m x 300 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 97.04
Min: -100.00
Std Dev: 15.23
Mean: 8.10
Median: 5.62
Composite Area: 3.6 ha
Surveyed Area: 2.4175 ha

Source Grids: 82
1 Col:0 Row:2 Field 1\71.xgd
2 Col:0 Row:3 Field 1\72.xgd
3 Col:0 Row:4 Field 1\73.xgd
4 Col:0 Row:5 Field 1\74.xgd
5 Col:0 Row:6 Field 1\75.xgd
6 Col:0 Row:7 Field 1\76.xgd
7 Col:0 Row:8 Field 1\77.xgd
8 Col:0 Row:9 Field 1\78.xgd
9 Col:0 Row:10 Field 1\79.xgd
10 Col:0 Row:11 Field 1\80.xgd
11 Col:0 Row:12 Field 1\81.xgd
12 Col:0 Row:13 Field 1\82.xgd
13 Col:1 Row:0 Field 1\56.xgd
14 Col:1 Row:1 Field 1\57.xgd
15 Col:1 Row:2 Field 1\58.xgd
16 Col:1 Row:3 Field 1\59.xgd
17 Col:1 Row:4 Field 1\60.xgd
18 Col:1 Row:5 Field 1\61.xgd
19 Col:1 Row:6 Field 1\62.xgd
20 Col:1 Row:7 Field 1\63.xgd
21 Col:1 Row:8 Field 1\64.xgd
22 Col:1 Row:9 Field 1\65.xgd
23 Col:1 Row:10 Field 1\66.xgd
24 Col:1 Row:11 Field 1\67.xgd
25 Col:1 Row:12 Field 1\68.xgd
26 Col:1 Row:13 Field 1\69.xgd
27 Col:1 Row:14 Field 1\70.xgd
28 Col:2 Row:0 Field 1\41.xgd
29 Col:2 Row:1 Field 1\42.xgd
30 Col:2 Row:2 Field 1\43.xgd
31 Col:2 Row:3 Field 1\44.xgd
32 Col:2 Row:4 Field 1\45.xgd
33 Col:2 Row:5 Field 1\46.xgd
34 Col:2 Row:6 Field 1\47.xgd
35 Col:2 Row:7 Field 1\48.xgd
36 Col:2 Row:8 Field 1\49.xgd
37 Col:2 Row:9 Field 1\50.xgd
38 Col:2 Row:10 Field 1\51.xgd
39 Col:2 Row:11 Field 1\52.xgd
40 Col:2 Row:12 Field 1\53.xgd
41 Col:2 Row:13 Field 1\54.xgd
42 Col:2 Row:14 Field 1\55.xgd
43 Col:3 Row:1 Field 1\27.xgd
44 Col:3 Row:2 Field 1\28.xgd
45 Col:3 Row:3 Field 1\29.xgd
46 Col:3 Row:4 Field 1\30.xgd
47 Col:3 Row:5 Field 1\31.xgd
48 Col:3 Row:6 Field 1\32.xgd
49 Col:3 Row:7 Field 1\33.xgd
50 Col:3 Row:8 Field 1\34.xgd
51 Col:3 Row:9 Field 1\35.xgd
52 Col:3 Row:10 Field 1\36.xgd
53 Col:3 Row:11 Field 1\37.xgd
54 Col:3 Row:12 Field 1\38.xgd
55 Col:3 Row:13 Field 1\39.xgd
56 Col:3 Row:14 Field 1\40.xgd
57 Col:4 Row:1 Field 1\13.xgd
58 Col:4 Row:2 Field 1\14.xgd
59 Col:4 Row:3 Field 1\15.xgd
60 Col:4 Row:4 Field 1\16.xgd
61 Col:4 Row:5 Field 1\17.xgd
62 Col:4 Row:6 Field 1\18.xgd
63 Col:4 Row:7 Field 1\19.xgd
64 Col:4 Row:8 Field 1\20.xgd
65 Col:4 Row:9 Field 1\21.xgd
66 Col:4 Row:10 Field 1\22.xgd
67 Col:4 Row:11 Field 1\23.xgd
68 Col:4 Row:12 Field 1\24.xgd
69 Col:4 Row:13 Field 1\25.xgd
70 Col:4 Row:14 Field 1\26.xgd
71 Col:5 Row:2 Field 1\01.xgd
72 Col:5 Row:3 Field 1\02.xgd
73 Col:5 Row:4 Field 1\03.xgd
74 Col:5 Row:5 Field 1\04.xgd
75 Col:5 Row:6 Field 1\05.xgd
76 Col:5 Row:7 Field 1\06.xgd
77 Col:5 Row:8 Field 1\07.xgd
78 Col:5 Row:9 Field 1\08.xgd
79 Col:5 Row:10 Field 1\09.xgd
80 Col:5 Row:11 Field 1\10.xgd
81 Col:5 Row:12 Field 1\11.xgd
82 Col:5 Row:13 Field 1\12.xgd

