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**LAND OFF  
SLEAFORD ROAD  
ANCASTER  
GEOPHYSICAL SURVEY  
(ANCQ18)**

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Work undertaken for  
**GOLDHOLME STONE LTD**  
c/o **HUGHES CRAVEN LTD**

May 2018

Report produced by  
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OASIS Record No: archaeol1-317128  
National Grid Reference: SK 9892 4346

APS Report No: **30/18**

**ARCHAEOLOGICAL  
PROJECT  
SERVICES**



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## 1. SUMMARY

*A detailed magnetic gradiometer survey was undertaken on land to the south of Sleaford Road, Ancaster, Lincolnshire. The survey was undertaken to assist in the planning of future quarry expansion and was carried out over an area totalling 7.2hectares.*

*The survey identified multiple anomalies, some of which are continuations of field boundaries recorded during archaeological investigations undertaken previously at the site. There are a number of anomalies which are of a geological or modern origin.*

## 2. INTRODUCTION

### 2.1 Definition of an Evaluation

Geophysical survey is a non-intrusive method of archaeological evaluation. Evaluation is defined as 'a limited programme of non-intrusive and/or intrusive fieldwork which determines the presence or absence of archaeological features, structures, deposits, artefacts or ecofacts within a specified area or site. If such archaeological remains are present Field Evaluation defines their character and extent, quality and preservation, and it enables an assessment of their worth in a local, regional, national or international context as appropriate' (ClfA 2014a).

### 2.2 Project Background

Archaeological Project Services was commissioned by Hughes Craven Ltd on behalf of Goldholme Stone Ltd to undertake a detailed magnetometer survey of some 7.2hectares of land adjacent to Castle Quarry, Sleaford Road, Ancaster, Lincolnshire. This was in order to assist in future quarrying operations adjacent to the existing works. The survey was carried out on the 8<sup>th</sup> and 9<sup>th</sup> May 2018.

### 2.3 Topography and Geology

Ancaster is situated 9.5km west of Sleaford and 10.6km northeast of Grantham in the administrative district of South Kesteven, Lincolnshire (Fig 1).

The proposed site is located 600m southeast of the centre of Ancaster, as defined by the parish church of St Martin, at National Grid Reference SK 9892 4346 (Fig 2). The site lies south of Sleaford Road at a height of c. 70m OD on land that slopes down to the north.

Local soils are of the Elmton 3 Association and consist of shallow loamy clayey soils (Hodge *et al.* 1984, 181, 194). The soils are developed upon a solid geology of Jurassic Upper Lincolnshire Limestone with no recorded superficial deposits (BGS 2016).

### 2.4 Archaeological Setting

There is a long history of archaeological investigation at Goldholme Quarry and the wider Ancaster area. At the quarry itself investigations first began in the 1960s when Jeffrey May (May 1976) undertook excavations adjacent to the original Castle Lime Pit quarry. When first identified this was the only settlement site of earlier Iron Age date known in Lincolnshire and the distinctive scored pottery recovered from the site became known as Ancaster-Breedon ware, taking this name from the Castle Pit site and a hill fort site in Leicestershire where the pottery was also recovered. Since this time this pottery has been recovered from many sites from around the East Midlands and is known simply as Scored Ware.

Although a portion of the site had been lost to the quarry, May was able to identify the remains of at least two structures which were interpreted as circular hut type buildings. One of these was defined by a 12.5m diameter shallow circular ditch which enclosed the remains of an oven and scattered post holes which possibly marked the positions of internal divisions or roof supports. The second hut was much smaller, just 4.6m in diameter and defined by a circular arrangement of post holes which marked the positions of the walls of the structure. Other features included the remains of up to 75 pits, some very shallow and only a few centimetres deep. Others were much larger and deeper including

several which were up to 1.5 metres in diameter.

The inhabitants of the site operated a subsistence based agricultural economy, the frequent quernstones recovered indicating the important role that growing and processing of cereals played. The pits possibly represented grain storage and a number of the post holes recorded on the site may have represented hay or straw drying racks. Burnt grain recovered from the fills of the pits provided additional evidence for the processing of cereals for consumption or storage. This Iron Age community also kept a range of domesticated animals including sheep, horses, cattle and pigs.

An Archaeological Desk-Based Assessment and geophysical survey was undertaken on a proposed extension to the quarry in April 2007 (Gardner and Jefferson 2007). The geophysical survey identified anomalies which indicated that the Middle Iron Age site excavated by May extended into the proposed quarry extension.

In August 2008 (Rowe 2008b) archaeological trial trench evaluation of the full area of the proposed quarry extension was undertaken. Anomalies of the previous geophysical survey were targeted and archaeological features were identified in all of the trenches. A pit of Iron Age date was recorded and a linear ditch which extended throughout much of the proposed extension proved to be distinctively V-shaped in profile. It was tentatively proposed that this latter feature may represent the enclosing ditch of a Roman military marching camp.

During July and August 2009 an archaeological Strip, Map and Record investigation was undertaken on a 40m square area in the southwest corner of the quarry extension (Rowe 2010). These excavations provided firm evidence of the remains of Iron Age settlement within the quarry extensions and also recovered additional evidence to support the interpretation that the site was occupied by a Roman military marching camp.

