UNDER WHITLE FARM,
SHEEN
DERBYSHIRE

Report on geophysical survey conducted in March 2016

Prepared by P. Johnson

June 2016

TPA Project Code – UWC

TPA Report No. 051/2016

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Report Number	051/2016
Status	Final Report

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SUMMARY

- Trent & Peak Archaeology was commissioned by the Tudor Farming Interpretation Group, to conduct geophysical surveys and engage in community-based volunteer training on land at Under Whitle Farm in the valley of the River Dove between Sheen and Longnor, Staffordshire (centred on NGR SK 1077 6405 at a height of c. 260m OD) as part of their Heritage Lottery funded 'Peeling Back the Layers' project (Fig. 1).

- The work was carried out between the 10th and 19th March 2016 in accordance with standard, accepted practices for archaeological geophysical surveys (EH 2008).

- The site is situated on bedrock of Bowland Shale Formation mudstone, siltstone and sandstone. No superficial deposits are mapped on the valley slopes.

- The site was composed of an area of c.2.5ha immediately north-east of the farm with three discrete areas targeted for resistivity survey within the larger area.

- Ground conditions for the survey were good with all of the area under pasture. Metal fencing and presence of farm machinery limited access in some areas close to boundaries.

- Geophysical survey demonstrated the presence of potential buried archaeological features, these comprised:

    - Probable archaeological features relating to settlement activity [5], [6] ,[7] & [8]; [r1], [r2], [9] & [12].
    - Probable archaeological features relating to land divisions or boundaries [26], [27], [28], [31] – [36]; [41] – [44]; [58].
    - Probable archaeological remains relating to the use of ridge and furrow cultivation [16] – [19]; [21] – [23].
    - Possible remains relating to settlement activities [8] & [40].
    - Possible archaeological remains of field-boundaries or land divisions [67]; [68].
    - Possible archaeological remains of a small-scale, stratigraphically-negative feature such as a small livestock or domestic enclosure [23].

Report on geophysical surveys at Under Whitle Farm, Sheen, Derbyshire.
NGR SK 1077 6405

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ACKNOWLEDGEMENTS

The Project Manager for the work undertaken was Paul Johnson. The Project advisor was Steve Malone. The Project Team comprised Tom Hooley, Tina Roushannafas. and Povilas Cepauskas.

Acknowledgements are due to Catherine Parker-Heath who commissioned the project on behalf of the Tudor Farming Interpretation Group; to Elspeth and Paul Walker for their hospitality and to Ian Parker-Heath and all of the volunteers who helped during the survey process

1. INTRODUCTION

1.1. Trent & Peak Archaeology was commissioned by the Tudor Farming Interpretation Group to conduct geophysical surveys and engage in community-based volunteer training on land at Under Whitle Farm, which lies in the valley of the River Dove between Sheen and Longnor, Staffordshire, centred on NGR SK 10772 64001 at a height of c. 260m OD (Fig. 1).

1.2. The fieldwork was conducted between the 10th and 19th March 2016 on approximately 2.5 hectares of land at Under Whitle Farm.

1.3. The site is located on deposits of Bowland Shale Formation - Mudstone, Siltstone, and Sandstone; Sedimentary Bedrock formed approximately 313–335 million years ago in the Carboniferous period. No superficial deposits are recorded on the valley slopes (British Geological Survey).

1.4. Topographically the site lays immediately to the northwest of the Dove Valley Activity Centre. The site displays notable topographical variation.

1.5. In 2004, an archaeological survey undertaken by Jim Rylatt of the Peak District National Park (Rylatt 2005) identified a number of possible medieval or post-medieval features at Under Whitle Farm. Subsequent research by the Tudor Farming Interpretation Group uncovered documents establishing the existence of farms and families in the Tudor period.

1.6. Peeling Back the Layers is a hands-on educational, Heritage Lottery funded, project, run by the Tudor Farming Interpretation Group (TFIG). A wide range of people are investigating the history and archaeology of Whitle, Sheen and the surrounding landscape. Groups and individuals are joining together with the primary and secondary schools, young archaeologists, local history enthusiasts and mental health groups in this fascinating exploration of our local heritage

2. PROJECT BACKGROUND

2.1. Potential Remains

2.1.1. The archaeological potential of the site is considered to be moderate-high as a result of its proximity to known heritage assets.

- *Prehistoric*
  No prehistoric features are known within the survey area.

- *Roman*
  No Roman features are known within the survey area..

- *Mediaeval*
  Probable mediaeval features were identified within the survey area by Jim Rylatt of the Peak District National Park (Rylatt 2005).

- *Post-Mediaeval*
  Probable post-mediaeval features were identified within the survey area by Jim Rylatt of the Peak District National Park (Rylatt 2005).

2.2. Proposed Fieldwork

2.2.1. In order to evaluate the potential archaeological remains in this area, the following geophysical fieldwork investigation was proposed:

- Geomagnetic survey at standard (1m x 0.25m) sampling density for archaeological evaluation across an area totalling c. 2 ha.
- Earth-resistance survey at standard (1m x 1m) sampling density for archaeological evaluation in targeted areas based on the results of the geomagnetic survey totalling c. 0.1 ha.

