THAMES VALLEY

ARCHAEOLOGICAL

SERVICES

SOUTH WEST

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset

Geophysical Survey (Magnetic)

by Kyle Beaverstock

Site Code: CPS16/04

(ST 4406 5631)

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset

Geophysical Survey (Magnetic) Report

For Aggregate Industries

by Kyle Beaverstock

Thames Valley Archaeological Services Ltd

Site Code CPS 16/04

May 2016

Summary

Site name: Proposed northern extension, Callow Rock Quarry, Shipham, Somerset

Grid reference: ST 4406 5631

Site activity: Magnetometer survey

Date and duration of project: 24th February - 9th March 2016

Project manager: Steve Ford

Site supervisor: Kyle Beaverstock

Site code: CPS16/04

Area of site: *c.* 12ha

Summary of results: A small number anomalies of possible archaeological origin were identified mostly in the north-western area of the site and along the southern edge. Those identified across the majority of the rest of the site are most likely geological in origin.

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✓ 16.04.16
	Andrew Mundin✓ 16.05.16

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Proposed northern extension, Callow Rock Quarry, Shipham, Somerset
A Geophysical Survey (Magnetic)

by Kyle Beaverstock

Report 16/04b

Introduction

This report documents the results of a geophysical survey (magnetic) carried out at Callow Rock Quarry, Shipham Road, Shipham, Somerset (ST 4406 5631) (Fig. 1). The work was commissioned by Mr John Penny of Aggregate Industries UK Ltd, Frome Regional Office, Edwin Sims House, Vallis Road, Frome, Somerset, BA11 5BR. Planning permission is being sought for an extension into three fields to the north of Callow Rock Quarry (ST 4407 5630). This is in accordance with the Department for Communities and Local Government's National Planning Policy Framework (NPPF 2012), and the County's policies on archaeology. The fieldwork was undertaken by Kyle Beaverstock, David Sanchez and Nick Dawson between 24th February and 9th March 2016 and the site code is CPS 16/04.

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

Location, topography and geology

The proposal site is situated south of Shipham, a village on the Mendip Hills north of Cheddar, Somerset (Fig. 1). Shipham lies 11km east of the coastal town of Weston-Super-Mare, 1.5km east of the slightly larger village of Winscombe, and 15km north-west of the city of Wells. The site comprises three adjacent broadly rectangular, fields immediately to the north of the present active quarry works. The boundary between the two areas corresponds with the civil parish boundary so that the active quarry is in Cheddar and the proposal site is in Shipham (Fig. 2). Callow Hill forms part of the plateau over the steep south-facing scarp of the Mendip Hills overlooking the Cheddar Valley and the northern Somerset Levels. It is divided from the main body of the plateau by dry valleys on its west, north and east sides. The former high point of the hill was removed by the present quarry and the highest ground is now towards the south east corner of the proposal site, *c*. 239m above ordnance datum (aOD). Immediately east of the site boundary the ground falls away steeply to a valley bottom at around 180m aOD. The plateau dips more gently to the west and north, falling to c. 200m aOD in its north-west corner. The underlying geology is stated as Carboniferous Limestone of the Black Rock Limestone Subgroup (BGS 1984).

Site history and archaeological background

The archaeological background for this site has been highlighted in a desk-based assessment (Tabor 2016). To summarise, the area appears to be rich in prehistoric archaeology a number of Palaeolithic and Bronze Age finds recorded including a hand axe found at Winscombe (Harding and Aston 2009) and Mesolithic flintwork has been recorded from nearby at Cheddar Road and Totty Pot cave, and even on Callow Hill itself (Hosfield *et al*. 2008). The surrounding Mendip hills are also known for clusters of Bronze Age barrows (Pollard and Healy 2008). Evidence of other periods of activity is scattered with little evidence of extensive occupation.

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. There were a few noteworthy obstructions, which include two dry stone walls dividing the three fields with some trees and hedges along their length, a monitoring well in the southern half of the middle field caused some disturbance, a small pond in the northern half of the western field and a few piles of rubble and fodder around the outer edges of the site prevented a complete survey.

