

The Landscape Research Centre

A fluxgate gradiometer survey



carried out to the east of
Hurrell Lane, Thornton-le-Dale
North Yorkshire
on behalf of Moorland Energy.

May 2010

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Report information

Client	Moorland Energy
Report type	Fluxgate gradiometer survey
Parish	Thornton-le-Dale
County	North Yorkshire
Central grid reference	SE 8502470 8190190
Report number	LRC 112
Site code	524 and 525
Date of Fieldwork	04/05/2010-10/05/2010
Date of report	12/05/2010
Fieldwork personnel	James Lyall MA (Hons), MSc
Report by	James Lyall MA (Hons), MSc
Produced by	The Landscape Research Centre Ltd

Summary

The Landscape Research Centre Ltd (LRC) carried out a fluxgate gradiometer survey on behalf of Moorland Energy over two areas (sites 524 and 525) to the east of Hurrell Lane and the north of New Ings Lane, Thornton-le-Dale, North Yorkshire (see Figure 1 for location). The areas coincide with a proposed gas processing facility (site 524) and associated temporary construction compound (site 525), which form part of the Ryedale Gas Project. The surveys represent further evaluation of the proposed development as set out in the Environmental Statement supporting the submitted planning application (Cardwell, 2010) The magnetic response of the area was low to medium, and detected the remains of ridge and furrow ploughing, removed field boundaries and a number of features of geological origin, as well as three features of possible archaeological significance.

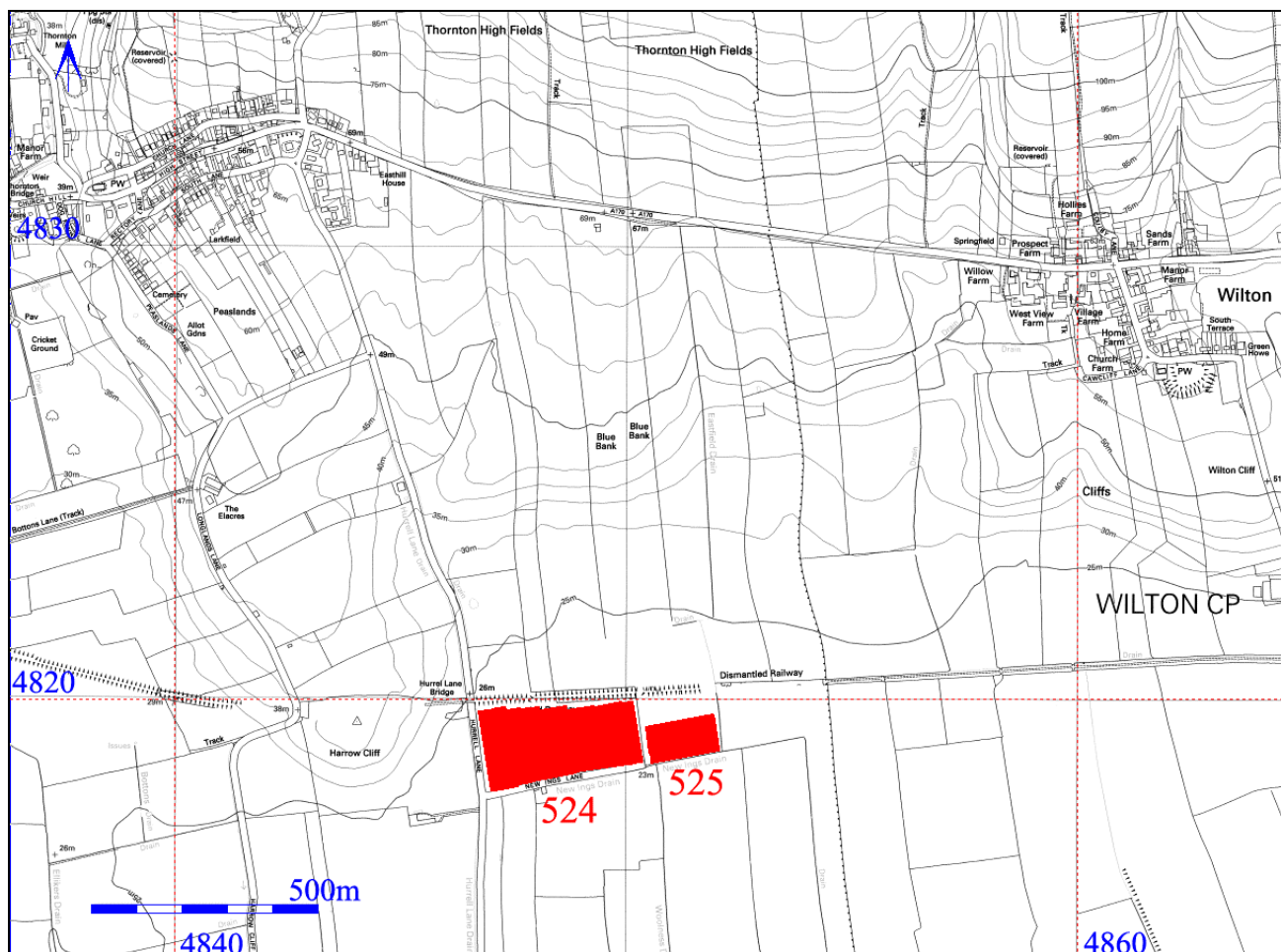


Figure 1 The location and extent of the two sites covered by the geophysical surveys (in red) with the villages of Thornton-le-Dale to the north-west and Wilton to the north-east