3. OBJECTIVES

3.1 The principal objective of this phase of geophysical investigation at Under Whitle Farm is to assess the extent and nature of any surviving archaeological remains adjacent to the Dove Valley Activity Centre, which will inform subsequent stages of this project in addition to further research and heritage management strategies for the site.

3.2 The archaeological work undertaken through this project aims to provide information that will enable the remains to be placed within their local, regional, and national context, and for their significance to be assessed.

4. METHODOLOGY

4.1. Geophysical Survey: Geomagnetic

4.1.1. The decision to use magnetic gradiometry to survey the site was based on its efficiency as a survey technique suitable for detecting the buried remains of a range of materials based on differences in their magnetic characteristics as compared to the geological background of the area (Gaffney et al. 1991, 6; 2003).

4.1.2. The results of this method are, however, severely restricted in areas of modern disturbance and by the presence of ferrous material (Scollar et al. 1990, 362ff). Because of the presence of metal fencing within the field boundaries, these features were given a wide-berth with an average distance of 3m being allowed to limit their effect on the archaeological data. Although a number of alternative geophysical survey techniques could be applied to the site (Appendix B), magnetometry represented the best compromise between speed and quality of data retrieval for an initial investigation.

4.1.3. The magnetometer survey was undertaken, within the guidelines advocated by English Heritage (David et al. 2008), by a two-person team using a Bartington Instruments Grad 601-2 fluxgate gradiometer. This equipment allowed the survey to be conducted rapidly as the area was relatively free of obstructions. Readings were taken at a standard for archaeological evaluation of 0.25m intervals along traverses of 1m spacing, walking southeast. This enabled a sufficiently high density of data for the purposes of archaeological evaluation to be collected across the site in the relatively short time allotted for the survey to be completed.

4.1.4. Owing to the lack of signal for connection to the real-time correction server it was not possible to set the geophysical survey grids out using the normal GPS methodology. Instead the 30m by 30m grids were set out using triangulation from mapped field boundaries and later matched to the Ordnance Survey National Grid coordinate system. The northeast-southwest orientation for the survey grids was dictated by use of site boundaries as a baseline As the orientation of archaeological features within the area was unknown, this orientation was therefore unable to ensure that surviving remains would be intersected by the survey traverses at the optimum angle of approximately 30°.

4.1.5. The geophysical survey data were processed in Geoplot 3.0 software to remove any environmental disturbances or variations produced in the course of the survey. Firstly, data were manipulated to remove any distorting 'spikes' from the survey results. A high-pass filter was then also used to reduce the effect of geological anomalies in the data-set. Low-pass filtering was then used to improve the resolution of larger archaeologically derived anomalies. Finally, the data were interpolated to produce uniform data-densities equivalent to 0.25m x 0.25m.

4.1.6. The results were exported as greyscale, raster images and inserted into the AutoCAD plan of the site, generated from Ordnance Survey data, for georeferencing and production of a descriptive, vector overlay. The anomalies presented here were identified visually and manually digitised to produce the vectorised plans which are discussed in the results section of this report. The final print-versions of these plans were elaborated and prepared for printing in Adobe Illustrator CS6.

4.2. Geophysical Survey: Earth-resistance

4.2.1. The decision to use earth-resistance survey on the site was based on its ability to provide relatively precise detail about buried structures and to indicate the presence of both stratigraphically positive and negative sub-soil features without the interference often present in magnetic data as a result of modern disturbance and the presence of ferrous material close to the ground surface (Geoscan Research 1996; Scollar et al. 1990, 362ff).

4.2.2. The results of this method are, however, severely restricted by environmental conditions such as the retention of moisture within the soil (Clark 1990, 27). Details of this survey technique are provided (Appendix B), although other techniques such as magnetometry or GPR could have been applied to the site. Earth-resistance survey represented the best compromise between speed and quality of data retrieval for an investigation of possible structures extending beyond the excavated areas. These had not been recognised in previous geomagnetic survey and so it was desirable to apply a technique measuring different physical properties in order to recover these features.

4.2.3. The earth-resistance survey was undertaken, within the guidelines advocated by English Heritage (David et al. 2008), by a two-person team using a Geoscan Research RM4 Resistance meter and DL10 data-logger module in twin-probe configuration, with a 0.5m Mobile-Probe separation. This equipment allowed the survey to be conducted relatively rapidly as the area was free of obstructions. Readings were taken at 1 m intervals along traverses of 1m spacing walking west. This enabled a sufficiently high density of data for the purposes of archaeological evaluation to be collected across the site in the relatively short time allotted for the survey to be completed.

4.2.4. The geophysical survey grids employed were based on the grid established for geomagnetic survey, but 10m by 10m grids were utilised in order to be able to focus the survey more precisely on features of interest.

4.2.5. The geophysical survey data were processed in Geoplot 3.0 software to remove any environmental disturbances or variations produced in the course of the survey. Firstly, data were manipulated to remove any distorting ‘spikes’ from the survey results and to normalise data from the two parallel arrays. A high-pass filter was then also used to reduce the effect of geological anomalies in the data-set. Low-pass filtering was then used to improve the resolution of larger archaeologically derived anomalies.