Processed data
Stats
Max: 10.20
Min: -9.80
Std Dev: 5.53
Mean: 0.14
Median: 0.02
Processes: 6
1 Base Layer
2 DeStripe Median Sensors: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -9.80 to 10.20 nT

South-west Field
Raw data
Northwest corner: 236456.89, 80116.64 m
Southeast corner: 236556.89, 79876.64 m
Direction of 1st Traverse: 195.51 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 400 x 240
Survey Size (meters): 100 m x 240 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 96.90
Min: -100.00
Std Dev: 29.56
Mean: 26.03

Median: 26.98
Composite Area: 2.4 ha
Surveyed Area: 1.8001 ha

Source Grids: 53
1 Col:0 Row:0 Field 2\42.xgd
2 Col:0 Row:1 Field 2\43.xgd
3 Col:0 Row:2 Field 2\44.xgd
4 Col:0 Row:3 Field 2\45.xgd
5 Col:0 Row:4 Field 2\46.xgd
6 Col:0 Row:5 Field 2\47.xgd
7 Col:0 Row:6 Field 2\48.xgd
8 Col:0 Row:7 Field 2\49.xgd
9 Col:0 Row:8 Field 2\50.xgd
10 Col:0 Row:9 Field 2\51.xgd
11 Col:0 Row:10 Field 2\52.xgd
12 Col:0 Row:11 Field 2\53.xgd
13 Col:1 Row:1 Field 2\31.xgd
14 Col:1 Row:2 Field 2\32.xgd
15 Col:1 Row:3 Field 2\33.xgd
16 Col:1 Row:4 Field 2\34.xgd
17 Col:1 Row:5 Field 2\35.xgd
18 Col:1 Row:6 Field 2\36.xgd
19 Col:1 Row:7 Field 2\37.xgd
20 Col:1 Row:8 Field 2\38.xgd
21 Col:1 Row:9 Field 2\39.xgd
22 Col:1 Row:10 Field 2\40.xgd
23 Col:1 Row:11 Field 2\41.xgd
24 Col:2 Row:1 Field 2\21.xgd
25 Col:2 Row:2 Field 2\22.xgd
26 Col:2 Row:3 Field 2\23.xgd
27 Col:2 Row:4 Field 2\24.xgd
28 Col:2 Row:5 Field 2\25.xgd
29 Col:2 Row:6 Field 2\26.xgd
30 Col:2 Row:7 Field 2\27.xgd
31 Col:2 Row:8 Field 2\28.xgd
32 Col:2 Row:9 Field 2\29.xgd
33 Col:2 Row:10 Field 2\30.xgd
34 Col:3 Row:1 Field 2\11.xgd
35 Col:3 Row:2 Field 2\12.xgd
36 Col:3 Row:3 Field 2\13.xgd
37 Col:3 Row:4 Field 2\14.xgd
38 Col:3 Row:5 Field 2\15.xgd
39 Col:3 Row:6 Field 2\16.xgd
40 Col:3 Row:7 Field 2\17.xgd
41 Col:3 Row:8 Field 2\18.xgd
42 Col:3 Row:9 Field 2\19.xgd
43 Col:3 Row:10 Field 2\20.xgd
44 Col:4 Row:1 Field 2\01.xgd
45 Col:4 Row:2 Field 2\02.xgd
46 Col:4 Row:3 Field 2\03.xgd
47 Col:4 Row:4 Field 2\04.xgd
48 Col:4 Row:5 Field 2\05.xgd
49 Col:4 Row:6 Field 2\06.xgd
50 Col:4 Row:7 Field 2\07.xgd
51 Col:4 Row:8 Field 2\08.xgd
52 Col:4 Row:9 Field 2\09.xgd
53 Col:4 Row:10 Field 2\10.xgd