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 the fast yet detailed surveying 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 seen 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 -1.80 to 2.20 nT	Enhance the contrast of the image to improve the appearance of possible archaeological anomalies.
Interpolate: *y* doubled	Increases the resolution of the readings in the *y* axis, enhancing the shape of 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 2.14.0 Essen 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

A range of magnetic anomalies were recoded across the survey area (Fig. 3). The majority of these are most likely caused by fissures in the natural bedrock **[Fig. 4: 21]**. The magnetic anomalies of possible archaeological origin are recognisable as positive variations in the site's general background magnetic field. The positive anomalies usually represent buried cut features such as ditches or pits whereas negative anomalies are indicative of earthen banks, or thickened or disturbed subsoil.

The most likely anomaly of archaeological origin was a positive linear that was detected running along the southern edge of the site from the west to the east **[Fig. 4: 1, 2 and 3]**. The two positive anomalies at **[1]** run parallel for c.98m while weaker positive anomaly **[2]** extends from the northern of the two for a further c.28m. Although the anomaly is not clearly defined along the bottom of the central field it appears again in the eastern field **[3]** for a further 119m. Together these probably represent the ditches of an earlier field boundary or possibly droveway.

What appears to be another set of positive linear anomalies extends north-westwards from the southern edge of the western field. A shorter section **[4]** extends for c.59m while a parallel anomaly c.40m to the north-east **[5]** extends for c.47m with a short break before it continues for a further c.81m **[6]** and then turns to take a more northerly course for 76m **[8]**. At the south-eastern end of **[6]** the anomaly branches northwards for c.39m **[7]** before becoming unclear in the area of anomalies of possible geological origin **[21]**. A second branch **[10]** heads off in a more westerly direction for c.35m at the point where **[6]** turns northwards. A c.45m-long positive anomaly **[9]** runs parallel to **[6]** some 37m to the north-east. At its northern end are a series of positive curvilinear anomalies of varying strength **[12]** which together appear to form the southern half of a circular feature consisting of at least two concentric rings with a total diameter of c.48m. In the north-western corner of

the western field two sections of positive linear anomaly **[11]** appear to create a length of north-south cut feature which then turns north-eastwards at its northern end.

The majority of the positive linear anomalies in the central and eastern fields appear to be on similar orientation as the anomalies which are probably caused by the underlying geology across the centre of the fields **[21]**. In the central field are two sets of linear anomalies **[13, 14]**, both on the same south-west - north-east orientation, while in the eastern field are a further two on the same alignment **[15, 16]** and a third, **[18]** which runs perpendicular.

In the northern part of the eastern field are a series of weak positive linear anomalies which appear to join with a stronger one to form three sides of a square **[17]**. It is on a slightly different alignment to the other positive anomalies noted in this field and measures c.14m × 14m. The eastern field also contains two areas of strong positive magnetic anomalies with strong negative responses **[19, 20]**. These may represent areas of heat effect ground such as burning, but could equally be an area of disturbed subsoil, which has changed its magnetic signature.

Several of the anomalies noted above, however, may have been influenced by the considerable interference across the southern and central area of the site which was most likely caused by the underlying geology. This may also be the source of some of the anomalies which have been interpreted as being of possible archaeological origin. Additionally, the monitoring well or borehole in the southern half of the central field as well as the wire fencing surrounding the site caused significant localised interference and may be masking possible features.

Conclusion

In conclusion, a few possible anomalies of probable archaeological origin were identified, mostly in the north-western area of the site and along the southern edge. The majority of the rest of the site appears to show extensive anomalies of probable geological origin mainly within a band along the southern and central areas of the site. It is possible that the anomalies interpreted as potential archaeological features in these areas may be geological fissures.

The survey was able to cover the entire field with a minimum of obstacles. The only areas of magnetic interference encountered were adjacent to the wire fencing which borders the fields to the north, east and west and the well or borehole in the central field.

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Appendix 1. Survey and data information

Programme:
Name: TerraSurveyor
Version: 3.0.25.0

Raw data
Instrument Type: Bartington (Gradiometer)
Units: nT
Survey corner coordinates (X/Y):
Northwest corner: 344331.85, 156177.79 m
Southeast corner: 344891.85, 155897.79 m
Direction of 1st Traverse: 268.12 deg
Collection Method: ZigZag
Sensors: 2 @ 1.00 m spacing.
Dummy Value: 2047.5

Dimensions
Composite Size (readings): 2240 x 280
Survey Size (meters): 560 m x 280 m
Grid Size: 20 m x 20 m
X Interval: 0.25 m
Y Interval: 1 m

Stats
Max: 97.09
Min: -100.00
Std Dev: 8.73
Mean: -0.18
Median: 0.55
Composite Area: 15.68 ha
Surveyed Area: 11.382 ha