Methodology



The survey was conducted using a *Foerster Ferex 4.032 DLG* fluxgate gradiometer 4-probe array. This machine is capable of high resolution data collection, and takes readings every 10cm along the traverse axis and every 50cm along the grid axis (thus achieving 18000 readings per 30m square). The machine collects samples at a 0.2 nT sensitivity range. Because the cart uses a real time kinematic GPS to position itself, each data point of the survey has an inbuilt sub 2cm accuracy. The area covered

Figure 2 Dried clay surface

over site 524 was 5.213 Ha, and 1.266 Ha was covered over site 525, giving a combined total of 6.479 Ha over the two sites. Sites 524 and 525 are currently under an arable regime, and at the time of survey both fields had a low winter cereal crop, which did not hamper the data collection. The drift geology is a sandy clay, which had dried out at the time of survey (see Figure 2)

The data from the magnetometer has been processed and presented using G-Sys (an in-house developed Geographic Database Management program which can also display, process and present digitised plans and images). This report was produced using Microsoft Word 2000 and Adobe Photoshop 7 for further image manipulation. All maps have north pointing to the top of the page, and have been provided by Peter Cardwell (Archaeological and Heritage Consultant).

Gradiometer results and interpretation

The results of the survey are displayed both as a greyscale image (see Figure 3) and an interpretative plan (see Figure 7 and Figure 8). The greyscale images for each site are printed to scale in [Appendix One](#) (see Figure 14 and Figure 15). Features discovered by magnetic survey techniques are referred to as “anomalies”, defined as such because they are different from the background magnetic norm.