Processed data
Stats
Max: 10.20
Min: -9.80
Std Dev: 6.77
Mean: 0.08
Median: -0.05

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -9.80 to 10.20 nT

South-west Field - Part 2
Raw data
Survey corner coordinates (X/Y):
Northwest corner: 236465.42, 80155.91 m
Southeast corner: 236505.42, 79915.91 m
Direction of 1st Traverse: 194.79 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 160 x 240
Survey Size (meters): 40 m x 240 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 96.61
Min: -100.00
Std Dev: 27.13
Mean: 27.24
Median: 27.88
Composite Area: 0.96 ha
Surveyed Area: 0.4469 ha

Source Grids: 21
1 Col:0 Row:0 Field 2 Part 2\13.xgd
2 Col:0 Row:1 Field 2 Part 2\14.xgd
3 Col:0 Row:2 Field 2 Part 2\15.xgd
4 Col:0 Row:3 Field 2 Part 2\17.xgd
5 Col:0 Row:4 Field 2 Part 2\18.xgd
6 Col:0 Row:5 Field 2 Part 2\19.xgd
7 Col:0 Row:6 Field 2 Part 2\20.xgd
8 Col:0 Row:7 Field 2 Part 2\21.xgd
9 Col:0 Row:8 Field 2 Part 2\22.xgd
10 Col:1 Row:0 Field 2 Part 2\01.xgd
11 Col:1 Row:1 Field 2 Part 2\02.xgd
12 Col:1 Row:2 Field 2 Part 2\03.xgd
13 Col:1 Row:3 Field 2 Part 2\04.xgd
14 Col:1 Row:4 Field 2 Part 2\05.xgd
15 Col:1 Row:5 Field 2 Part 2\06.xgd
16 Col:1 Row:6 Field 2 Part 2\07.xgd
17 Col:1 Row:7 Field 2 Part 2\08.xgd
18 Col:1 Row:8 Field 2 Part 2\09.xgd
19 Col:1 Row:9 Field 2 Part 2\10.xgd
20 Col:1 Row:10 Field 2 Part 2\11.xgd
21 Col:1 Row:11 Field 2 Part 2\12.xgd

Processed data
Stats
Max: 10.20
Min: -9.80
Std Dev: 6.17
Mean: 0.16
Median: -0.12

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -9.80 to 10.20 nT

North-east Field
Raw data
Survey corner coordinates (X/Y):
Northwest corner: 236534.26, 79944.82 m
Southeast corner: 236714.26, 79724.82 m
Direction of 1st Traverse: 301.05 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

60 Col:7 Row:9 grids\Field 3\21.xgd

Dimensions
Composite Size (readings): 720 x 220
Survey Size (meters): 180 m x 220 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 97.02
Min: -100.00
Std Dev: 21.71
Mean: -3.93
Median: -2.49
Composite Area: 3.96 ha
Surveyed Area: 2.051 ha