Source Grids: 358
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269 Col:20 Row:12 grids\152.xgd
270 Col:20 Row:13 grids\153.xgd
271 Col:21 Row:0 grids\154.xgd
272 Col:21 Row:1 grids\155.xgd
273 Col:21 Row:2 grids\156.xgd
274 Col:21 Row:3 grids\157.xgd
275 Col:21 Row:4 grids\158.xgd
276 Col:21 Row:5 grids\159.xgd
277 Col:21 Row:6 grids\160.xgd
278 Col:21 Row:7 grids\161.xgd
279 Col:21 Row:8 grids\162.xgd
280 Col:21 Row:9 grids\163.xgd
281 Col:21 Row:10 grids\164.xgd
282 Col:21 Row:11 grids\165.xgd
283 Col:21 Row:12 grids\166.xgd
284 Col:21 Row:13 grids\167.xgd
285 Col:22 Row:0 grids\168.xgd
286 Col:22 Row:1 grids\169.xgd
287 Col:22 Row:2 grids\170.xgd
288 Col:22 Row:3 grids\171.xgd
289 Col:22 Row:4 grids\172.xgd
290 Col:22 Row:5 grids\173.xgd
291 Col:22 Row:6 grids\174.xgd
292 Col:22 Row:7 grids\175.xgd
293 Col:22 Row:8 grids\176.xgd
294 Col:22 Row:9 grids\177.xgd
295 Col:22 Row:10 grids\178.xgd
296 Col:22 Row:11 grids\179.xgd
297 Col:22 Row:12 grids\180.xgd
298 Col:22 Row:13 grids\181.xgd
299 Col:23 Row:0 grids\182.xgd
300 Col:23 Row:1 grids\183.xgd
301 Col:23 Row:2 grids\184.xgd
302 Col:23 Row:3 grids\185.xgd
303 Col:23 Row:4 grids\186.xgd
304 Col:23 Row:5 grids\187.xgd
305 Col:23 Row:6 grids\188.xgd
306 Col:23 Row:7 grids\189.xgd
307 Col:23 Row:8 grids\190.xgd
308 Col:23 Row:9 grids\191.xgd
309 Col:23 Row:10 grids\192.xgd
310 Col:23 Row:11 grids\193.xgd
311 Col:23 Row:12 grids\194.xgd
312 Col:23 Row:13 grids\195.xgd
313 Col:24 Row:0 grids\196.xgd
314 Col:24 Row:1 grids\197.xgd
315 Col:24 Row:2 grids\198.xgd
316 Col:24 Row:3 grids\199.xgd
317 Col:24 Row:4 grids\200.xgd
318 Col:24 Row:5 grids\201.xgd
319 Col:24 Row:6 grids\202.xgd
320 Col:24 Row:7 grids\203.xgd
321 Col:24 Row:8 grids\204.xgd
322 Col:24 Row:9 grids\205.xgd
323 Col:24 Row:10 grids\206.xgd
324 Col:24 Row:11 grids\207.xgd
325 Col:24 Row:12 grids\208.xgd
326 Col:25 Row:0 grids\209.xgd
327 Col:25 Row:1 grids\210.xgd
328 Col:25 Row:2 grids\211.xgd
329 Col:25 Row:3 grids\212.xgd
330 Col:25 Row:4 grids\213.xgd
331 Col:25 Row:5 grids\214.xgd
332 Col:25 Row:6 grids\215.xgd
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334 Col:25 Row:8 grids\217.xgd
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336 Col:25 Row:10 grids\219.xgd
337 Col:25 Row:11 grids\220.xgd
338 Col:25 Row:12 grids\221.xgd
339 Col:26 Row:1 grids\222.xgd
340 Col:26 Row:2 grids\223.xgd
341 Col:26 Row:3 grids\224.xgd
342 Col:26 Row:4 grids\225.xgd
343 Col:26 Row:5 grids\226.xgd
344 Col:26 Row:6 grids\227.xgd
345 Col:26 Row:7 grids\228.xgd
346 Col:26 Row:8 grids\229.xgd
347 Col:26 Row:9 grids\230.xgd
348 Col:26 Row:10 grids\231.xgd
349 Col:26 Row:11 grids\232.xgd
350 Col:26 Row:12 grids\233.xgd
351 Col:27 Row:5 grids\234.xgd
352 Col:27 Row:6 grids\235.xgd
353 Col:27 Row:7 grids\236.xgd
354 Col:27 Row:8 grids\237.xgd
355 Col:27 Row:9 grids\238.xgd
356 Col:27 Row:10 grids\239.xgd
357 Col:27 Row:11 grids\240.xgd
358 Col:27 Row:12 grids\241.xgd