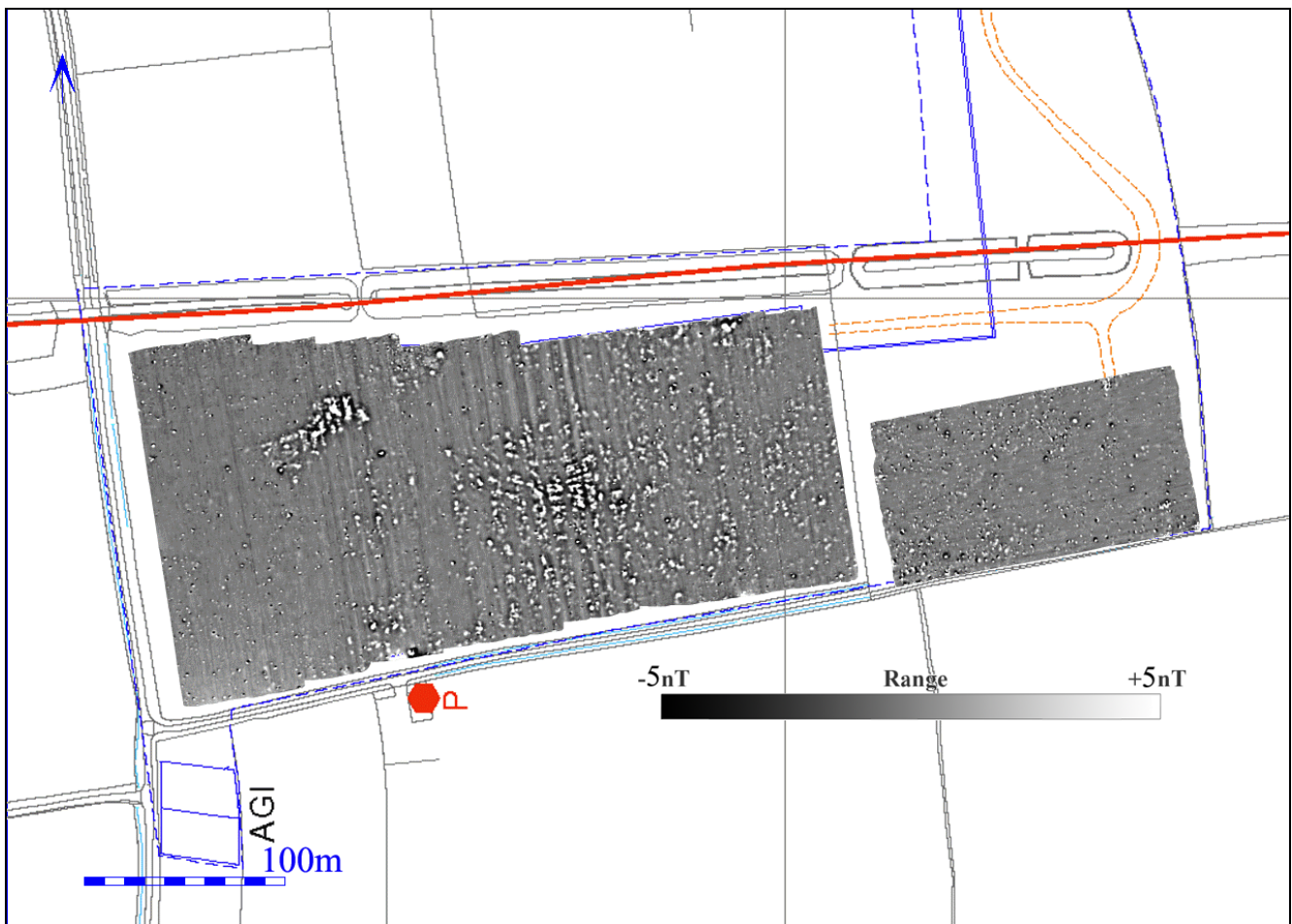


Figure 3 A greyscale plot of the geophysical data

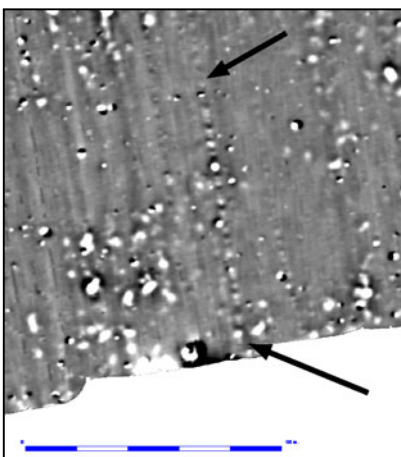
The small black and white areas in the greyscale images (see Figure 14 and Figure 15) are dipoles (iron spikes), which indicate the presence of iron or steel objects. These are generally found in the topsoil, and although they could signify the presence of archaeological objects, it is much more likely that they relate to more modern detritus, such as broken ploughshares, iron horseshoes, shotgun cartridges etc.

Ridge and furrow ploughmarks

From the Google Earth coverage, it is clear that ridge and furrow ploughmarks were present to the north of the surveyed areas (see arrowed in Figure 4), where the greener lines indicate the remains of the furrows (the ridges have been ploughed out). The potential presence of ridge and furrow was indicated in paragraph 13.65 of the Environmental Statement, (Cardwell, 2010). It is also clear that furrows extend into the surveyed area, although they are not fully represented in the magnetic data. They were just visible in the western and eastern parts of site 524 (digitised as single lines in Figure 7), but were much clearer in the centre of the field, and here they are digitised as full polygons. In total, 32 anomalies were interpreted as furrows, with the central 10 being the most evident. No evidence for ridge and furrow was detected in the magnetic data for site 525.



Figure 4 The geophysical survey data in relation to Google Earth imagery showing ridge and furrow ploughmarks (arrowed, and in this instance a montage of 2002 and 2009 Google Earth images)



A line of dipoles (see arrowed in Figure 5) leading from the south of site 524 hinted at an old field boundary which had been removed as indicated in paragraph 13.75 of the Environmental Statement, (Cardwell, 2010). A quick perusal of the 1854 1st edition Ordnance survey map showed that site 524 had originally been divided into five fields (see Figure 6). All but one of these boundaries were detected in the magnetic survey, although none as clearly defined as that marked by the line of dipoles. The north-south field divisions were masked by the ridge and furrow, which was at the same angle (see Figure 7), and

Figure 5 A line of dipoles

the single east-west boundary was defined as a very faint positive magnetic anomaly.



Figure 6 Location of the survey areas in relation to the 1st edition Ordnance Survey map (1854)

