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LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA
REPORT ON GEOPHYSICAL SURVEY, JULY 2013

Neil Linford, Paul Linford and Andrew Payne

REMOTE
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SUMMARY

A caesium magnetometer survey was conducted at Millbeck Farm, Middleton, Cumbria, over a D-shaped enclosure identified from a cropmark through initial aerial survey as part of the National Archaeological Identification Surveys: Upland Pilot (RASMIS 6304). It was hoped that the magnetic survey might enhance the archaeological record of the site, as the cropmarks were in places indistinct possibly due to the variable geological background that might obscure the identification of wider significant activity. A vehicle-towed, caesium magnetometer array was used to cover an area of 6.5ha over the cropmark and two adjacent fields to the south and west. The results confirm the presence of the enclosure and provide some additional definition including the position of a possible entrance, tentative evidence for a connecting drove-way to the south west and some indication of internal occupation activity. The northern side of the enclosure appears to have been constructed alongside a linear boundary ditch and confirms the aerial photographic evidence that suggests this is not directly incorporated into the D-shaped cropmark.

CONTRIBUTORS

The field work was conducted by Neil Linford, Paul Linford and Andy Payne from the English Heritage, Remote Sensing, Geophysics Team.

ACKNOWLEDGEMENTS

The authors wish to express their thanks to the land owner, Mr Stephen Chapman, for granting access to the farmland to allow the survey to take place. We are also grateful for the logistical support provided at Millbeck Farm with repairs to our trailer following a burst tyre.

ARCHIVE LOCATION

Fort Cumberland.

DATE OF FIELDWORK AND REPORT

The fieldwork was conducted between 23rd and 25th July 2013. The report was completed on 26th November 2013. The cover shows a view of the survey in progress in the field south of the cropmark looking south-east towards the Pennine uplands above the village of Barbon.

CONTACT DETAILS

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INTRODUCTION

A caesium magnetometer survey was conducted at Millbeck farm, Middleton, Cumbria, over a D-shaped enclosure indentified from a cropmark (NGR SD 623849, AMIE Monument HOB UID 1476760, Figure 1) during the Upland pilot of the National Archaeological Identification Survey (NAIS) programme (NAIS Upland, Lakes and Dales; NHPP Project Number 3A4.312, RaSMIS 6304). The NAIS Upland pilot project covers the Arnside & Silverdale AONB together with parts of the proposed extensions to the Yorkshire Dales and Lake District National Parks, and aims to improve both the understanding of known sites and also include areas where the current archaeological record is sparse (Oakey 2013). The results of the project will directly feed into the management of these protected landscapes.

Geophysical survey was included in the project to complement the initial aerial investigation on selected sites in the Lune Valley, where ground-based methods could potentially enhance the assessment of the archaeological evidence (Linford *et al.* 2013a; 2013b; Linford *et al.* 2013c). The site at Millbeck was chosen as one of the few cropmarks identified in the aerial survey and, due to its indistinct nature against the geological deposits, there was a possibility that the D-shaped enclosure formed part of a wider complex of archaeological activity. The enclosure sits on the summit of a localised knoll in the floor of the Lune valley, overlooking the floodplain of the river to the west where a Roman road (AMIE HOB UID 966041) follows a north-south route between Ribchester and Low Borrowbridge. It was possible that the cropmark at Middleton and the Roman road were related, although the enclosure could also be of an earlier prehistoric origin.

The site is situated on Silurian Kirkby Moor Formation siltstone solid geology overlain by shallow well drained fine loamy and fine silty soils of the 541j Denbigh 1 association (Soil Survey of England and Wales 1983; British Geological Survey (NERC) 2013). No superficial geology is mapped in the area, although the aerial photography suggests considerable local soil variation and several small tributaries of the Lune drain from the high Pennine uplands of the Middleton Fell area to the east. At the time of the survey the site was down to pasture and weather conditions during the field work were warm, dry and sunny interrupted by an occasional heavy rain shower.

Figure 1. The Millbeck enclosure partially defined as a series of darker lines in the centre of the aerial photograph against a background of variable geological deposits (20588/47 27-JUL-2006 © English Heritage).