4.2.6. The results were exported as greyscale, raster images and inserted into the AutoCAD plan of the site, generated from Ordnance Survey data, for georeferencing and production of a descriptive, vector overlay. The anomalies presented here were identified visually and manually digitised to produce the vectorised plans which are discussed in the results section of this report. The final print-versions of these plans were elaborated and prepared for printing in Adobe Illustrator CS6.

Ground Conditions

4.3.1. Ground conditions for the survey were satisfactory. The site is used as pasture.

5. RESULTS
(Figures 2-5)

5.1. Geomagnetic Survey
5.1.1. Within the area surveyed, the site exhibited a generally good response to the geomagnetic survey. Geophysical anomalies can be observed across the whole area surveyed, and buried features can be clearly discerned against the geological background. There is relatively little noise in the dataset, with the main concentration in Area A, where fewest archaeologically derived anomalies are observed. The overall magnetic response is good, although spikes within the dataset extend the range of unfiltered values to $^{+}/_{-}$ 100nT the standard deviation of the raw-data typically remained within c. 5 nT of the mean. Any cut features are likely to show against this background as areas of positive magnetism. Positively magnetic anomalies are likely to result from the presence of settlement activity and deposition of thermo-remanent, or depositionally-remanent magnetised material within stratigraphically-negative features.

5.1.2. The results are presented below as greyscale images of the processed data (Fig. 2), and complementary numbered interpretative plans to which the following description relates (Fig. 3). This description is organised broadly from southwest to northeast. Unprocessed survey data are also presented below (Fig. 7). These data are unfiltered and hence show striping resulting from slight but consistent imbalances between the two sensors used for the survey.

Area A:
5.1.3. The southwestern corner of the survey demonstrated the presence of a group of three positively-magnetic anomalies, forming a north–south alignment. The northernmost of these, is a c. 8m-long, curvilinear, anomaly [1], which appears to intersect the northwestern edge of the survey area to its north. Approximately 2m to the south of this feature is a c. 6.5m-long, irregular anomaly [2], orientated east–west. Approximately 1m to the south of this feature is a bulbous, cruciform, 9m by 5.5m anomaly [3], orientated north–south. The southern corner of the survey contains a c. 8m-long, linear, positively-magnetic anomaly [4]. orientated northwest–southeast. A group of three large dipolar anomalies [5], [6], & [7], located c. 4m to the north of this feature, define a rectilinear area of c. 19m by 17m, orientated northeast–southwest. The centre of this area is occupied by an irregular, quasi-"T-shaped", c. 7m by 6m, positively-magnetic anomaly [8]. Immediately to the northeast of [7], is a 12.5m by 11m, broadly "L-shaped", dipolar macula [9], on the same orientation. Immediately to the east of this feature is a c. 6m-diameter, dipolar macula [10]. Immediately to the northwest of [9], is a c. 4m-diameter, dipolar macula [11]. Immediately to the west of this feature is a c. 7m-long, irregular, linear, positively-magnetic anomaly [12], running broadly southwest–northeast. Immediately to the west of the northern end of this feature is a c. 6m-long, irregular, positively-magnetic anomaly [13], running northwest–southeast. Immediately to the north of this feature is a c. 20m-long, linear, dipolar anomaly [14], running southwest–northeast. Approximately 2.5m to the southeast of [7], is a c. 6m by 3m, positively-magnetic anomaly [15], intersecting and parallel to the edge of the survey area.

5.1.4. Approximately 2.5m to the northeast of [9], is a 6m-long, linear, positively-magnetic anomaly [16], orientated northeast–southwest. Approximately 2.5m to the northwest of this feature is a c. 3m-diameter, positively-magnetic macula [17]. Approximately 6m to the east of [16], is a c. 8m-long, positively-magnetic, distorted, linear anomaly [18], running northeast–southwest. Approximately 6m to the north of this feature is a c. 7m-long, linear, positively-magnetic anomaly [19], orientated northeast–southwest and aligned with [16]. Approximately 1.5m to the east of [19], and aligned parallel to it, is a c. 22m-long, linear, dipolar anomaly [20]. Immediately to the east of this feature, and also parallel to it, is an irregular, 12m-long, broadly-linear, positively-magnetic anomaly [21]. Approximately 3.5m to the southeast of this feature is a c. 14.5m-long, slightly curving, linear, positively-magnetic anomaly [22], orientated parallel to the previously discussed features. Approximately 1m to the south of this feature is a c. 16m-long, curvilinear, positively-magnetic anomaly [23], broadly aligned to the previously discussed anomaly [22]. Approximately 3m to the south of this feature is a c. 5m by 2.5m, sub-rectangular, positively-magnetic anomaly [24], intersecting and aligned parallel to the edge of the survey area. Immediately adjacent to this feature is a large, c. $71m^2$, amorphous dipolar response [25], which intersects the edge of the survey area to its south.