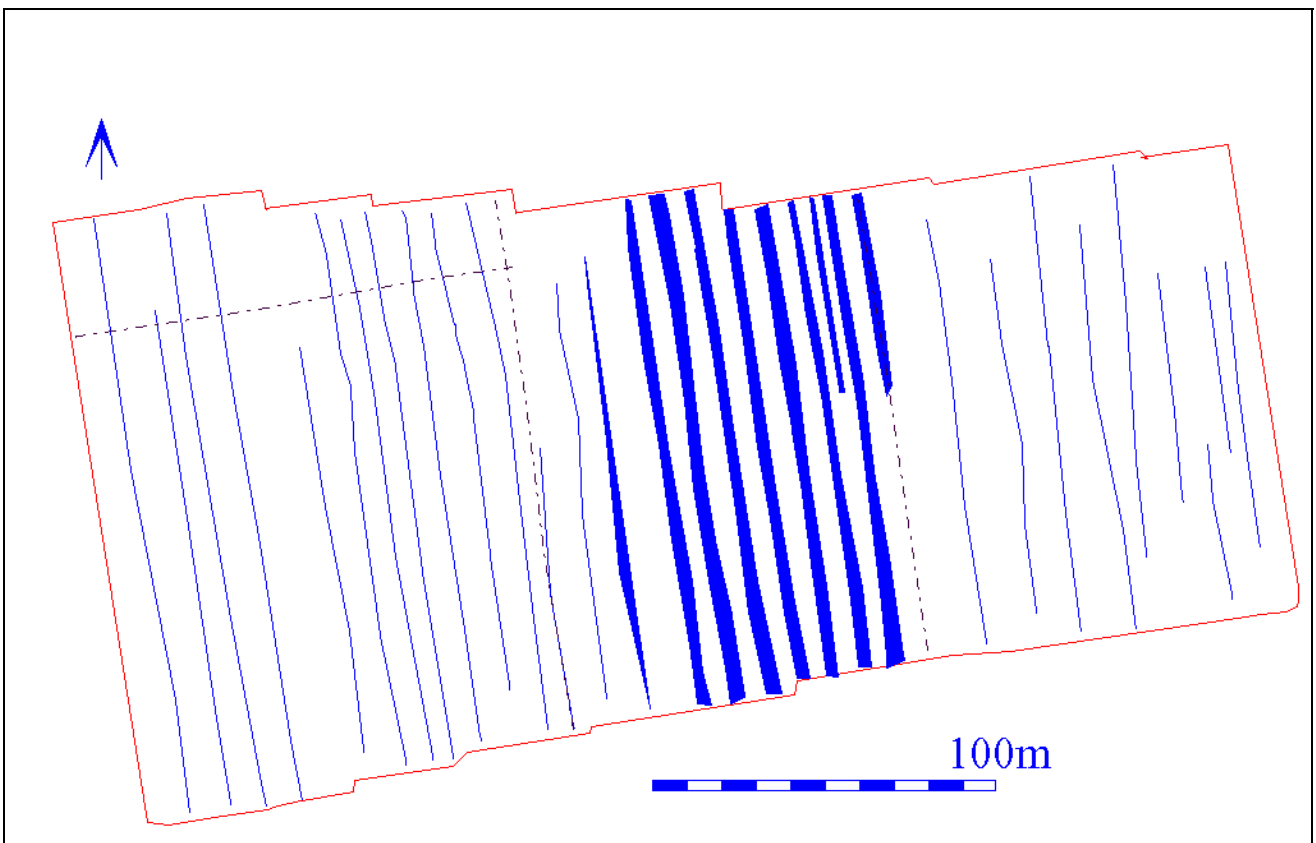


Figure 7 Interpreted ridge and furrow ploughmarks (in blue) with old field boundaries (dashed in black)

Groups of localised anomalies

The most striking aspect of the survey data from both fields was the number of localised or discrete anomalies detected. They were not evenly spread across the area, and have been interpreted into 9 different groupings (A to H in Figure 8). Some of these may be related to the construction of the railway embankment which lies immediately to the north of the survey (for instance group B).

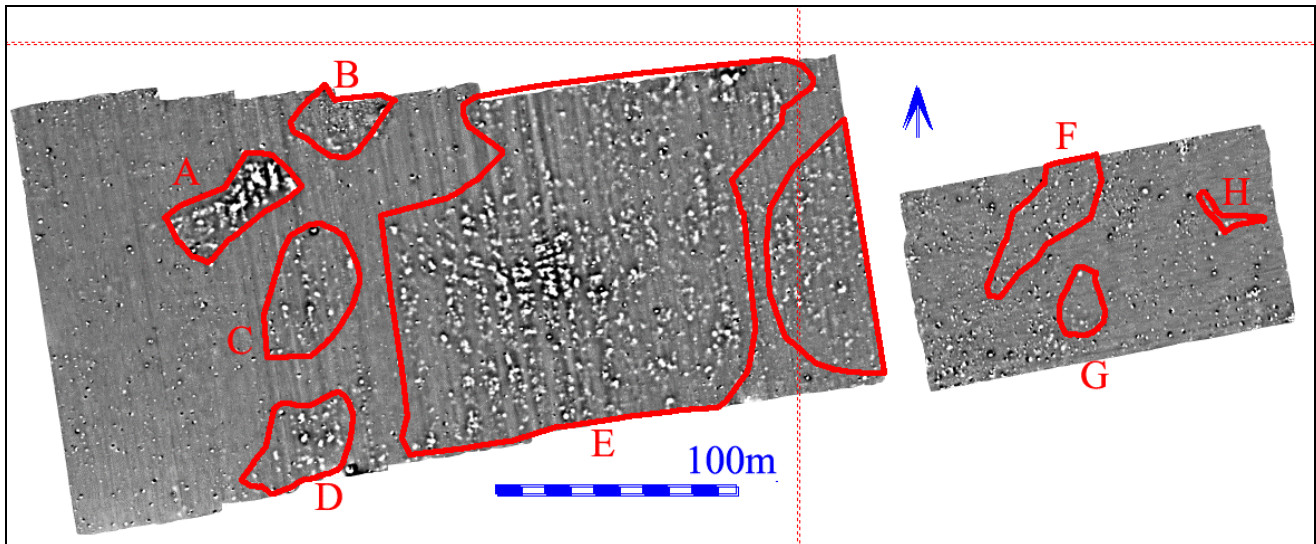


Figure 8 The groupings of discrete anomalies

However, the distribution of these features means that it is likely that most of them are geological in origin. Group A has the strongest magnetic signature, although some of the anomalies in group E are of a similar nature. Groups A, C and D are all contained within what was the westernmost of the original field system, but this may have little significance.