METHOD

Magnetic Survey

The magnetometer data was collected along the instrument swaths shown on Figure 2 using an array of six high sensitivity Geometrics G862 caesium vapour magnetometer sensors mounted on a non-magnetic sledge. This sledge was towed behind a low impact, all-terrain vehicle (ATV) which also provided the power supply and housed the data logging electronics. Five of the sensors were mounted in a linear array transverse to the direction of travel 0.5m apart and, vertically, ~0.2m above the ground surface. The sixth was fixed 1.0m directly above the central magnetometer in the array to act as a gradient sensor. The sensors were set to sample at a rate of 16 Hz based on the typical average travel speed of the ATV (3.2 m/s) giving a sampling density of ~0.2m by 0.5m along successive swaths. Each swath was separated from the last by approximately 2.5m, navigation and positional control being achieved using a Trimble 4700 series Global Positioning System (GPS) receiver mounted on the sensor platform 1.75 m in front of the central sensor. Sensor output and survey location was monitored during acquisition to ensure data quality and minimise the risk of gaps in the coverage due to the use of a grid-less system.

After data collection the corresponding readings from the gradient sensor were subtracted from the measurements made by the other five magnetometers to remove any transient magnetic field effects caused by the towing ATV. The median value of each instrument traverse was then adjusted to zero by subtracting a running median value calculated over a 60m 1D window. This operation corrects for slight biases added to the measurements owing to the diurnal variation of the Earth's magnetic field and any slight directional sensitivity of the sensors. A linear greyscale image of the combined magnetic data is shown superimposed over the base Ordnance Survey (OS) mapping on Figure 3 and minimally processed versions of the range truncated data (+/- 50 nT/m) are shown as a traceplot and an equal area greyscale image in Figures 4 and 5 respectively.

RESULTS

Magnetic survey

A graphical summary of the significant magnetic anomalies, [**m1-20**], discussed in the following text, superimposed on the base OS map data, is provided in Figure 6.

General response

A mixed, low magnitude, magnetic response complicates the interpretation of archaeological anomalies and probably reflects the geological and geomorphological variation over the site, including possible former or seasonal water-courses [**m1** and **m2**] and large, amorphous areas of disturbance across the site [for example **m3**], perhaps indicating near surface outcrops of more magnetic (igneous or metamorphic) bedrock or glacially transported deposits. A service pipe is found at [**m4**] together with a number of other areas of strong magnetic disturbance [**m5-8**], related to near surface ferrous material with [**m6**] probably indicative of a filled in former pond.

The D-shaped cropmark enclosure and associated activity

The D-shaped enclosure is replicated as a series of linear and curvi-linear positive magnetic anomalies [**m9-12**] against a magnetic background that is generally less disturbed than other parts of the surveyed area. To the north of [**m9**] a narrow linear ditch [**m13**] runs parallel to the main enclosure before gradually fading out to the west. It is possible that [**m13**] represents part of a system of coaxial land boundaries, known elsewhere in the area (Jecock 1998) and the weak linear anomaly [**m14**] south of the enclosure may represent a further parallel ditch within the alignment (cf Linford *et al.* 2013a).

A 9m wide gap facing south-west at [**m15**] may represent an entrance to the enclosure, perhaps associated with a linear zone of reduced magnetic disturbance [**m16**] corresponding with a band of lighter tone in the aerial photography (Figure 1), tentatively suggestive of a drove-way. However, anomaly [**m16**] appears very similar to [**m17**]

immediately to the N and it is possible that both of these responses are geological. Neither of [**m16**] or [**m17**] have been identified on the AP abstraction (Figure 7) and the course of [**m16**] does not extend directly towards the probable entrance to the enclosure at [**m15**]. Anomalies [**m18-19**] within the enclosure may indicate internal occupation activity, possibly hut emplacements, but the detail is insufficiently clear to be certain. A further large pit or quarry may be present centrally at [**m20**], together with a number of pit type anomalies that occur within the bounds of the enclosure, although these may also be due to geological variations.