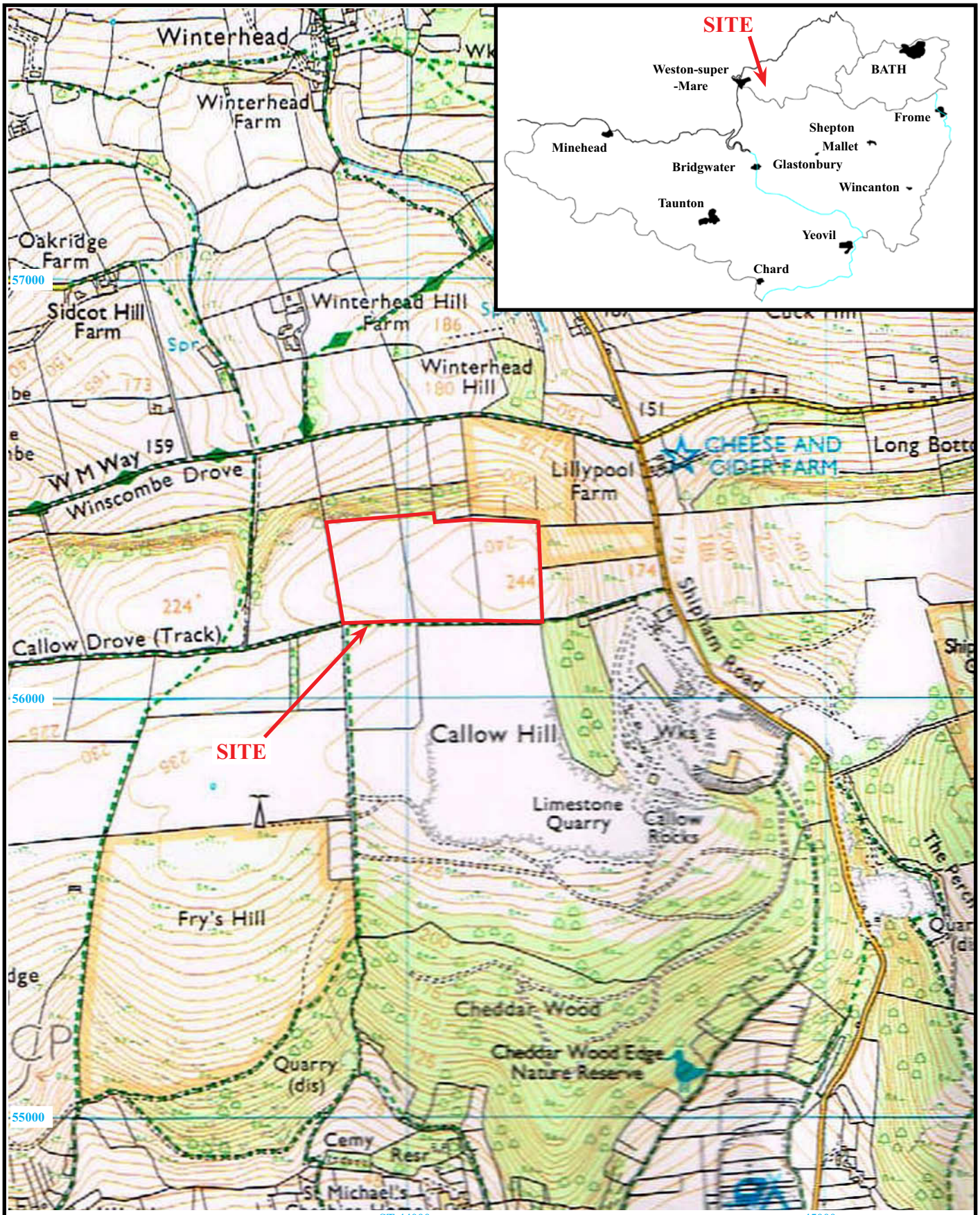
Processed data

Stats

Max:	2.20
Min:	-1.80
Std Dev:	1.00
Mean:	0.05
Median:	0.01

Processes: 9

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 -1.80 to 2.20 nT
7 Move (Area: Top 0, Left 720, Bottom 559, Right 2239) to X -80, Y 0
8 Move (Area: Top 0, Left 1360, Bottom 439, Right 2159) to X -80, Y 0
9 Move (Area: Top 440, Left 1440, Bottom 559, Right 2159) to X -80, Y 0