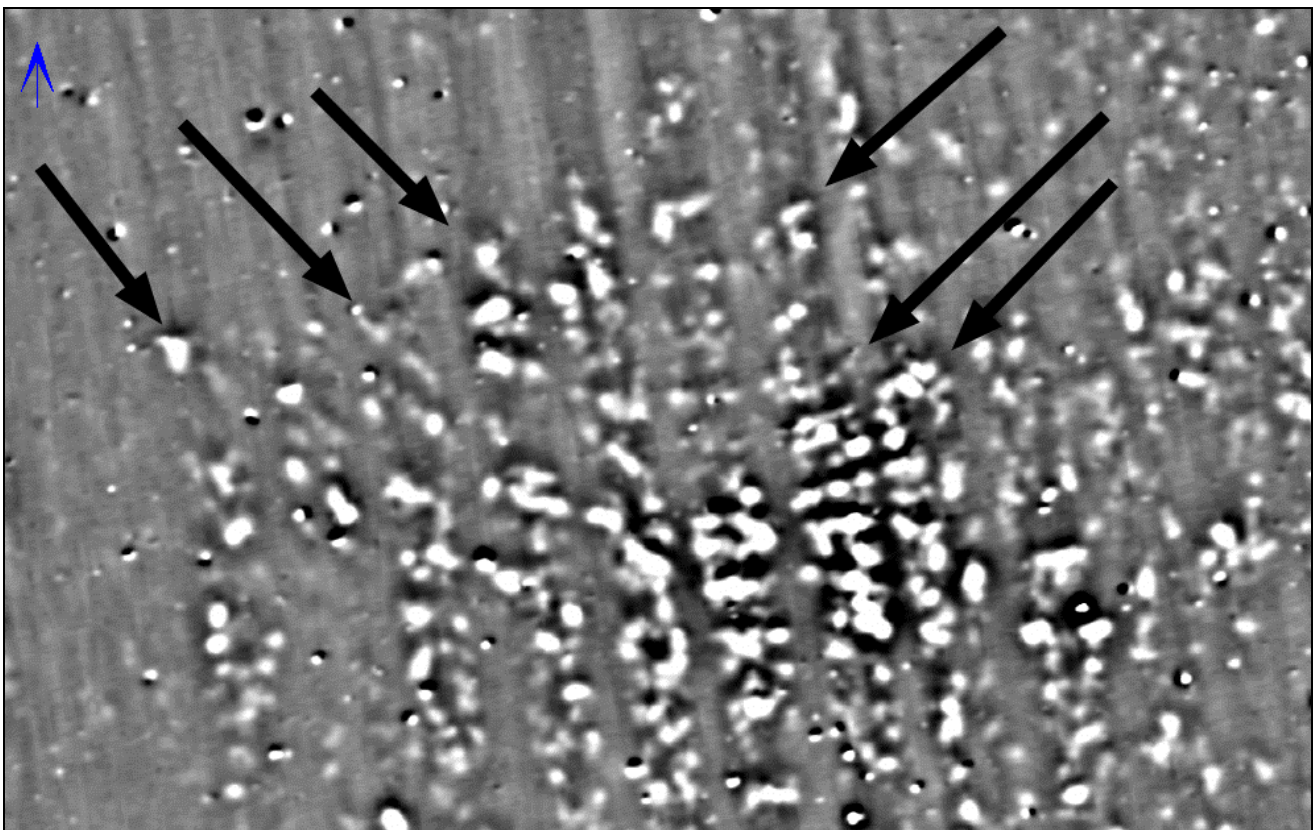


Figure 9 Probable natural features showing a curvilinear trend

Interestingly, some of the anomalies in group E appear to have a curvilinear trend (see Figure 9). The significance of this is not apparent at this stage. It is also clear that these anomalies have been cut through by the ridge and furrow ploughing.

Potential features of interest

Although no obvious features of archaeological significance are immediately apparent in the magnetic dataset, there are three potential faint anomalies which might prove to be of interest (see Figure 10 for location).