5.1.5. Adjacent to the northern edge of the survey area, approximately 72m from its southwestern corner, is a c. 9.5m-long, linear, positively-magnetic anomaly [26], orientated broadly east–west. Approximately 3m to the east of this feature, is a 5.5m by 7m, "T-shaped", positively-magnetic anomaly [27], which appears to be aligned with the previously discussed anomaly. Approximately 10.5m further to the east, and continuing the alignment defined by the two previously discussed features is an irregular, 6.5m by 3.5m, positively-magnetic anomaly [28]. Approximately 9m to the east of this feature is a c. 8m-long, linear, positively-magnetic anomaly [29], orientated northeast–southwest, slightly off-alignment with [26], [27], & [28]. Immediately north of the previously discussed feature is a c. 6m-diameter, dipolar macula [30], which does appear to continue the alignment defined by [26], [27], & [28]. Approximately 5m to the east of this feature is a c. 6m-long, linear, positively-magnetic anomaly [31], orientated northeast–southwest, and possibly aligned to [29]. Immediately to the southeast of this feature is a c. 9m-long, curvilinear, positively-magnetic anomaly [32], orientated broadly east–west and curving to the south. Approximately 2m to the southeast of this feature is a c. 7m by 6.5m, "L-shaped", positively-magnetic anomaly [33], aligned to the previously discussed feature and returning northeast–southwest. Immediately to the southeast of this feature is an approximately 4m-long, linear, positively-magnetic anomaly [34], running north–south. Approximately 1m to the south of this feature is a c. 7.5m-long, linear, positively-magnetic anomaly [35], orientated northwest–southeast. Approximately 2m south of the eastern end of this feature is a c. 7m-long, linear, positively-magnetic anomaly [36], orientated northwest–southeast. These previously discussed features, [31] to [36], appear to describe a 35m-long, slightly arcing alignment of positive magnetic responses. Approximately 5m to the south of [36], is a large, c $134m^2$ area of dipolar response [37]. Approximately 5.5m to the southwest of this feature is a group of three, c. 1.5m-diameter, positively-magnetic maculae [38], describing an arc of c. 10.5m, open to the south. Approximately 4m beyond the southern end of [38] is a c 6.5m-diameter, dipolar macula [39]. Immediately to the north of this feature is an elongated but irregular dipolar response of c. $100m^2$ [40], apparently orientated northeast–southwest. Approximately 1.5m to the east of the northern end of the previously discussed feature is a c. 8m-long, linear, positively-magnetic anomaly [41], orientated northeast–southwest. Approximately 1.5m to the north of this feature, and aligned parallel to it, is a c. 11.5m-long, linear, positively-magnetic anomaly [42]. Approximately 2.5m to the northwest of this feature is a squat, c. 3m by 4.5m, positively-magnetic anomaly [43]. Approximately 3m to the west of this feature is a c. 5m-long, linear, positively-magnetic anomaly [44], orientated northeast–southwest. The previously discussed anomalies [41] to [44], appear to define an alignment of positive magnetism surrounding or constraining the large area of dipolar response [40]. Approximately 9m to the west of [44] is a cluster of four c. 2m-diameter, positively-magnetic maculae [45], describing an irregularly trapezoidal area of 7.5m by 6.5m by 10m. Approximately 16m to the northwest of this feature is a c 4.5m-diameter, dipolar macula [46]. Immediately to the northeast of [33], is an extremely large, c. 14.5m-diameter, dipolar macula [47]. Approximately 2.5m to the southeast of [39] is a c. 10m by 4m area of positive magnetic response [48], intersecting the southwestern edge of the survey area.

5.1.6. Approximately 7m to the southeast of [48] is a c. 4m by 5m, positively-magnetic anomaly [49], intersecting the southeastern edge of the survey area. Approximately 4.5m to the northeast of this feature is a c. 5m-diameter, dipolar macula [50]. Approximately 6m further to the northeast of this feature is a c. 7m-long, broadly linear, positively-magnetic anomaly [51], orientated north–south. Approximately 3.5m to the east of this feature is a group of four, c. 2m-diameter, positively-magnetic maculae [52], describing an alignment of c. 14.5m, running north–south. Approximately 7m to the southeast of this alignment is a cluster of five, c. 2.5m-diameter, positively-magnetic maculae [53], describing an irregular pentagon c. 17m by 6m on its main axes. The southern corner of the survey area contains a c. 57m^2 area of dipolar magnetic response [54]. Approximately 2.5m to the northwest of this feature is a northeast–southwest alignment of three, c. 3.5m-diameter, dipolar maculae [55]. Approximately 3.5m to the southeast of the northernmost of these is a single, c. 2.5m-diameter, dipolar, macula [56].

5.1.7. The central part of the survey area exhibits a significantly lower density of anomalies compared with the previously discussed area to the south. The narrowest point of the survey demonstrates the presence of a dispersed cluster of six, c. 2m-diameter, positively-magnetic anomalies [57], covering an area of c. 190m^2. Approximately 3m to the northeast of this cluster is a c. 49m-long, linear, positively-magnetic anomaly [58], orientated northeast–southwest. Approximately 22m to the southeast of this feature is a pair of c. 2m-diameter, positively-magnetic maculae [59], orientated parallel to the previously discussed feature. Approximately 7m to the north of these features are three, c. 3m-diameter, dipolar maculae [60]. Immediately to the northeast of these dipolar responses is a group of three c. 2m-diameter, positively-magnetic maculae [61], describing an arc of c. 14m, open to the north. Approximately 7.5m to the north of this arc, is a group of four, c. 2.5m-diameter, positively-magnetic maculae [62], describing an irregular rectangle of c. 8m by 9m, orientated northeast–southwest. Approximately 9.5m to the north of this feature are three, c. 2m-diameter, positively-magnetic maculae [63], describing an arc of c. 13m, open to the north.