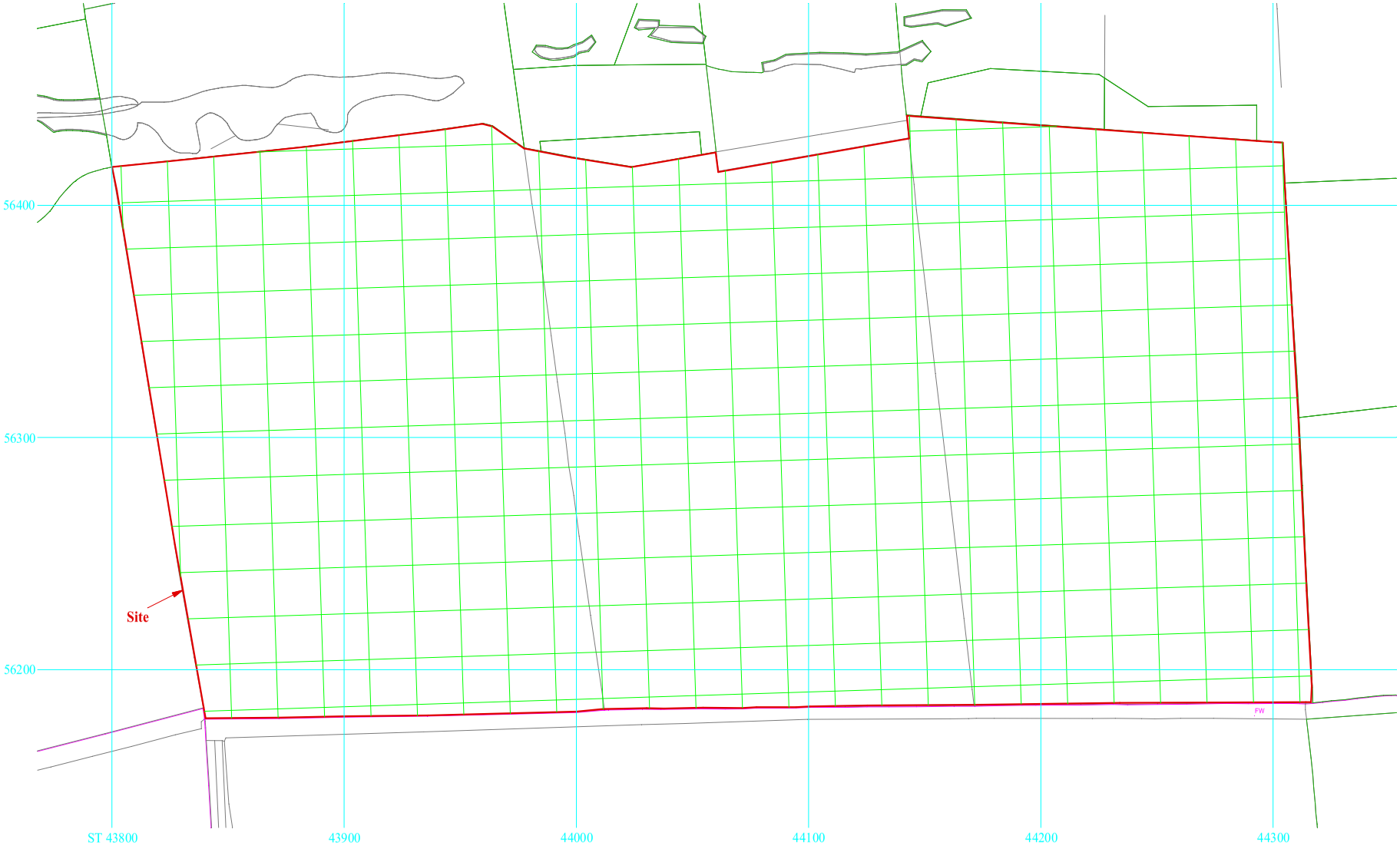


CPS 16/04b

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset, 2016
Geophysical Survey (Magnetic)

Figure 1. Location of site within Callow and Somerset.