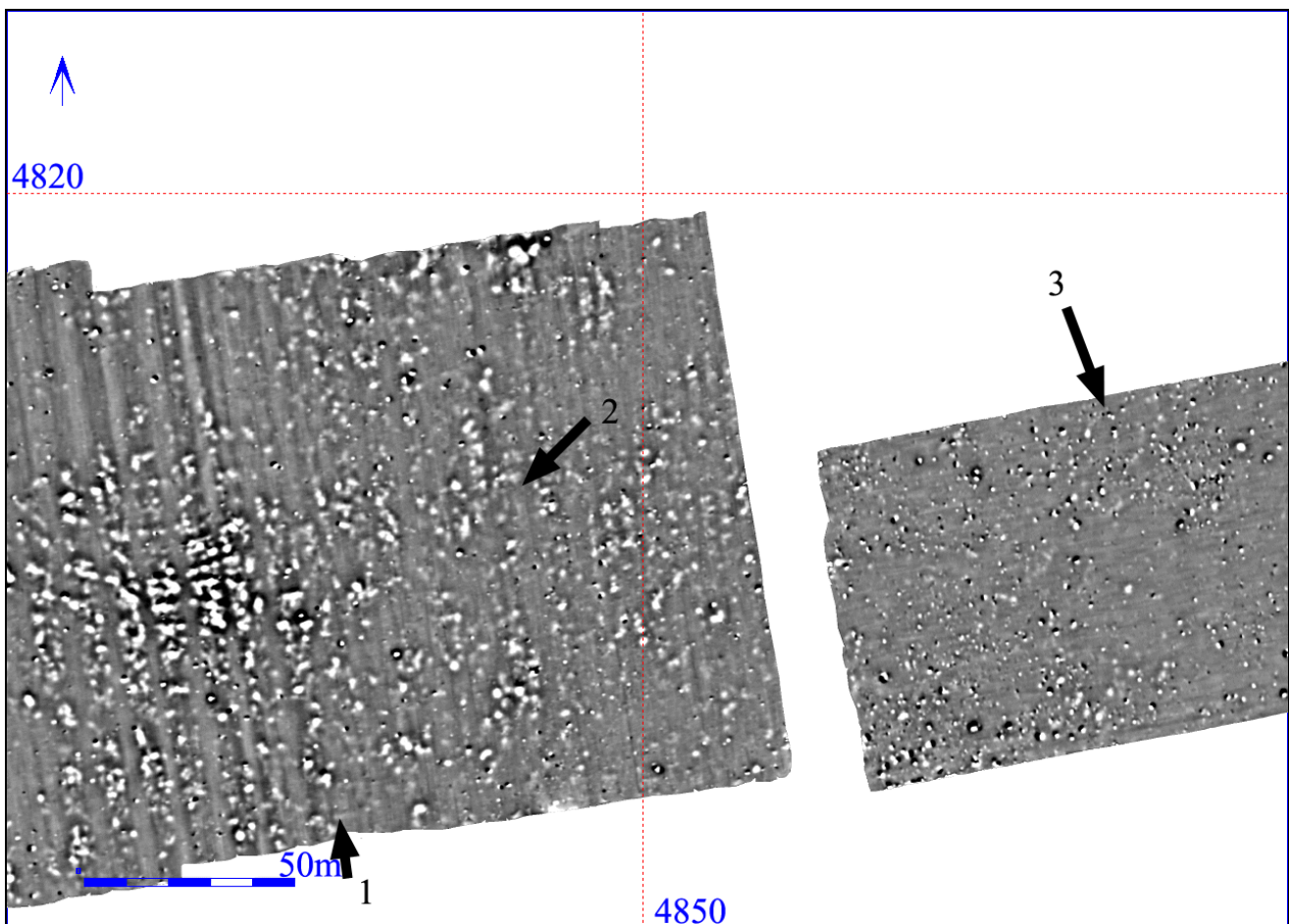


Figure 10 Location of potential features of interest

Anomaly 1 (see Figure 11) is the most obvious of the three, and is ovate in shape, being 34m long by 21m wide. The other two anomalies are potentially circular, with number 2 (see Figure 12) being 21m in diameter and number 3 (see Figure 13) being just over 12m in diameter.

It is difficult to place an interpretation on such faint magnetic anomalies, but anomaly 1 could relate to a small enclosure, and anomalies 2 and 3 might be small round barrows. However, given the ephemeral nature of the magnetic anomalies, these interpretations have only a low level of confidence, and should be treated with a degree of caution.