5.1.8. The northern part of the survey area, again, demonstrates an increased density of geophysical responses. Adjacent to the northwestern edge of the survey is a c. 5m-diameter, dipolar macula [64]. Approximately 3m to the northeast of this feature is an irregular, c. 155m^2 expanse of dipolar signal [65]. Approximately 7m to the east of this feature is a c. 5.5m-diameter dipolar macula [66]. Approximately 4m to the southeast of this feature is a c. 10m by 3.5m, "L-shaped", positively-magnetic anomaly [67], orientated northwest–southeast. Approximately 2m to the northeast of this feature is a c. 27.5m-long, linear, dipolar anomaly [68], orientated northeast–southwest and intersecting the northeastern edge of the survey area. Approximately 8m to the northwest of this feature is a group of three, c. 4m-diameter, dipolar maculae [69]. The northern corner of the survey area exhibits a group of three, c. 2.5m-diameter, positively-magnetic maculae [70]. Approximately 17m to the southeast of [68], is a c. 19m-long, curvilinear, positively-magnetic anomaly [71]. Apparently aligned with the northern end of this feature and c. 5m to the north of it, is a c. 2.5m-diameter, positively-magnetic macula [72]. Approximately 1.5m to the southeast of the apex of [71], is a c. 2m-diameter, positively-magnetic macula [73].

5.2. Earth-resistance Survey

5.2.1. Within the areas surveyed, the site exhibited a variable response to the earth-resistance survey, although a reasonable density of geophysical anomalies can be observed in each of the areas surveyed, and buried features can be discerned against the geological background. Any cut features are likely to show against the background as areas of relatively low resistance. In contrast, structural remains and voids are likely to present high-resistance signals.

5.2.2. The results are presented below as a greyscale image of the processed data (Fig. 4), and a complementary numbered interpretative plan to which the following description relates (Fig. 5), this description is organised from west to east. Minimally processed survey data is also presented below (Fig. 8), these data are unfiltered but have been corrected to remove striping resulting from a slight but consistent imbalance between the two parallel twin arrays used for the survey.

5.2.3. The earth-resistance survey consisted of three, small, discrete areas along the western edge of the geomagnetic survey, labelled Areas B, C, and D. Within the southwestern area, Area B, a number of anomalies were defined as a result of the survey. This area of the survey is dominated by a c. 14m by 14m, "L-shaped", high-resistance anomaly [r1], orientated northeast–southwest and abutting the northwestern edge of the survey area. Approximately 1m from the eastern end of this feature, and aligned with it, is a c. 4m-long, linear, high-resistance anomaly [r2], intersecting the southeastern edge of the survey area. Immediately to the northeast of [r1], is a c. 3m by 5m, low-resistance anomaly [r3], aligned northwest–southeast. Within the area defined by the angle of [r1], is a c. 6m by 3m, low-resistance anomaly [r4], orientated northeast–southwest. Approximately 5m to the southeast of this feature is a c. 6m-long, linear, high-resistance anomaly [r5], orientated north-northeast–south-southwest. Approximately 5.5m to the east of this feature is a c. $8m^2$, low-resistance macula [r6].

5.2.4. The two northern areas of earth-resistance survey (Areas C, and D) are both characterised by the scarcity of readily discernible anomalies. The northwestern edge of Area C demonstrates the presence of a c. 2.5m-wide band of high-resistance [r7]. Abutting the northeastern edge of the survey area is a c. 4m-long, 1m-wide, high-resistance anomaly [r8]. Approximately 3m to the north of the southern corner of this survey area is a c. 3.5m2, low-resistance macula [r9]. The northern corner of Area D demonstrates the presence of a c. 5.5m by 8m, vaguely "L-shaped", high-resistance anomaly [r10].

6. DISCUSSION

6.1. Geomagnetic Survey

6.1.1. The geomagnetic response to the survey revealed a moderate density of anomalies across the majority of the survey area. Numerous features with archaeological potential could be recognised within the dataset (Fig. 6). The scale of these features is varied, with many probably relating to evidence for ridge/furrow cultivation and former field divisions. Likely archaeological features were generally represented by positive magnetic anomalies. The overall character of the geophysical anomalies revealed by the survey suggests a high probability for the presence of archaeological remains within the area surveyed.

6.2. Earth-resistance Survey

6.2.1. The earth-resistance response to the survey revealed a moderate density of anomalies across the majority of the survey area, with an increased clarity, to the south, several features with archaeological potential could be recognised within the dataset (Fig. 6). Likely archaeological features were generally represented by high-resistance anomalies. The overall character of the geophysical anomalies revealed by the survey suggests a possibility for the presence of archaeological remains within the area surveyed.