Source Grids: 72
1 Col:0 Row:4 grids\Field 3\72.xgd
2 Col:1 Row:3 grids\Field 3\68.xgd
3 Col:1 Row:4 grids\Field 3\69.xgd
4 Col:1 Row:5 grids\Field 3\70.xgd
5 Col:1 Row:6 grids\Field 3\71.xgd
6 Col:2 Row:2 grids\Field 3\62.xgd
7 Col:2 Row:3 grids\Field 3\63.xgd
8 Col:2 Row:4 grids\Field 3\64.xgd
9 Col:2 Row:5 grids\Field 3\65.xgd
10 Col:2 Row:6 grids\Field 3\66.xgd
11 Col:2 Row:7 grids\Field 3\67.xgd
12 Col:3 Row:2 grids\Field 3\54.xgd
13 Col:3 Row:3 grids\Field 3\55.xgd
14 Col:3 Row:4 grids\Field 3\56.xgd
15 Col:3 Row:5 grids\Field 3\57.xgd
16 Col:3 Row:6 grids\Field 3\58.xgd
17 Col:3 Row:7 grids\Field 3\59.xgd
18 Col:3 Row:8 grids\Field 3\60.xgd
19 Col:3 Row:9 grids\Field 3\61-a.xgd
20 Col:4 Row:1 grids\Field 3\44.xgd
21 Col:4 Row:2 grids\Field 3\45.xgd
22 Col:4 Row:3 grids\Field 3\46.xgd
23 Col:4 Row:4 grids\Field 3\47.xgd
24 Col:4 Row:5 grids\Field 3\48.xgd
25 Col:4 Row:6 grids\Field 3\49.xgd
26 Col:4 Row:7 grids\Field 3\50.xgd
27 Col:4 Row:8 grids\Field 3\51.xgd
28 Col:4 Row:9 grids\Field 3\52.xgd
29 Col:4 Row:10 grids\Field 3\53.xgd
30 Col:5 Row:1 grids\Field 3\34.xgd
31 Col:5 Row:2 grids\Field 3\35.xgd
32 Col:5 Row:3 grids\Field 3\36.xgd
33 Col:5 Row:4 grids\Field 3\37.xgd
34 Col:5 Row:5 grids\Field 3\38.xgd
35 Col:5 Row:6 grids\Field 3\39.xgd
36 Col:5 Row:7 grids\Field 3\40.xgd
37 Col:5 Row:8 grids\Field 3\41.xgd
38 Col:5 Row:9 grids\Field 3\42.xgd
39 Col:5 Row:10 grids\Field 3\43.xgd
40 Col:6 Row:0 grids\Field 3\23.xgd
41 Col:6 Row:1 grids\Field 3\24.xgd
42 Col:6 Row:2 grids\Field 3\25.xgd
43 Col:6 Row:3 grids\Field 3\26.xgd
44 Col:6 Row:4 grids\Field 3\27.xgd
45 Col:6 Row:5 grids\Field 3\28.xgd
46 Col:6 Row:6 grids\Field 3\29.xgd
47 Col:6 Row:7 grids\Field 3\30.xgd
48 Col:6 Row:8 grids\Field 3\31.xgd
49 Col:6 Row:9 grids\Field 3\32.xgd
50 Col:6 Row:10 grids\Field 3\33.xgd
51 Col:7 Row:0 grids\Field 3\12.xgd
52 Col:7 Row:1 grids\Field 3\13.xgd
53 Col:7 Row:2 grids\Field 3\14.xgd
54 Col:7 Row:3 grids\Field 3\15.xgd
55 Col:7 Row:4 grids\Field 3\16.xgd
56 Col:7 Row:5 grids\Field 3\17.xgd
57 Col:7 Row:6 grids\Field 3\18.xgd
58 Col:7 Row:7 grids\Field 3\19.xgd
59 Col:7 Row:8 grids\Field 3\20.xgd
61 Col:7 Row:10 grids\Field 3\22.xgd
62 Col:8 Row:0 grids\Field 3\01.xgd
63 Col:8 Row:1 grids\Field 3\02.xgd
64 Col:8 Row:2 grids\Field 3\03.xgd
65 Col:8 Row:3 grids\Field 3\04.xgd
66 Col:8 Row:4 grids\Field 3\05.xgd
67 Col:8 Row:5 grids\Field 3\06.xgd
68 Col:8 Row:6 grids\Field 3\07.xgd
69 Col:8 Row:7 grids\Field 3\08.xgd
70 Col:8 Row:8 grids\Field 3\09.xgd
71 Col:8 Row:9 grids\Field 3\10.xgd
72 Col:8 Row:10 grids\Field 3\11.xgd

Processed data
Stats
Max: 10.20
Min: -9.80
Std Dev: 5.85
Mean: 0.09
Median: -0.02

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -9.80 to 10.20 nT

South-east Field
Raw data
Survey corner coordinates (X/Y):
Northwest corner: 236350.99, 79979.89 m
Southeast corner: 236510.99, 79759.89 m
Direction of 1st Traverse: 32.18 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 640 x 220
Survey Size (meters): 160 m x 220 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 96.80
Min: -100.00
Std Dev: 11.39
Mean: 1.06
Median: 0.73
Composite Area: 3.52 ha
Surveyed Area: 2.0765 ha