Subsequent investigations undertaken by Archaeological Project Services (Jefferson & Peachey 2016; Failes 2016) revealed ditches forming enclosures of Middle Iron Age date along with pits and post holes. The site would have formed part of a settlement with a subsistence based agricultural economy involving cereal production and processing along with animal husbandry, primarily sheep based.

### **3. GEOPHYSICAL SURVEY**

#### **3.1 Methods**

A magnetic gradiometry survey was carried out with a Bartington Grad 601-2 fluxgate magnetometer. The fields were divided into grids and each grid was walked systematically in a zigzag pattern, taking readings every 0.25m in traverses 1m apart.

The layout of the survey area is shown in Figure 3.

The survey was undertaken in accordance with English Heritage (2008) and ClfA (2014b) guidelines and codes of conduct. Detailed methodology can be found in Appendix 1.

#### **3.2 Results**

The presentation of the data for the site involves a greyscale print-out of the minimally processed data (Fig 4; clipped for display but otherwise unprocessed) and the processed data (Fig 5). Magnetic anomalies have been identified and plotted on to an interpretative drawing (Fig 6) and interpretations have then been plotted next to previous excavation work (Fig 7).

##### **Area 1**

Within the area there are several positive linear anomalies. These are likely to represent former ditches and field boundaries. Some of these are clearly extensions to ditches formerly excavated in the area to the west and are presumably part of the wider prehistoric field pattern.

There are a number of weaker positive linear anomalies aligned in a northeast-southwest direction.

These could also be ditches, particularly as they are parallel to the known field systems, but a geological anomaly could also be a possible interpretation.

A former small wooded area in the southeast corner (shown on Fig. 2) is indicated by discrete negative and bipolar anomalies.

In the north of the area are eight discrete patches of positive magnetic responses. Although these could indicate the position of pits, they could also indicate small-scale quarrying particularly given their position adjacent to Sleaford Road.

An area of bipolar response in the north accords well with a natural geological fissure/dry valley that was first identified in the adjacent excavated areas and possibly relating to glacial activity in the region.

Two distinct trends of positive linear patterning in the area have been identified as agricultural in origin. A slightly broader patterning, aligned north to south is possibly remnants of ridge and furrow of the medieval field system. The narrower, east-west aligned, trend is the result of modern ploughing.

#### **Area 2**

In the southern part of this area are a number of northeast-southwest aligned linear anomalies which are possibly the continuations of the prehistoric field boundaries recorded to the northeast. However, these are slightly more irregular and could also be geological.

There is a single weak positive linear anomaly that forms a sub-circular shape. This measures approximately 12m in diameter and accords well with the ring ditches of circular buildings that were excavated by May in the 1960s. However, such ditches would normally provide a higher magnetic response due to the debris associated with settlement entering the features.

The northern part of this area is dominated by a highly disturbed response. Assigned a geological response, this is probably related to former quarrying at the site, as evidenced on an early 19<sup>th</sup> century map which has this falling within *Castlepits* (OS 1814).

## **4. DISCUSSION**

The geophysical results have identified that there are multiple anomalies present within the site several of which are continuations of the field boundaries previously known from archaeological investigations adjacent to Castle Quarry. As such, these are of probable Middle Iron Age date. A small circular anomaly to the southwest of the current quarry workings, may indicate the position of a roundhouse, although a higher magnetic response would be expected.

A disturbed area of Area 2 is likely to indicate the position of the *Castlepits*, a series of small regular workings which could have originated in the medieval period, particularly when the quarries came under Royal control in the 14<sup>th</sup> century (Alexander 1995, 113). Also identified as being medieval, are traces of ridge and furrow of the field system.

## **5. ACKNOWLEDGEMENTS**

Archaeological Project Services wishes to acknowledge Mr O Craven of Hughes Craven Limited who commissioned the project on behalf of Goldholme Stone Ltd. The work was coordinated by Paul Cope-Faulkner who also edited this report. Elizabeth Bates kindly allowed access to the parish files and library maintained by Heritage Lincolnshire.

## **6. PERSONNEL**

Project coordinator: Paul Cope-Faulkner  
Geophysical Survey: Jonathon Smith, Sean Parker, Andrea Frasca  
Survey processing and reporting: Sean Parker

Archiving: Denise Buckley

## 7. BIBLIOGRAPHY

Alexander, JS, 1995 'Building Stone from the East Midlands Quarries: Sources, Transportation and Usage', *Medieval Archaeology* **XXXIX**, pp107-135

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May, J, 1976 *Prehistoric Lincolnshire* The History of Lincolnshire Committee

OS, 1814 *Lincolnshire Sheet*, Surveyors 2" drawing

Rowe, M, 2008b *Land Adjacent to the Castle Quarry, Ancaster, Lincolnshire. Archaeological Evaluation* Pre-Construct Archaeology Unpublished Report

Rowe, M, 2010 *Land Adjacent to the Castle Quarry, Ancaster, Lincolnshire. Archaeological Strip, Map and Record* Pre-Construct Archaeology Unpublished Report