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST



CPS 16/04b

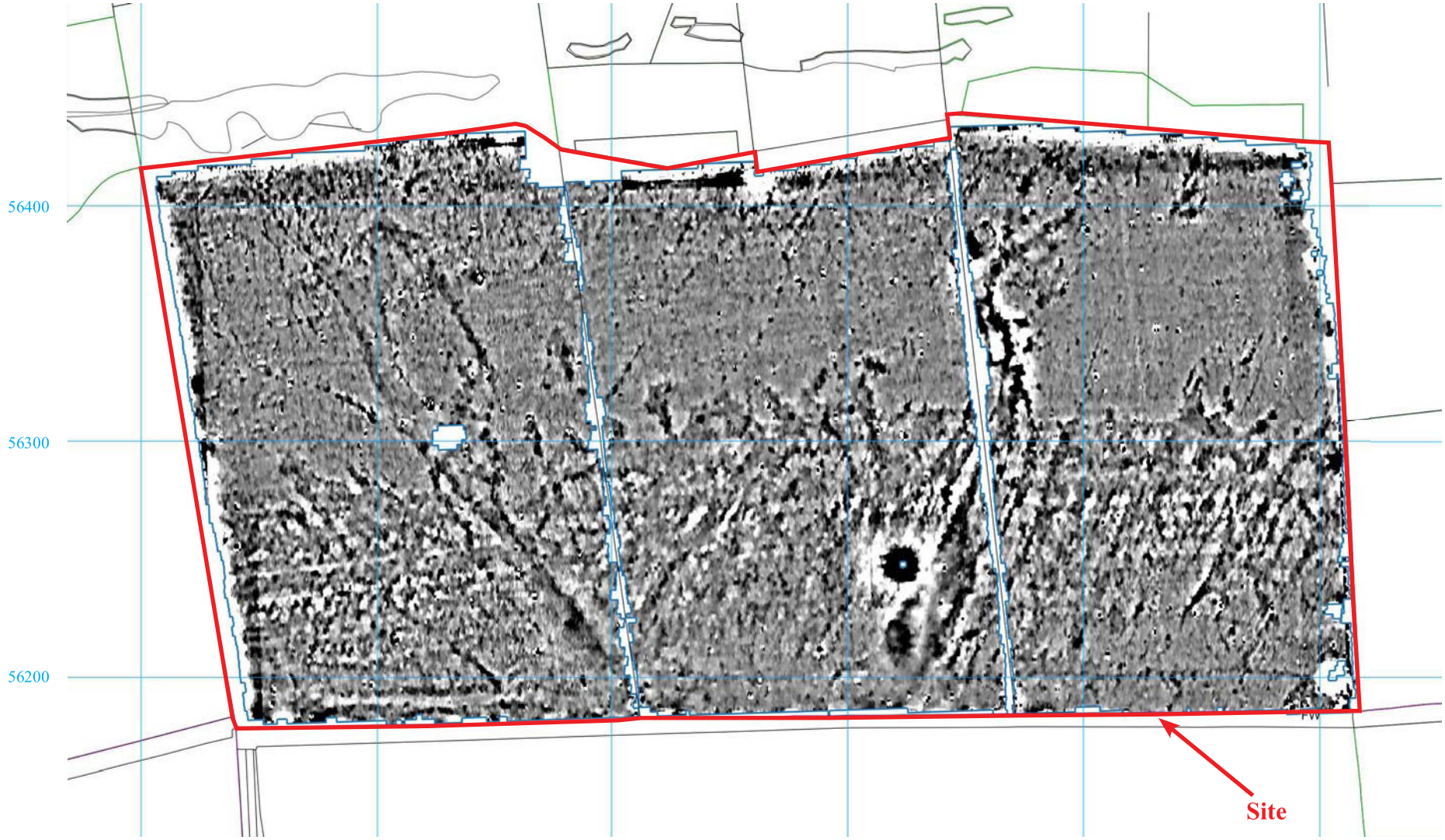
N

Proposed northern extension, Callow Rock Quarry,
Shipham, Somerset, 2016
Geophysical Survey (Magnetic)

Figure 2. Plan of the site showing survey grid layout.