Source Grids: 65
1 Col:0 Row:0 Field 4\01.xgd
2 Col:0 Row:1 Field 4\02.xgd
3 Col:0 Row:2 Field 4\03.xgd
4 Col:0 Row:3 Field 4\04.xgd
5 Col:0 Row:4 Field 4\05.xgd
6 Col:0 Row:5 Field 4\06.xgd
7 Col:0 Row:6 Field 4\07.xgd
8 Col:0 Row:7 Field 4\08.xgd
9 Col:0 Row:8 Field 4\09.xgd
10 Col:0 Row:9 Field 4\10.xgd
11 Col:1 Row:0 Field 4\11.xgd
12 Col:1 Row:1 Field 4\12.xgd
13 Col:1 Row:2 Field 4\13.xgd
14 Col:1 Row:3 Field 4\14.xgd
15 Col:1 Row:4 Field 4\15.xgd
16 Col:1 Row:5 Field 4\16.xgd
17 Col:1 Row:6 Field 4\17.xgd
18 Col:1 Row:7 Field 4\18.xgd
19 Col:1 Row:8 Field 4\19.xgd
20 Col:1 Row:9 Field 4\20.xgd

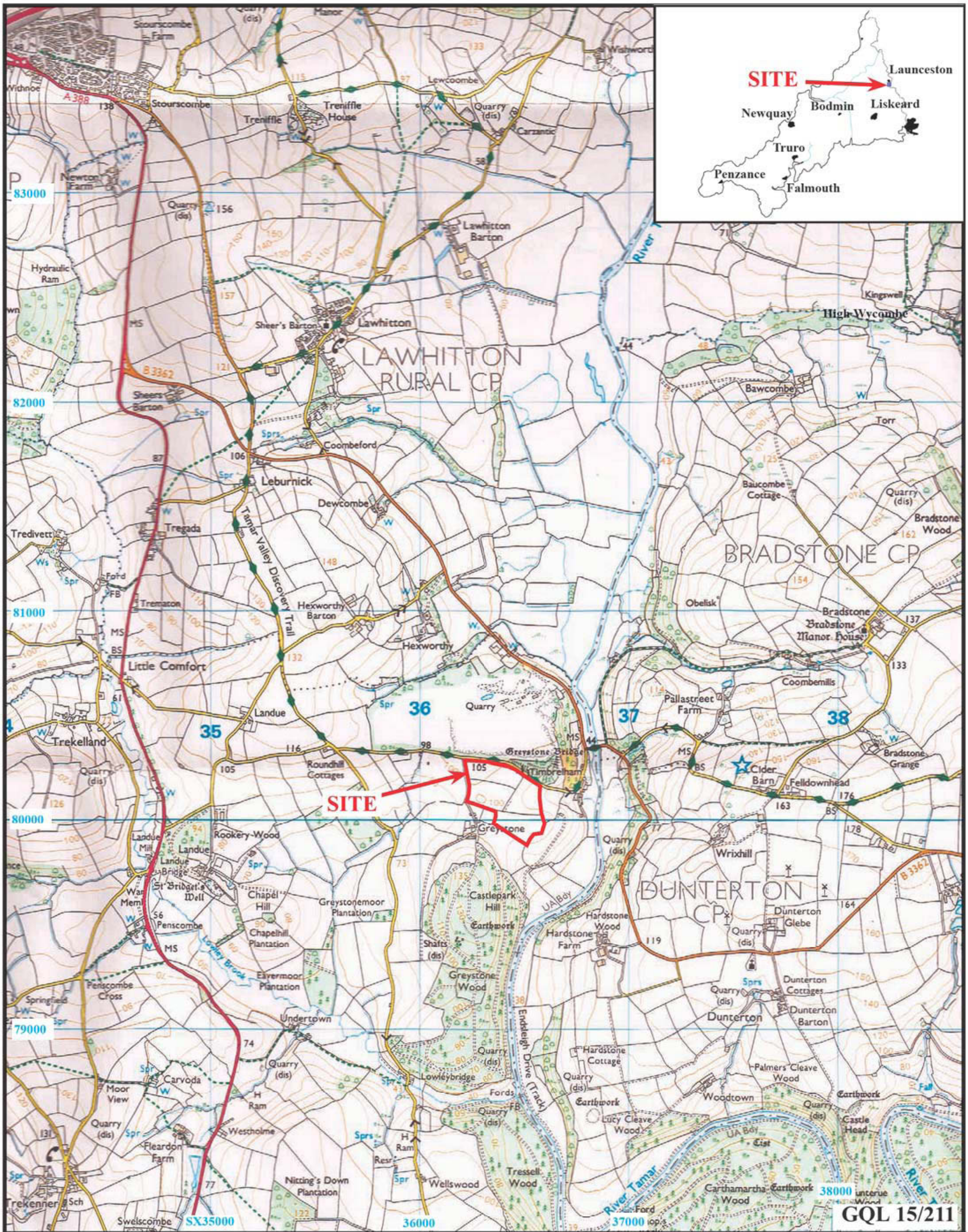
21 Col:2 Row:0 Field 4\21.xgd
22 Col:2 Row:1 Field 4\22.xgd
23 Col:2 Row:2 Field 4\23.xgd
24 Col:2 Row:3 Field 4\24.xgd
25 Col:2 Row:4 Field 4\25.xgd
26 Col:2 Row:5 Field 4\26.xgd
27 Col:2 Row:6 Field 4\27.xgd
28 Col:2 Row:7 Field 4\28.xgd
29 Col:2 Row:8 Field 4\29.xgd
30 Col:2 Row:9 Field 4\30.xgd
31 Col:3 Row:0 Field 4\31.xgd
32 Col:3 Row:1 Field 4\32.xgd