## 8. ABBREVIATIONS

APS Archaeological Project Services

BGS British Geological Survey

ClfA Chartered Institute for Archaeologists

OS Ordnance Survey

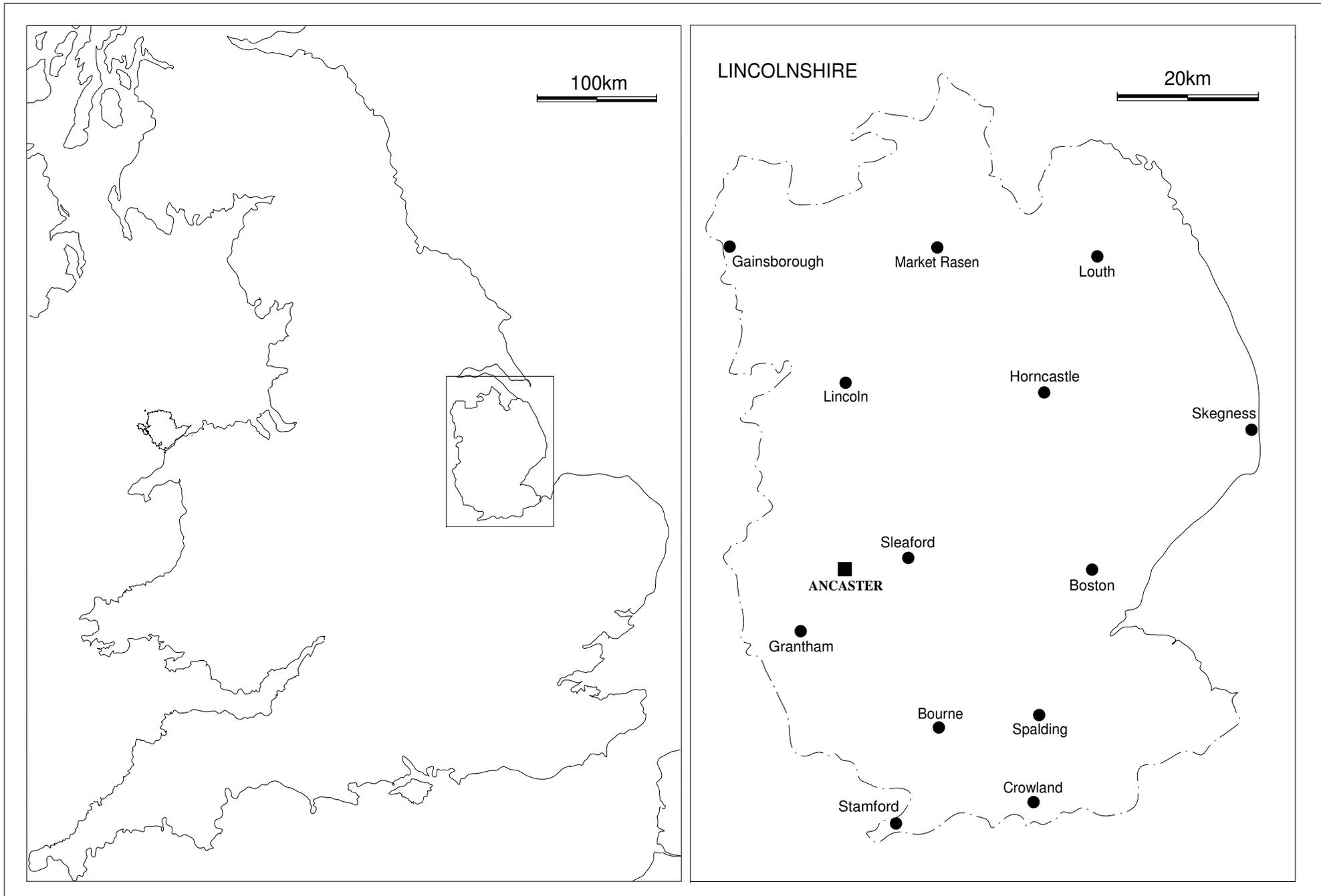


Figure 1 - General location plan



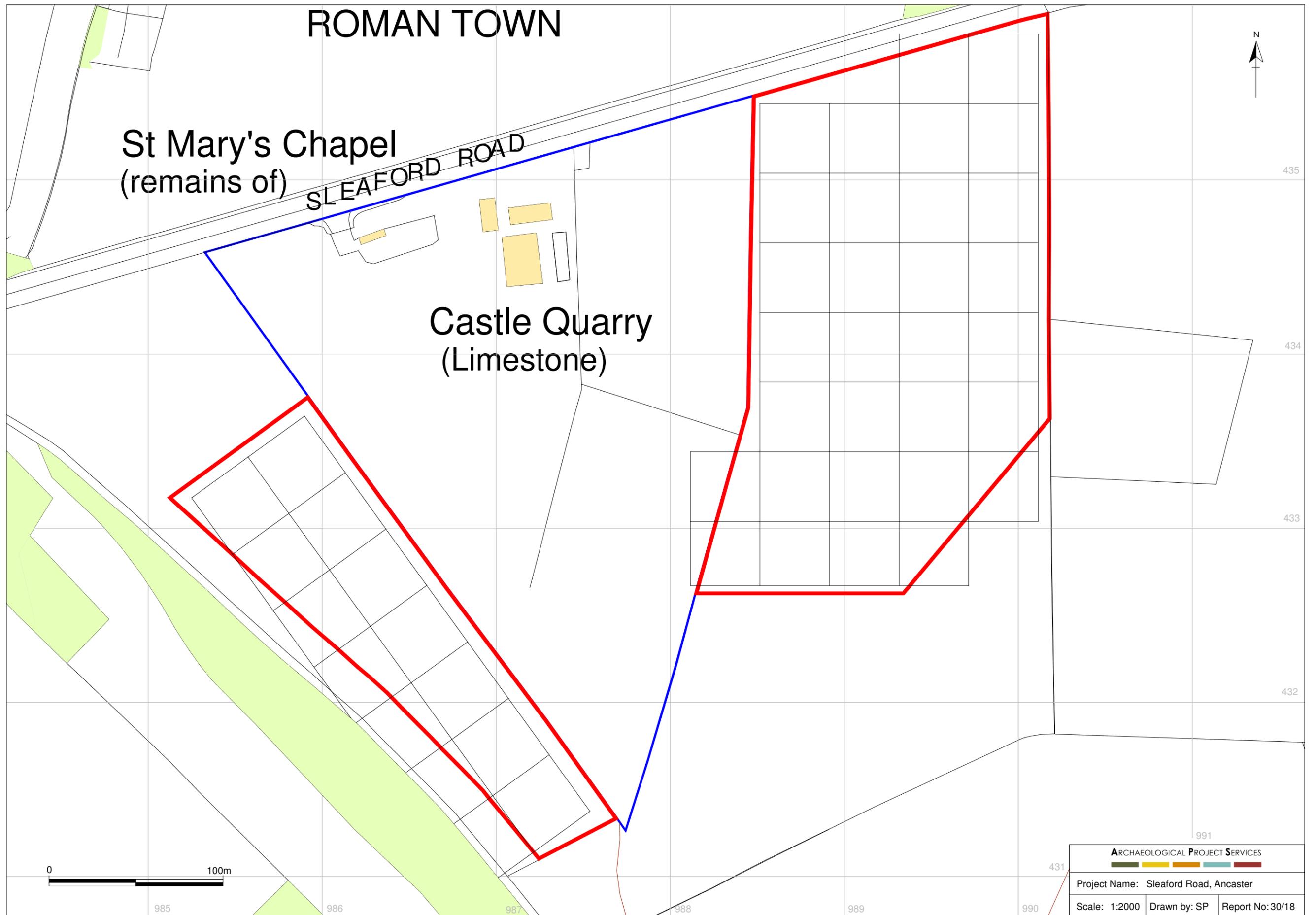


Figure 3 - Site Setout

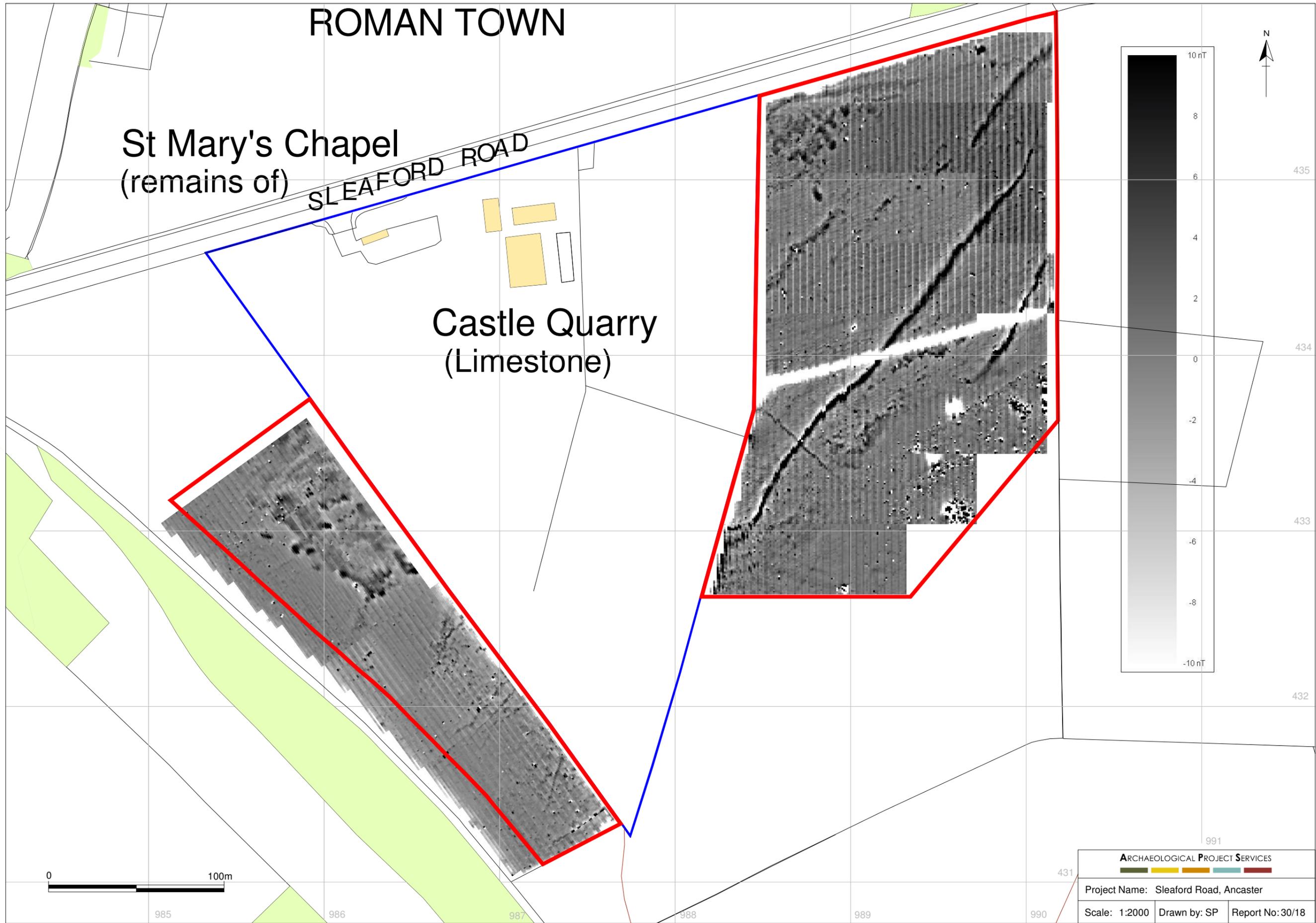


Figure 4 - Raw Greyscale data

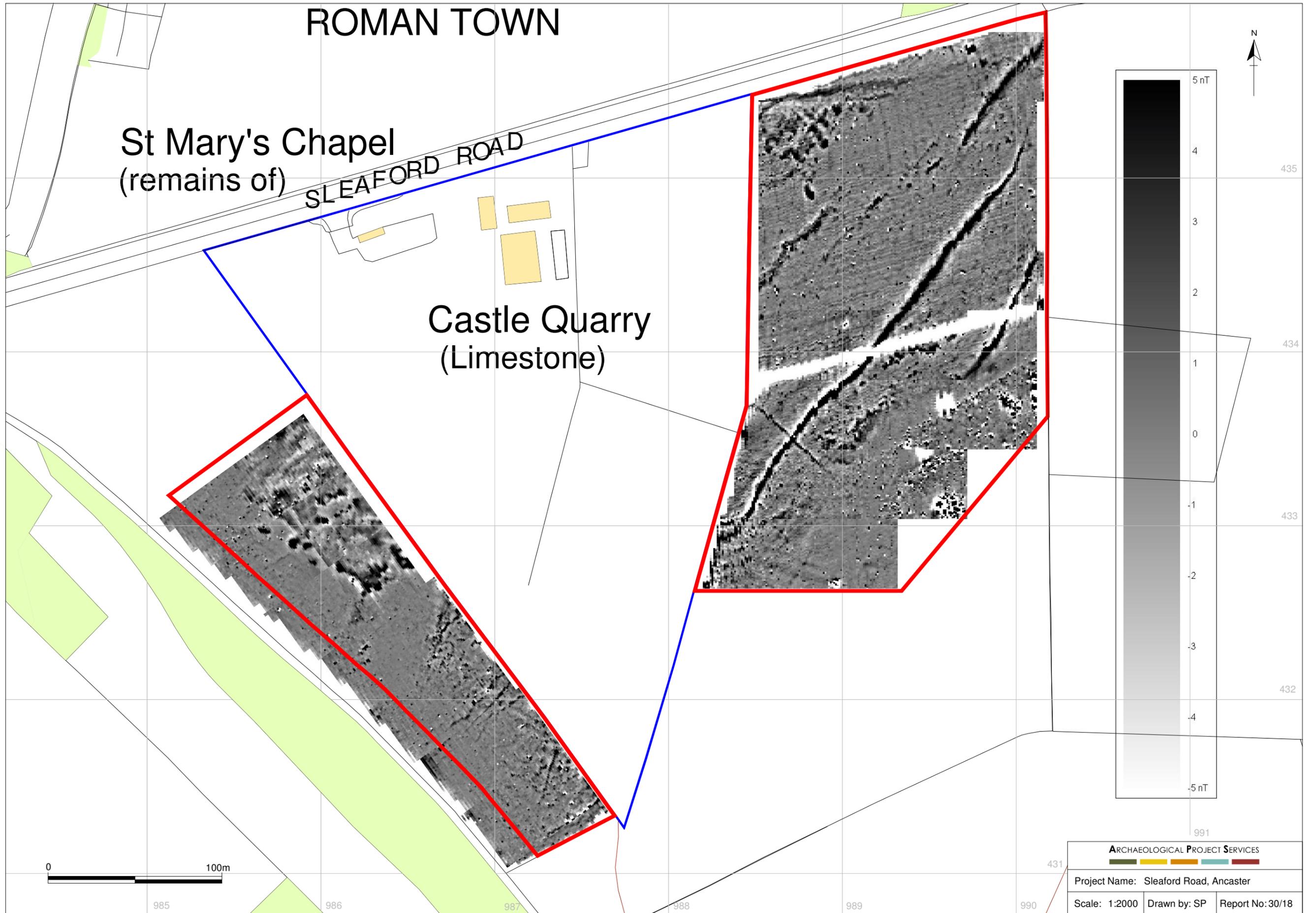


Figure 5 - Processed Greyscale data

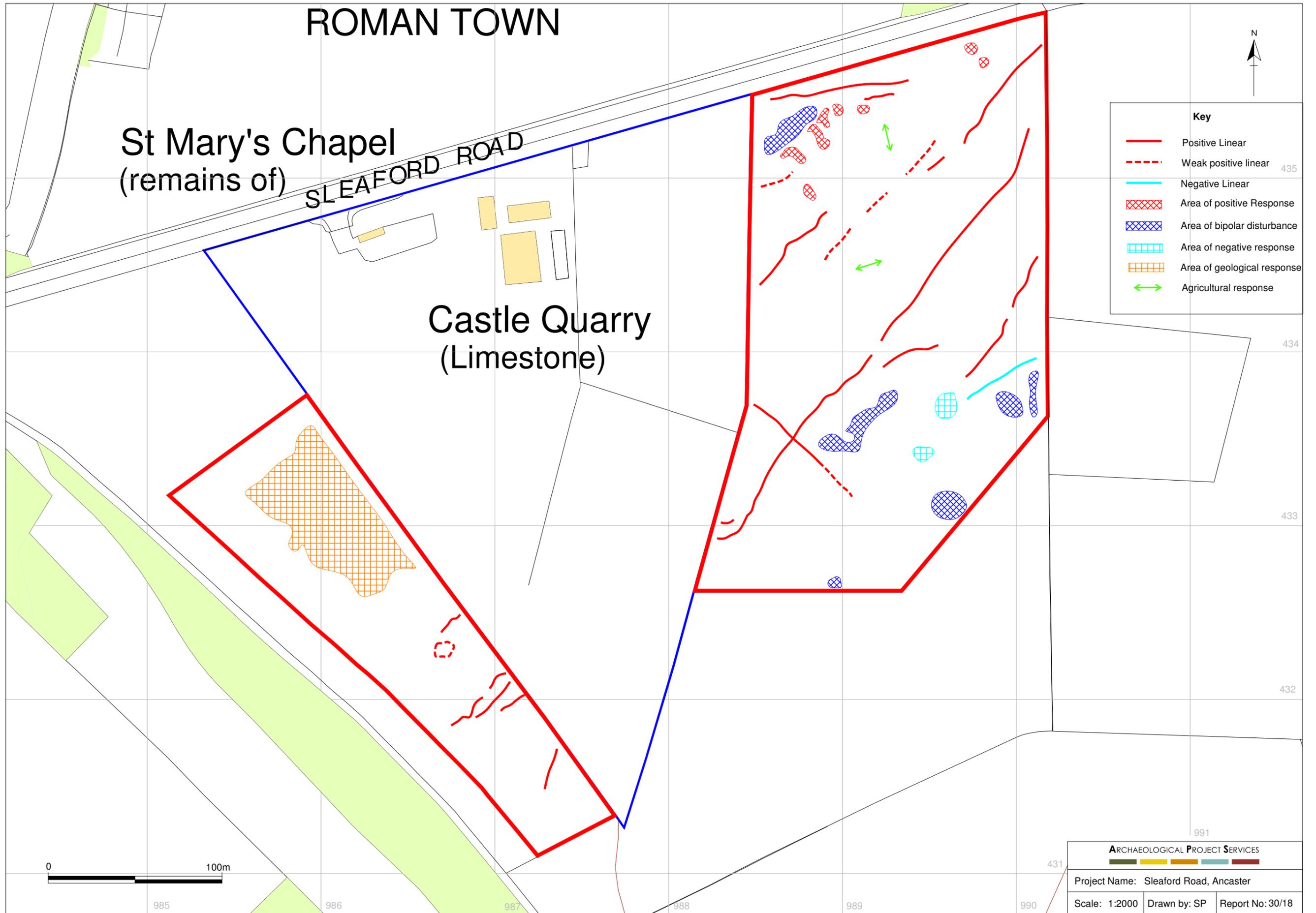


Figure 6 - Interpretation

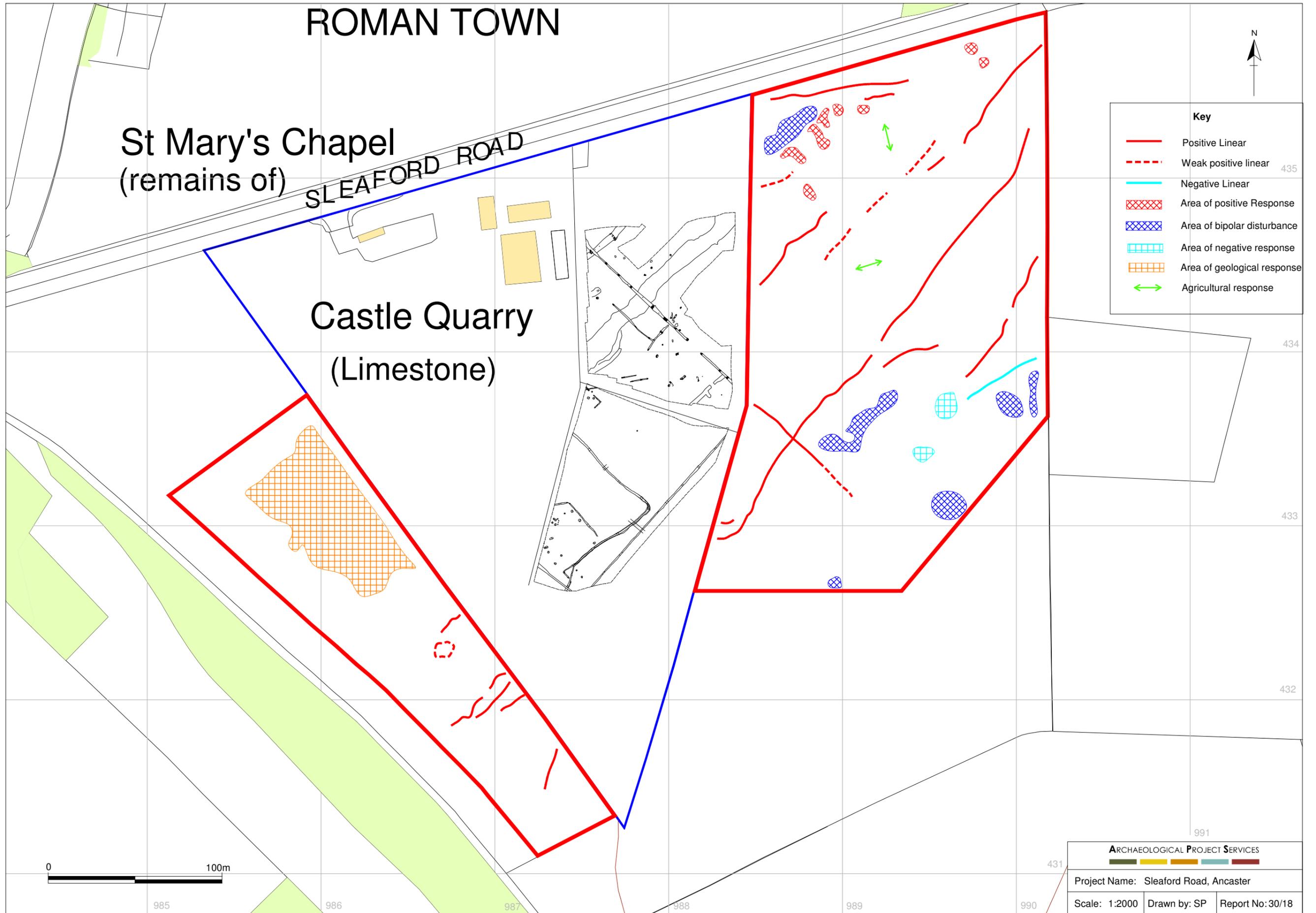


Figure 7 - Interpretation and previous excavation work