CONCLUSION

Despite the background geological disturbance, caesium magnetometer survey has clarified and enhanced the detail of the cropmark available from the aerial photographic record, providing better definition of a probable entrance in the south-west segment of the circuit, the course of the ditch forming the north west portion of the enclosure and the adjacent narrower linear boundary ditch immediately to the north (cf Figure 7). Some internal occupation activity has also been revealed, although it is not possible to suggest a definite settlement function for the enclosure from the geophysical evidence alone. In the wider environs of the enclosure, the magnetometer survey provides tentative evidence for a possible drove-way leading towards the River Lune and the Roman road to the west, a system of possible parallel coaxial field boundaries and the presence of former water-courses that may have influenced the location of the site. The D-shaped enclosure is certainly larger than other known Iron Age and Romano British enclosed farmsteads in the Upper Lune Valley, many of which still survive as earthworks (such as Borwens 1.1km to the south-east (NGR SD 62848 83948, SAM 1007196)), suggesting Millbeck may represent a site of a different type or period.

LIST OF ENCLOSED FIGURES

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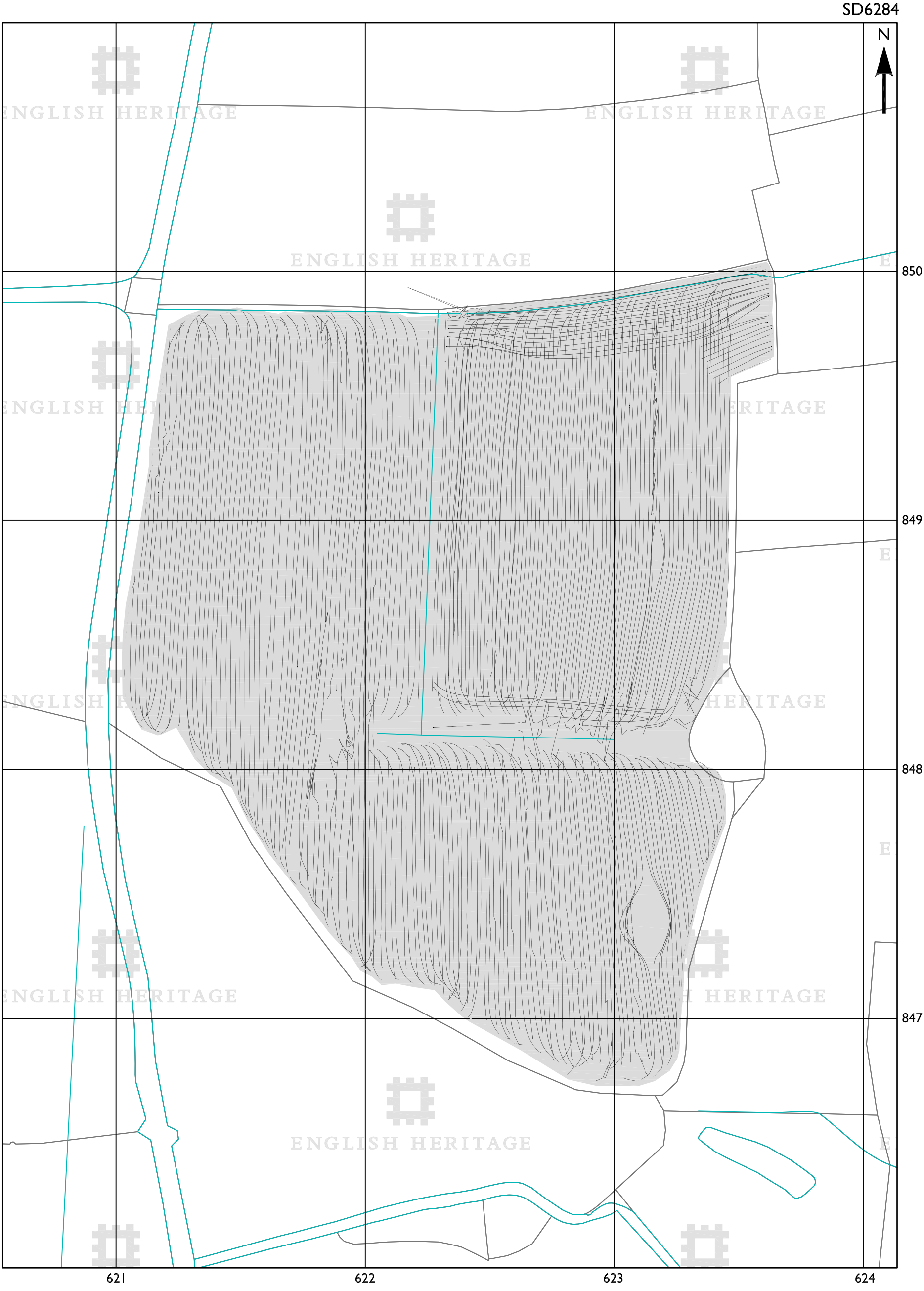
Figure 2