0 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST



CPS 16/04b

N

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset, 2016
Geophysical Survey (Magnetic)

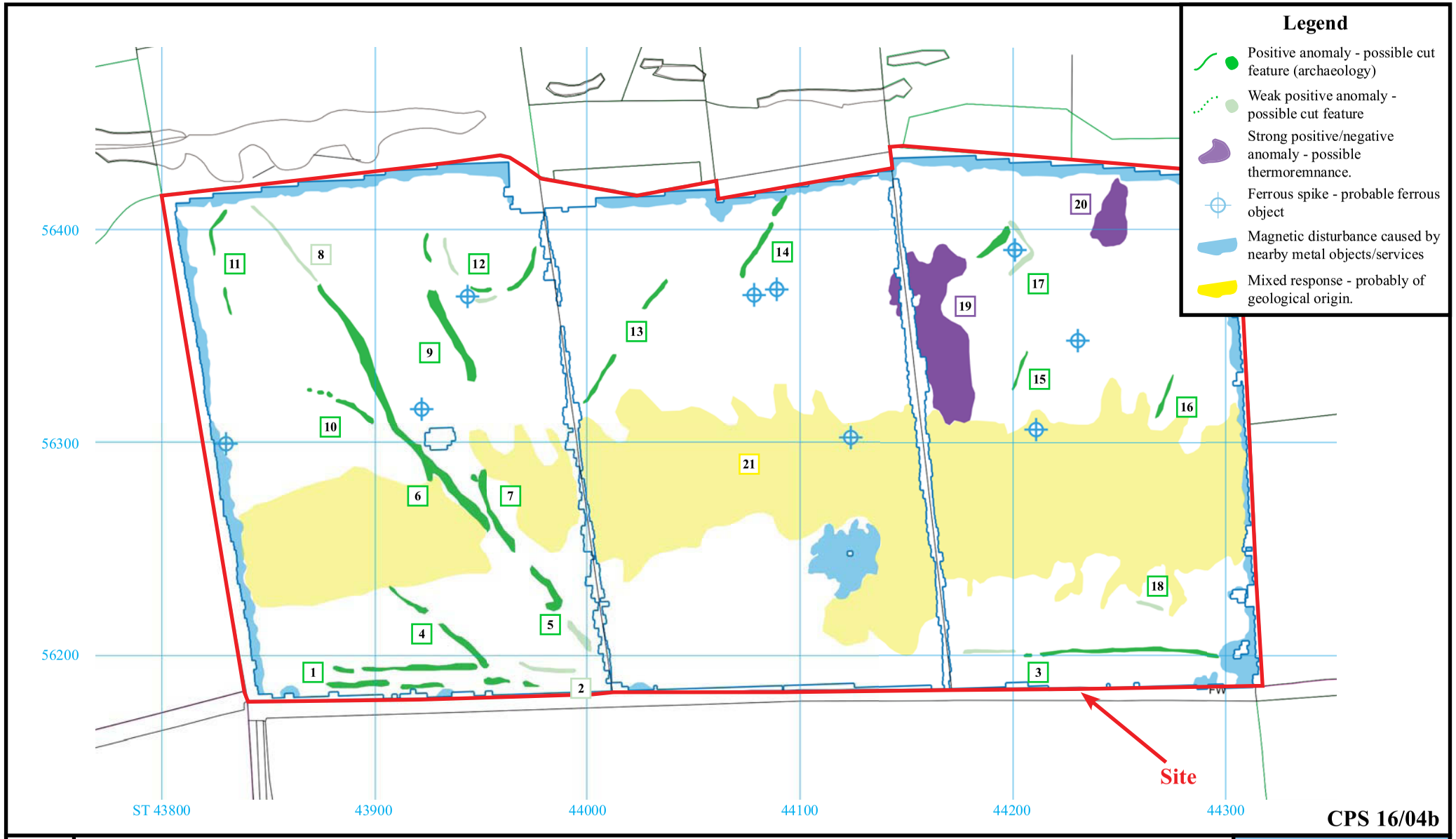
Figure 3. Plot of minimally processed gradiometer data.

0m 100m

+2.2 nT

-1.8 nT

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST



N

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset, 2016
Geophysical Survey (Magnetic)
Figure 4. Interpretation plot.

0m 100m

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST

Plate 1. The site looking westwards along the northern boundary.

Plate 2. The site looking north-west from the southern boundary.

CPS 16/04b

Proposed northern extension, Callow Rock Quarry, Shipham, Somerset, 2016
Geophysical Survey (Magnetic)
Plates 1 - 2.

THAMES VALLEY ARCHAEOLOGICAL SERVICES SOUTH WEST

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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