# Appendix 1

## TECHNICAL INFORMATION

### Principles of magnetometry

The basis for magnetic prospecting is the presence of weakly magnetised iron oxides in the soil. Depending on the state of iron oxides, the material will exhibit either a weak or a strong magnetisation (Gaffney and Gater 2003).

Human activities tend to enrich sediments with magnetic particles. Strong heat, such as that generated by fires, cause surrounding iron particles in the soil to become aligned with the earth's magnetic field and take on a magnetic charge. Where these particles accumulate, such as in cut features like ditches and pits, a weak positive magnetic anomaly is apparent. In cases where very strong heat has been applied, such as furnace and kiln bases, a bipolar magnetic anomaly will be apparent, with one area having a strong positive signature and one area having a strongly negative area. Where banks have been built up from natural geological material which excludes magnetically enriched sediments, or walls have been made of stone, this may result in a negative anomaly. Modern metallic items and fired bricks cause sharp bipolar spikes. Modern services have a tendency to alternate between positive and negative readings along their length.

It should be noted that not all features will be responsive and absence of anomalies does not necessarily indicate absence of archaeological features (Clark 1996).

### Bartington Grad 601-2

A gradiometer uses two sensors separated by a fixed distance in order to measure the difference in strength between the earth's magnetic field and the soil. The Bartington Grad 601 uses two fluxgate sensors separated vertically by 1m to take these readings, which reduces variations associated with the Earth's magnetic field and deep geology. Changes as small as 0.2 nanoTesla (nT) in an overall field strength of c. 49,000nT can be accurately detected using this instrumentation, although in practice instrument interference and soil noise can limit sensitivity. The instrument has typical penetration of 0.5m-1m, although stronger anomalies can be detected at greater depths. The 601-2 model uses two pairs of sensors to take parallel readings 1m apart.

### Methodology

The survey area is divided into grid squares of 30m<sup>2</sup> or 40m<sup>2</sup>, depending on the terrain. The grids are set out using a survey grade GPS, accurate to 0.03m. The grids are systematically walked in a zig-zag pattern with the gradiometer taking readings every 0.25m along a traverse, and each traverse being separated by 1m. This equates to 3600 sampling points in a full 30m x 30m grid or 6400 in a 40m x 40m grid. Readings are automatically recorded on a datalogger which is downloaded at the end of each day. The gradiometer is 'zeroed' at the start of each day and at intervals throughout to ensure consistent results are achieved throughout the survey.