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA

Location of geophysical survey, July 2013



0 90m

1:1500

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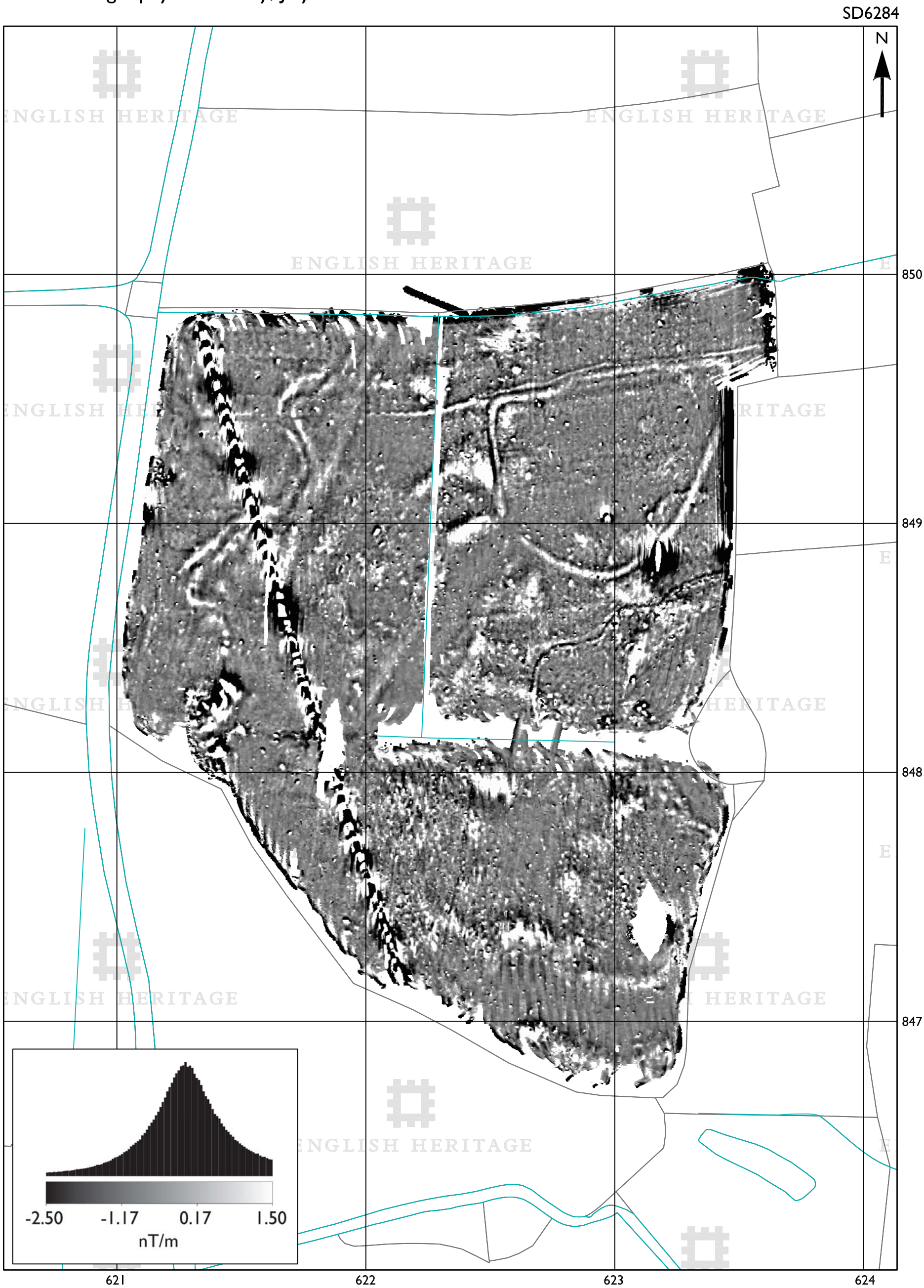
Figure 3