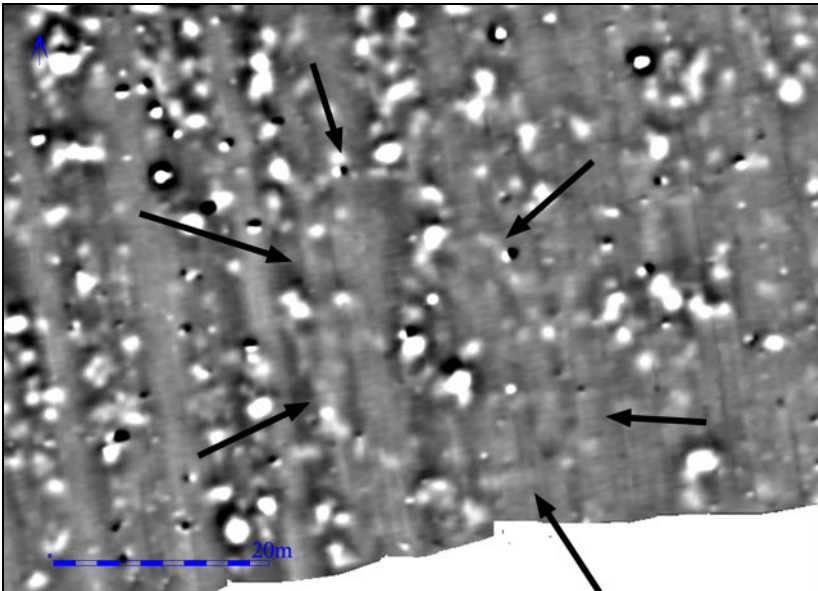


Figure 11 Potential feature 1

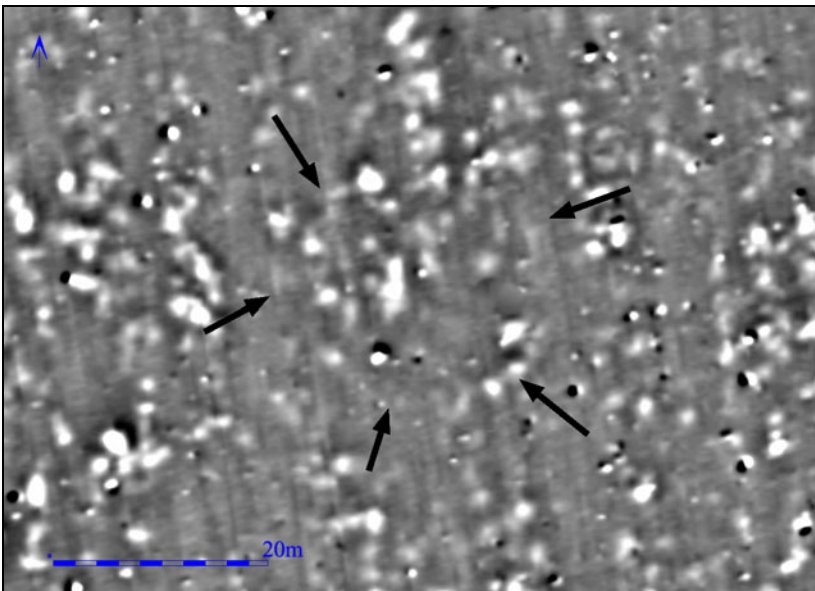


Figure 12 Potential feature 2

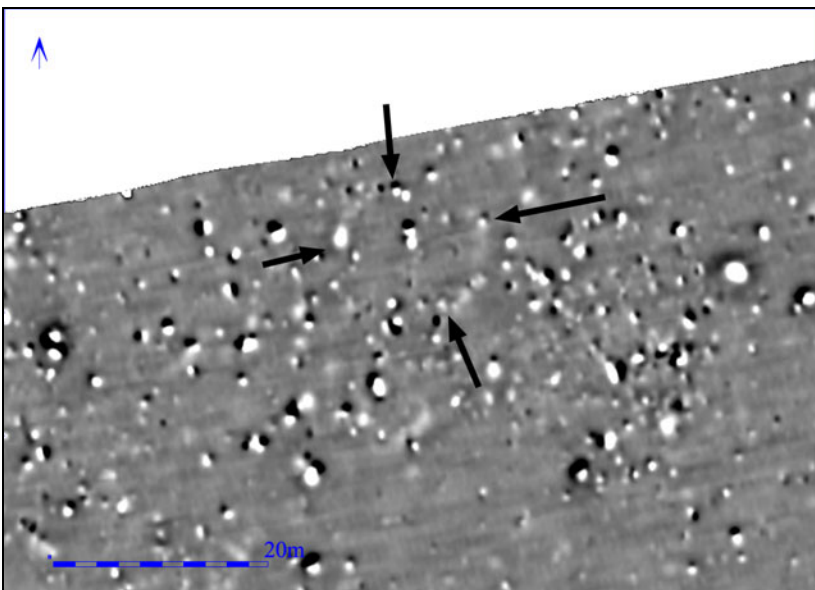


Figure 13 Potential feature 3

Conclusions

In conclusion, it can be stated that the area was of low to medium magnetic contrast, and the majority of the features detected are probably of a natural or geological origin. Also found were the remains of a ridge and furrow field system, although only in site 524, as there was no evidence for remnant furrows in site 525. The remains of a post-Medieval field system were detected, albeit faintly, in the magnetic data. Three features of potential archaeological significance were also encountered, although the nature of these anomalies was difficult to interpret because of their exceptionally faint magnetic contrast.

Bibliography

Cardwell, P. (2010) Chapter 13 Cultural Heritage. In Barton Willmore - Ryedale Gas Project: Environmental Statement.

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Appendix one – the geophysical survey data