6.3. General

6.3.1. The overall impression given by the combined techniques employed at Under Whitle Farm is that of an area which was of a rural character in antiquity. The combined surveys indicated settlement activity and possible field systems, or enclosures

6.3.2. The features [5], [6] ,[7] & [8] appear to suggest a probable building platform or structure.

6.3.3. The features [r1], [r2], [9] & [12], probably represent the remains of a boundary surrounding the feature discussed above.

6.3.4. The group of features [16] – [19], & [21] – [23] appear to represent probable vestiges of ridge and furrow cultivation.

6.3.5. The features [26], [27], [28], [31] – [36] appear to suggest the probable presence of a large-scale boundary or enclosure ditch.

6.3.6. Features [41] – [44] suggest the presence of another, smaller, boundary or enclosure ditch.

6.3.7. Feature [58] probably represents the line of a former field boundary, or a vestigal trace of ridge and furrow cultivation, though the latter interpretation seems less likely in the context of the relative isolation of this feature.

6.3.8. Features [8] & [40] may represent the possible remains of activities carried out within structures or enclosures.

6.3.9. Features [67] & [68] indicate possible remains of former field boundaries.

6.3.10 Feature [71] suggests the possibility of a small-scale feature, probably stratigraphically negative, such as a small enclosure or boundary ditch.

7. CONCLUSION

7.1. Geophysical survey strongly suggested the presence of potential buried archaeological features.

These comprised:

- Probable archaeological features relating to settlement activity [5], [6] ,[7] & [8]; [r1], [r2], [9] & [12].
- Probable archaeological features relating to land divisions or boundaries [26], [27], [28], [31] – [36]; [41] – [44]; [58].
- Probable archaeological remains relating to the use of ridge and furrow cultivation [16] – [19]; [21] – [23].
- Possible remains relating to settlement activities [8] & [40].
- Possible archaeological remains of field-boundaries or land divisions [67]; [68].
- Possible archaeological remains of a small-scale, stratigraphically-negative feature such as a small livestock or domestic enclosure [23].

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Scollar et al. 1990. *Archaeological Prospecting and Remote Sensing*. Cambridge: Cambridge University Press.

Cartographic references

BGS British Geological Survey: England and Wales (online) Solid and Drift Geology: 1: 50,000

OS Ordnance Survey 1: 50,000 Landranger Map

Ordnance Survey Maps: All editions 1859-1992

Appendix A: Details of Survey Strategy

Date of Survey: 10th - 19th March 2016
Site: UWC – Under Whitle Farm, Sheen (Staffordshire)
Region: Staffordshire
Grid Reference: NGR SK 10772 64001
Surveyor: Trent and Peak Archaeology
Personnel: Tom Hooley, Povilas Cepauskas, Tina Roushannafas
Geology: Bowland Shale Formation mudstone, siltstone and sandstone
Survey Type 1: Geomagnetic, fluxgate gradiometry
Approximate area: 2 hectares
Grid size: 30m
Traverse Interval: 1m
Reading Interval: 0.25m
Instrument: Bartington Instruments Grad 601-2
Resolution: 0.1nT
Traverse mode: Zig-zag
Survey Type 2: Earth-resistance, twin-probe array
Approximate area: 0.1 hectares
Grid size: 20m
Traverse Interval: 0.5m
Reading Interval: 0.5m
Instrument: Geoscan Research RM4, with DL10 data-logger
Resolution: 0.1Ω
Traverse mode: Zig-zag

Appendix B: Geophysical Prospection Methods

Magnetic Survey

Magnetic prospection of soils is based on the measurement of differences in magnitudes of the earth's magnetic field at points over a specific area. The iron content of a soil provides the principal basis for its magnetic properties. Presence of magnetite, maghaematite and haematite iron oxides all affect the magnetic properties of soils.

Although variations in the earth's magnetic field which are associated with archaeological features are weak, especially considering the overall strength of the magnetic field of around 48,000 nano-Tesla (nT), they can be detected using specific instruments (Gaffney et al. 1991).

Three basic types of magnetometer are available to the archaeologist; proton magnetometers, fluxgate gradiometers, and alkali vapour magnetometers (also known as caesium magnetometers, or optically pumped magnetometers).

Fluxgate Gradiometer

Fluxgate instruments are based around a highly permeable nickel iron alloy core (Scollar et al. 1990, 456), which is magnetised by the earth's magnetic field, together with an alternating field applied via a primary winding. Due to the fluxgate's directional method of functioning, a single fluxgate cannot be utilised on its own, as it cannot be held at a constant angle to the earth's magnetic field. Gradiometers therefore have two fluxgates positioned vertically to one another on a rigid staff. This reduces the effects of instrument orientation on readings.

Fluxgate gradiometers are sensitive to 0.5nT or below depending on the instrument. However, they can rarely detect features which are located deeper than 1m below the surface of the ground.

Archaeological features such as brick walls, hearths, kilns and disturbed building material will be represented in the results, as well as more ephemeral changes in soil, allowing location of foundation trenches, pits and ditches. The results are however extremely dependent on the geology of the particular area, and whether the archaeological remains are derived from the same materials.