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA

Location of geophysical survey, July 2013



0 90m

1:1500

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Figure 4

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA
Caesium magnetometer survey, July 2013

Traceplot of the minimally processed data

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Figure 5

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA
Caesium magnetometer survey, July 2013

Histogram equalised greyscale plot of minimally processed data

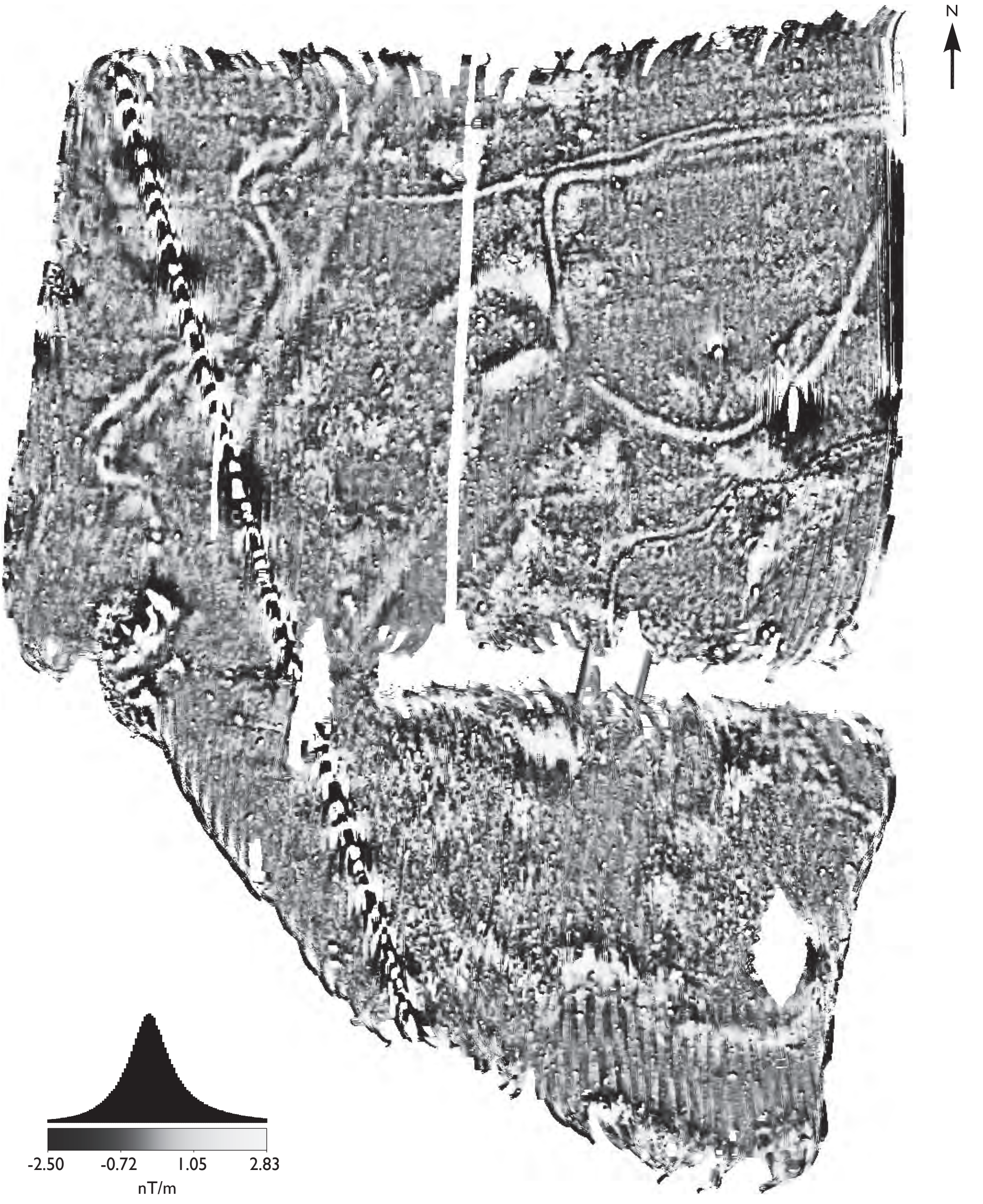

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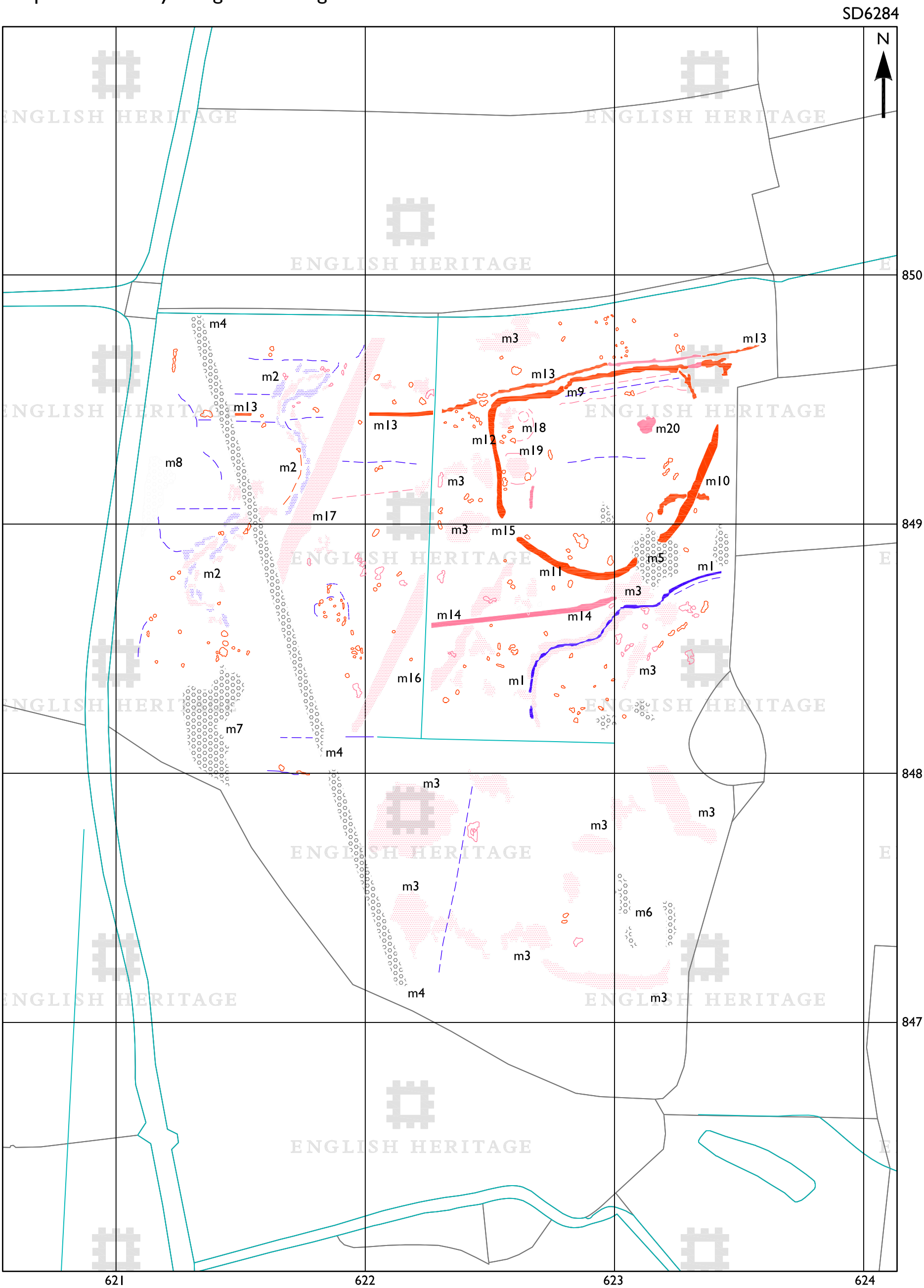
Figure 6