33 Col:3 Row:2 Field 4\33.xgd
34 Col:3 Row:3 Field 4\34.xgd
35 Col:3 Row:4 Field 4\35.xgd
36 Col:3 Row:5 Field 4\36.xgd
37 Col:3 Row:6 Field 4\37.xgd
38 Col:3 Row:7 Field 4\38.xgd
39 Col:3 Row:8 Field 4\39.xgd
40 Col:3 Row:9 Field 4\40.xgd
41 Col:3 Row:10 Field 4\41.xgd
42 Col:4 Row:2 Field 4\42.xgd
43 Col:4 Row:3 Field 4\43.xgd
44 Col:4 Row:4 Field 4\44.xgd
45 Col:4 Row:5 Field 4\45.xgd
46 Col:4 Row:6 Field 4\46.xgd
47 Col:4 Row:7 Field 4\47.xgd
48 Col:4 Row:8 Field 4\48.xgd
49 Col:4 Row:9 Field 4\49.xgd
50 Col:4 Row:10 Field 4\50.xgd
51 Col:5 Row:4 Field 4\51.xgd
52 Col:5 Row:5 Field 4\52.xgd
53 Col:5 Row:6 Field 4\53.xgd
54 Col:5 Row:7 Field 4\54.xgd
55 Col:5 Row:8 Field 4\55.xgd
56 Col:5 Row:9 Field 4\56.xgd
57 Col:5 Row:10 Field 4\57.xgd
58 Col:6 Row:6 Field 4\58.xgd
59 Col:6 Row:7 Field 4\59.xgd
60 Col:6 Row:8 Field 4\60.xgd
61 Col:6 Row:9 Field 4\61.xgd
62 Col:6 Row:10 Field 4\62.xgd
63 Col:7 Row:7 Field 4\63.xgd
64 Col:7 Row:8 Field 4\64.xgd
65 Col:7 Row:9 Field 4\65.xgd