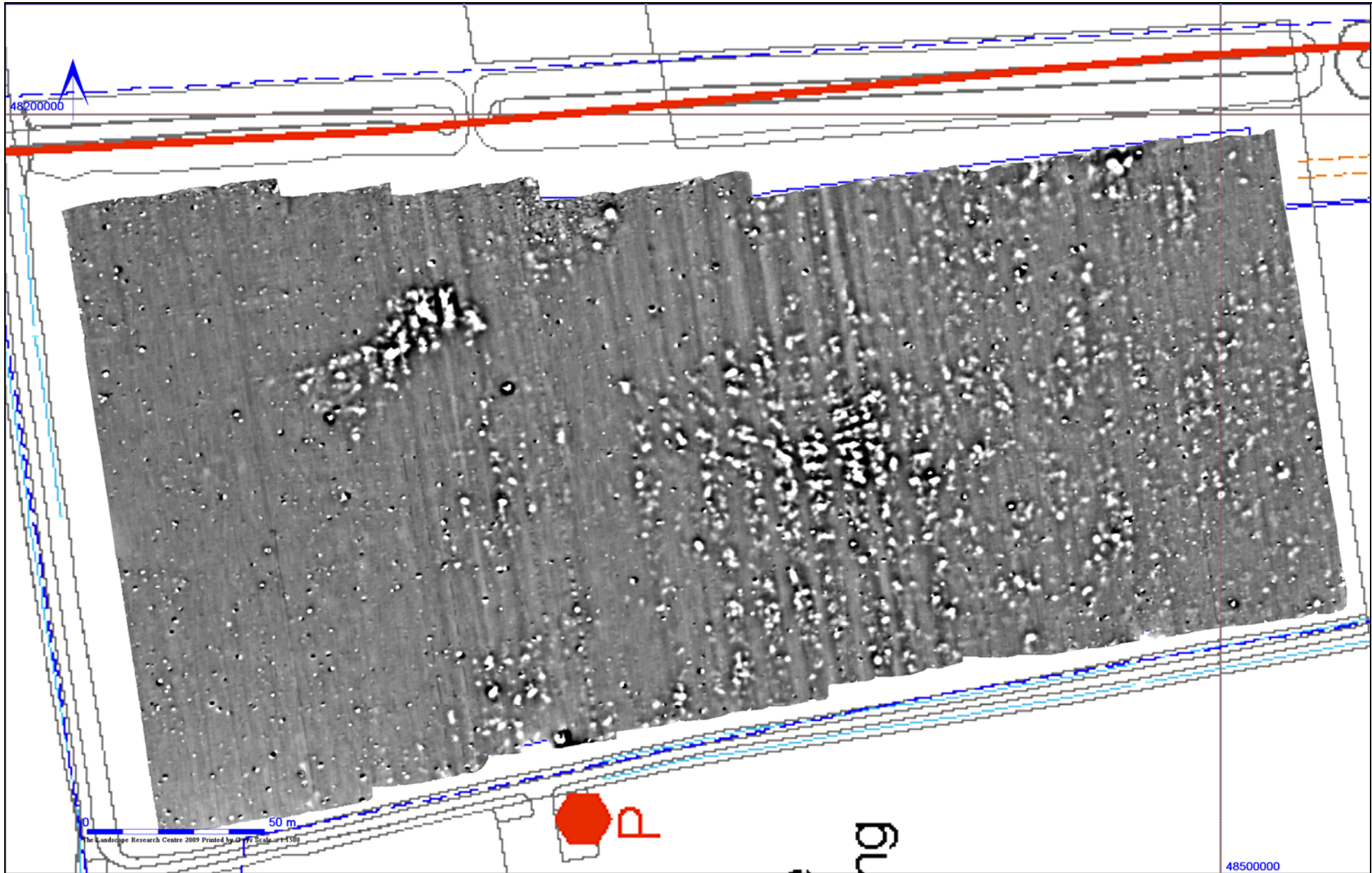


Figure 14 Site 524 greyscale plot at a scale of 1:1500, with values clipped at -5nT to $+5\text{nT}$

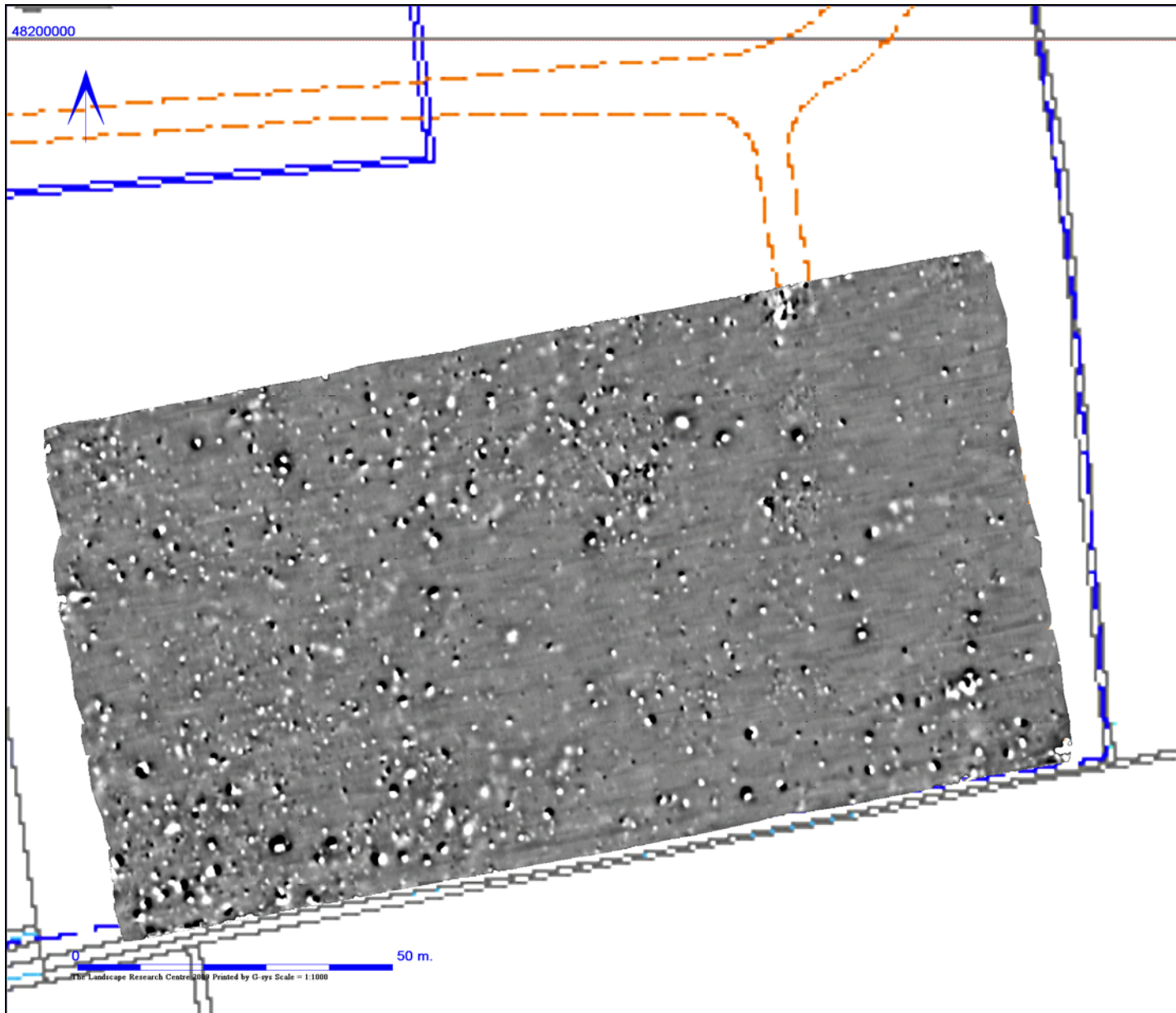


Figure 15 Site 525 greyscale plot at a scale of 1:1000, with values clipped at $-5nT$ to $+5nT$