Earth-resistance Survey

Resistivity survey is based on the ability of sub-surface materials to conduct an electrical current passed through them. Differences in the structural and chemical make-up of soils affect the degree of resistance to an electrical current (Clark 1990, 27). The technique involves the passing of an electrical current through a pair of probes into the earth in order to measure variations in resistance over the survey area. Resistance is measured in ohms (Ω), whereas resistivity, the resistance in a given volume of earth, is measured in ohm-metres (Ωm).

Four probes are generally utilised for electrical profiling (Gaffney et al. 1991, 2), two mobile and two remote probes. Earth-resistance survey can be undertaken using a number of different probe arrays; twin probe, Wenner, Double-Dipole, Schlumberger and Square arrays.

Twin Electrode Configuration:

This array represents the most popular configuration used in British archaeology (Clark 1990; Gaffney et al. 1991, 2), usually undertaken with a 0.5m separation between mobile probes. Details of survey methodology are dealt with elsewhere (Geoscan Research 1996) and so will not be discussed here. The twin probe array configuration utilises two probes on a mobile frame, with two remote probes located at a distance from the mobile frame of least 30 times the separation between the mobile probes.

Alterations can be made to suit different conditions. For extremely dry soils, a range of 0.1mA can be used. If the background resistance is lower than 100Ω, then a gain of x10 should be used. If the background resistance is lower than 10Ω, then a gain of x100 can be used. In urban situations, it may be necessary to alter the range and gain of the instrument to 10mA and x1 respectively.

A number of factors may affect the interpretation of twin probe survey results, including the nature and depth of structures, soil type, terrain and localised climatic conditions. The response to non-archaeological features may lead to a misinterpretation of the results, or the masking of archaeological anomalies. A twin probe array of 0.5m will rarely recognise features below a depth of 0.75m (Gaffney et al 1991). More substantial features may register up to a depth of 1m.

Although changes in the moisture content of the soil, as well as variations in temperature, can affect the form of anomalies present in resistivity survey results, in general, higher resistance features are interpreted as structures which have a limited moisture content, for example walls, mounds, voids, rubble filled pits, and paved or cobbled areas. Lower resistance anomalies usually represent buried ditches, foundation trenches, pits and gullies.