Processed data

Stats

Max:	10.20
Min:	-9.80
Std Dev:	5.50
Mean:	0.15
Median:	0.03

Processes: 6
1 Base Layer
2 DeStripe Median Sensors: All
3 De Stagger: Grids: All Mode: Both By: -1 intervals
4 Despike Threshold: 1 Window size: 3x3
5 Interpolate: Y Doubled.
6 Clip from -9.80 to 10.20 nT



Timbrelham Extension, Greystone Quarry, Launceston, Cornwall, 2015

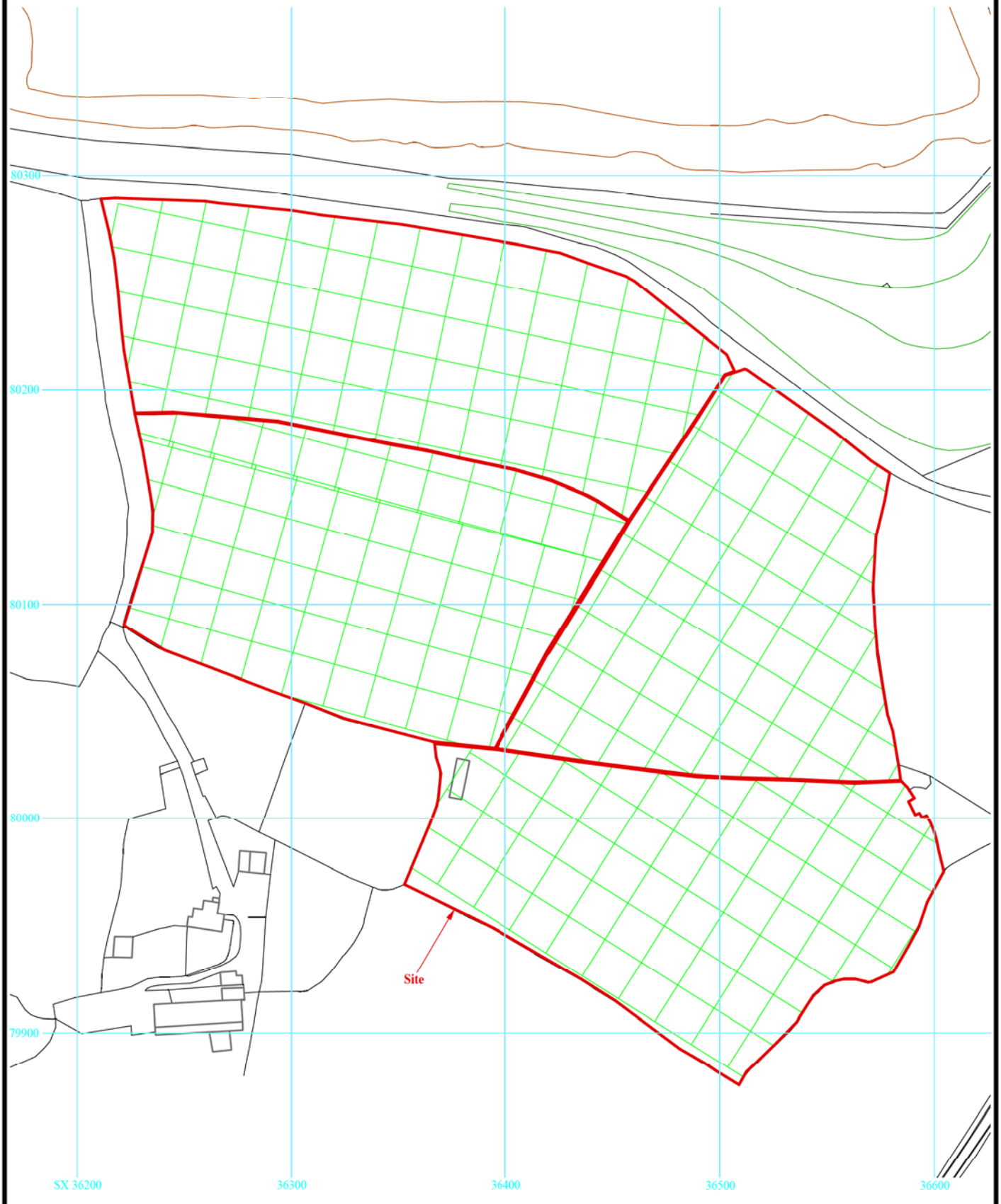
Geophysical Survey (Magnetic)

Figure 1. Location of site in relation to Lawhitton and in Cornwall

Reproduced from Ordnance Survey Explorer 116 at 1:25000

Ordnance Survey Licence 100025880

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST



GQL 15/211b

N

Timbrelham Extension, Greystone Quarry, Launceston, Cornwall, 2015
Geophysical Survey (Magnetic)

Figure 2. Survey grid layout.

0 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST

N

Timbrelham Extension, Greystone Quarry, Launceston, Cornwall, 2015
Geophysical Survey (Magnetic)