### Data Processing

The data is downloaded and processed using TerraSurveyor software (version 3.0.33.1). The raw data is then adjusted to emphasise possible features. At each stage the data is examined as a greyscale image and as a trace plot.

#### *Minimally Processed data*

The data is clipped so that the mid-range of readings is most visible. This involves excluding all readings outside of the -10nT to 10nT range.

#### *Processed Data*

The following processes are applied to produce the processed greyscale image:

- **Destripe:** Each traverse is flattened with regard to surrounding traverses by setting the median value of the traverse to 0nT. This produces cleaner images, but may cause bleeding where particularly strong signals are present at one end of a traverse.
- **Data Clip:** The data is clipped to provide the most suitable contrast for seeing archaeological features. This excludes readings outside of the -5nT to 5nT range.

The following processes may also be applied to improve the clarity of the processed greyscale images:

- Despiking: Isolated anomalous readings, such as those generated by tiny iron fragments, are removed from the data. This makes the images cleaner. The parameters used are: X radius = 2; Y radius = 2; Threshold = 3SD; Spike replacement = median.
- Destagger: Minor inconsistencies in the way an operator walked grids can be corrected by shifting a traverse up to 0.5m to match edges with adjacent traverses.

Data is exported as a JPG image and georeferenced for use in scale plans of the site. Anomalies are then checked against historical maps, and where available, lidar contour data.

### **References**

Clark, A., 1996 *Seeing Beneath the Soil*, London, 2<sup>nd</sup> edn.

Gaffney C. and Gater, J., 2006 *Revealing the Buried Past: Geophysics for Archaeologists*, The History Press

## Appendix 2

### THE ARCHIVE

The archive consists of:

- 2 Daily record sheets
- 1 Report text and illustrations
- 1 Digital data

File names	ANCQ18a.xyz, ANCQ18b.xyz
Explanation of codes used in file names	.xyz files allow whole composite to be generated and stored easily.
Description of file formats	All files are in xyz format where Z= nT reading
List of codes used in files	
Hardware, software and operating systems	TerraSurveyor 3.0.33.1 running under Windows 10
Date of last modification	21/05/18
Indications of known areas of weakness in data	
Survey Technique	Zigzag
Origin	Starts at 0
Grid size	40m x 40m
Interval	X=0.25, Y=1m
Dummy Value	32702
XYZ Separation	Comma

All primary records are currently kept at:

Archaeological Project Services  
The Old School  
Cameron Street  
Heckington  
Sleaford  
Lincolnshire  
NG34 9RW

Final destination of the archive is:

The Collection  
Art and Archaeology in Lincolnshire  
Danes Terrace  
Lincoln  
LN2 1LP

OASIS code:               archaeol1-317128

Site Code:                 ANCQ18

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**OASIS ID: archaeol1-317128**

### Project details

Project name	Land off Sleaford Road, Ancaster, Geophysical Survey
Short description of the project	geophysical survey of 2 areas next to Ancaster Quarry surveying 7.2ha of pasture and arable farmland.
Project dates	Start: 08-05-2018 End: 09-05-2018
Previous/future work	No / Not known
Any associated project reference codes	ANCQ18 - Sitecode
Type of project	Field evaluation
Site status	None
Current Land use	Cultivated Land 4 - Character Undetermined
Monument type	DITCHES Uncertain
Monument type	ENCLOSURE Uncertain
Significant Finds	NONE None
Methods & techniques	"Geophysical Survey"
Development type	Mineral extraction (e.g. sand, gravel, stone, coal, ore, etc.)
Prompt	Voluntary/self-interest
Position in the planning process	Pre-application
Solid geology (other)	UPPER LINCOLNSHIRE LIMESTONE
Drift geology (other)	None
Techniques	Magnetometry

### Project location

Country	England
Site location	LINCOLNSHIRE SOUTH KESTEVEN ANCASTER Land off Sleaford Road
Postcode	NG32 3PU
Study area	7.2 Hectares
Site coordinates	SK 989 434 52.978493625484 -0.526853290486 52 58 42 N 000 31 36 W Point
Site coordinates	SK 986 432 52.976751512989 -0.531381238324 52 58 36 N 000 31 52 W Point
Height OD / Depth	Min: 60m Max: 75m

### Project creators

Name of Organisation	Archaeological Project Services
Project brief originator	Consultant
Project design originator	Archaeological Project Services
Project director/manager	Paul Cope-Faulkner
Project supervisor	Sean Parker
Type of sponsor/funding body	Developer

### Project archives

Physical Archive Exists?	No
Digital Archive recipient	The Collection
Digital Media available	"Geophysics","Survey","Text"
Paper Archive recipient	Archaeological Project Services
Paper Archive ID	ANCQ18
Paper Media available	"Diary","Photograph","Report","Survey "
Entered by	Sean Parker (info@apsarchaeology.co.uk)
Entered on	14 May 2018

## OASIS:

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