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA

Graphical summary of significant magnetic anomalies



positive magnetic

negative magnetic

weak positive magnetic

ferrous / agricultural noise

0 90m

1:1500

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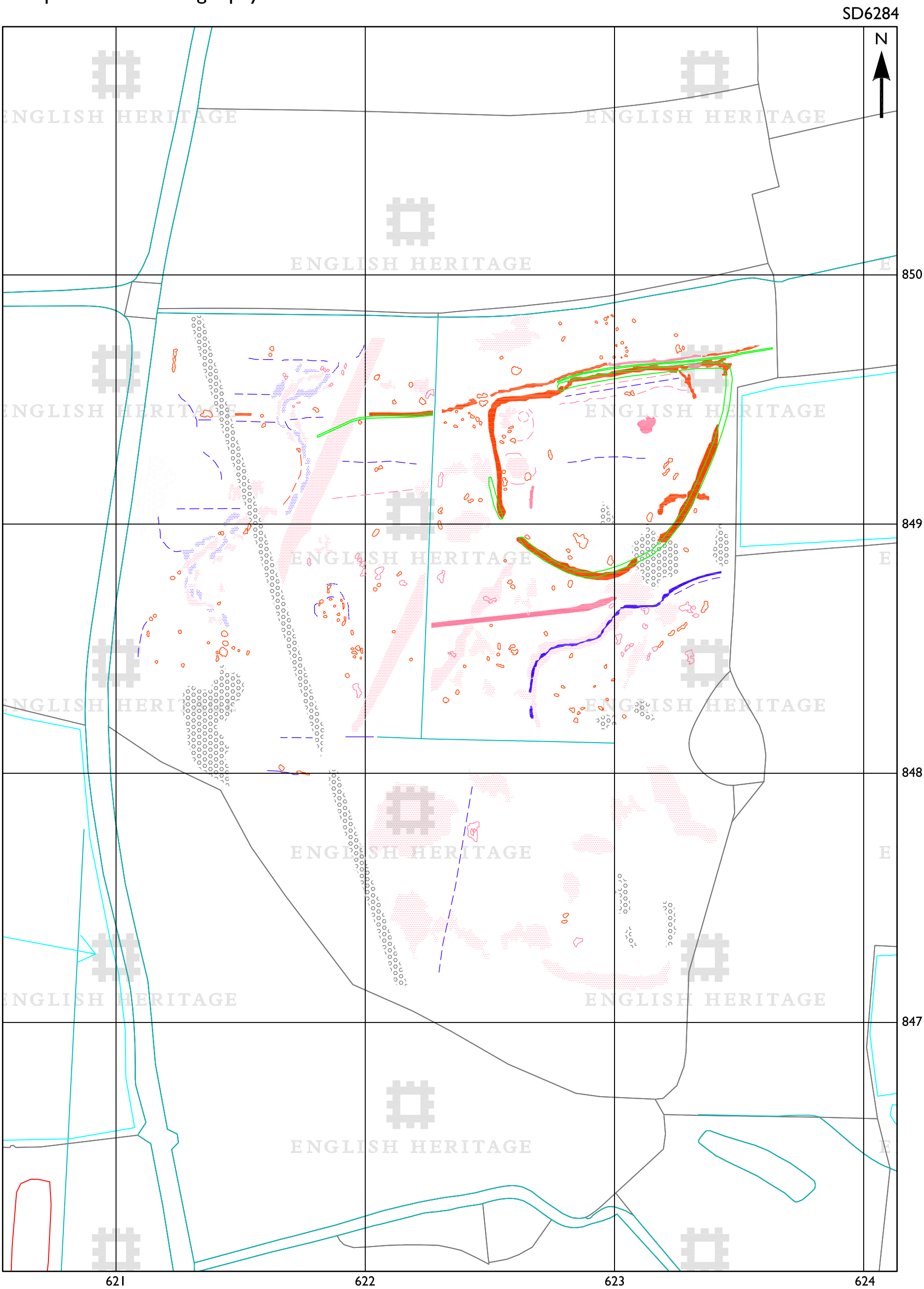
Figure 7

LAKES AND DALES NAIS, MILLBECK FARM, MIDDLETON, CUMBRIA

Comparison between geophysical anomalies and AP evidence



aerial photographic evidence for ditch

0 90m

1:1500

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