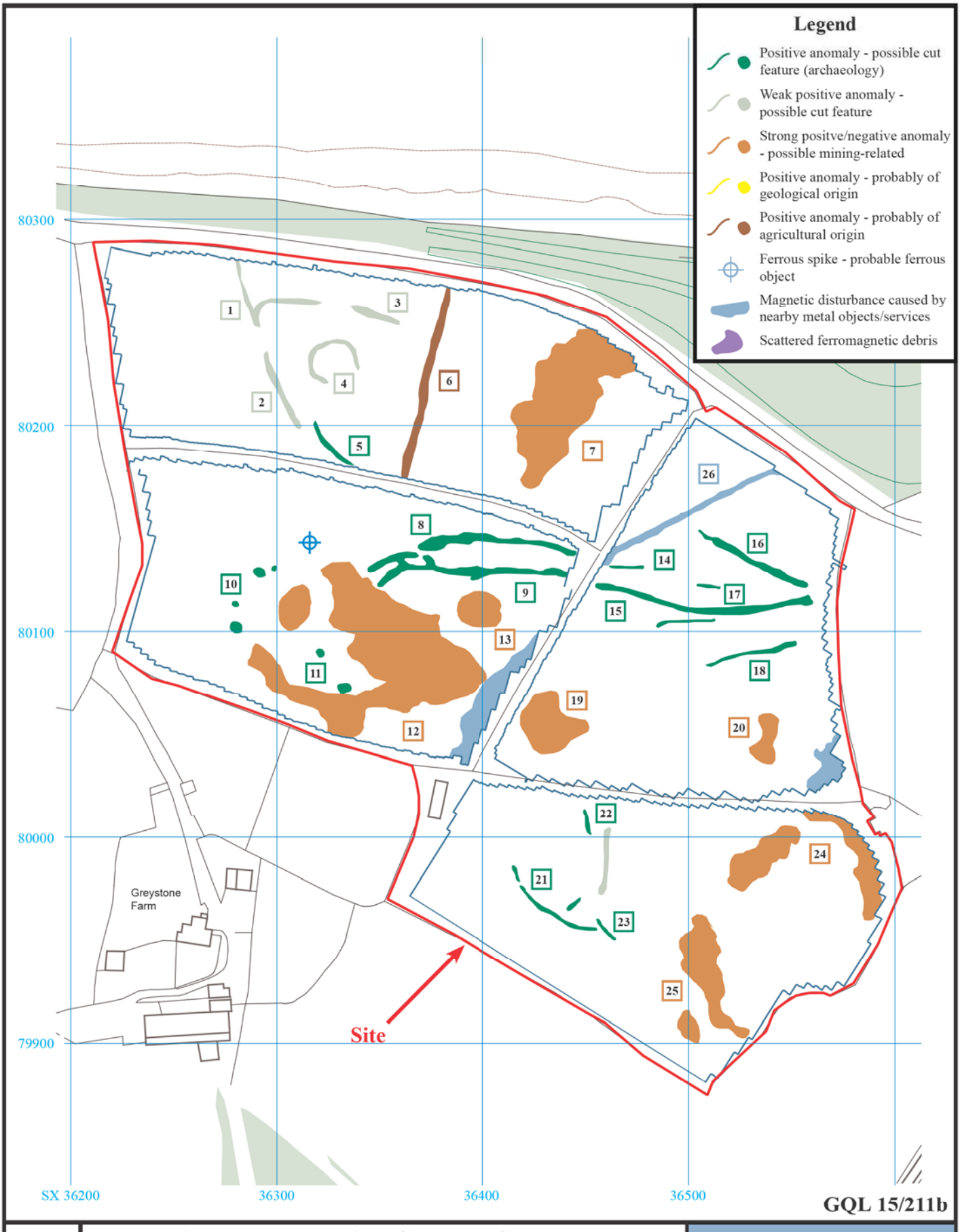
Figure 3. Plot of minimally processed gradiometer data.

0m 100m

+10.2 nT

-9.8 nT

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST



N

Timbrelham Extension, Greystone Quarry, Launceston, Cornwall, 2015
Geophysical Survey (Magnetic)

Figure 4. Interpretation plot.

0m 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST

Plate 1. The north-western field, looking south-west.

Plate 2. The south-western field, looking south-west.

Plate 3. The north-eastern field, looking south-east.

Plate 4. The south-eastern field, looking east.

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Timbrelham Extension, Greystone Quarry,
Launceston, Cornwall, 2015
Geophysical Survey (Magnetic)
Plates 1 - 4.

THAMES VALLEY
ARCHAEOLOGICAL
SERVICES

TIME CHART

	Calendar Years
Modern	AD 1901
Victorian	AD 1837
Post Medieval	AD 1500
Medieval	AD 1066
Saxon	AD 410
Roman	AD 43
Iron Age	BC/AD 750 BC
Bronze Age: Late	1300 BC
Bronze Age: Middle	1700 BC
Bronze Age: Early	2100 BC
Neolithic: Late	3300 BC
Neolithic: Early	4300 BC
Mesolithic: Late	6000 BC
Mesolithic: Early	10000 BC
Palaeolithic: Upper	30000 BC
Palaeolithic: Middle	70000 BC
Palaeolithic: Lower	2,000,000 BC

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