FIGURES

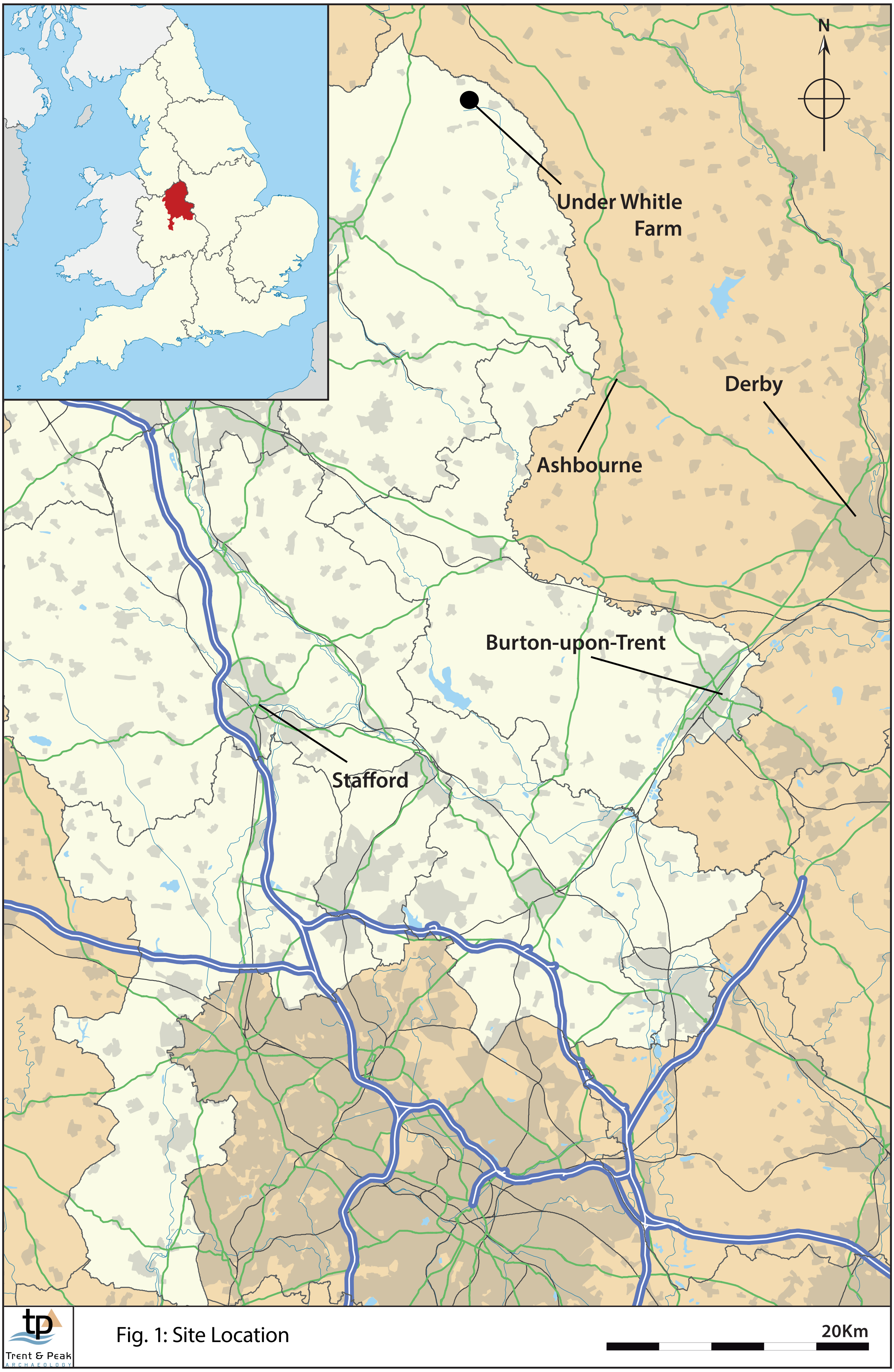

Fig. 1: Site Location

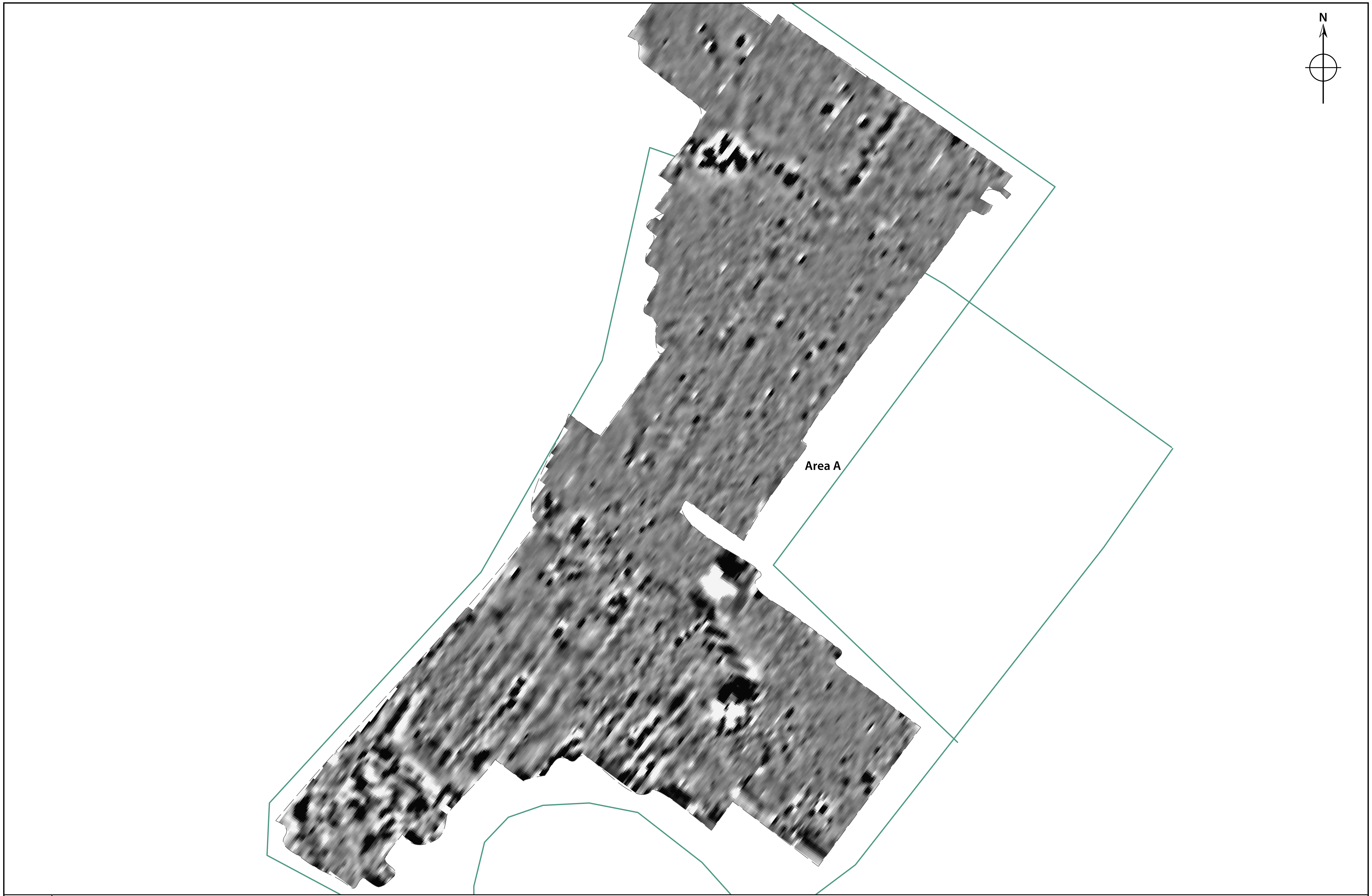

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Fig. 2: Greyscale plot of geomagnetic survey results

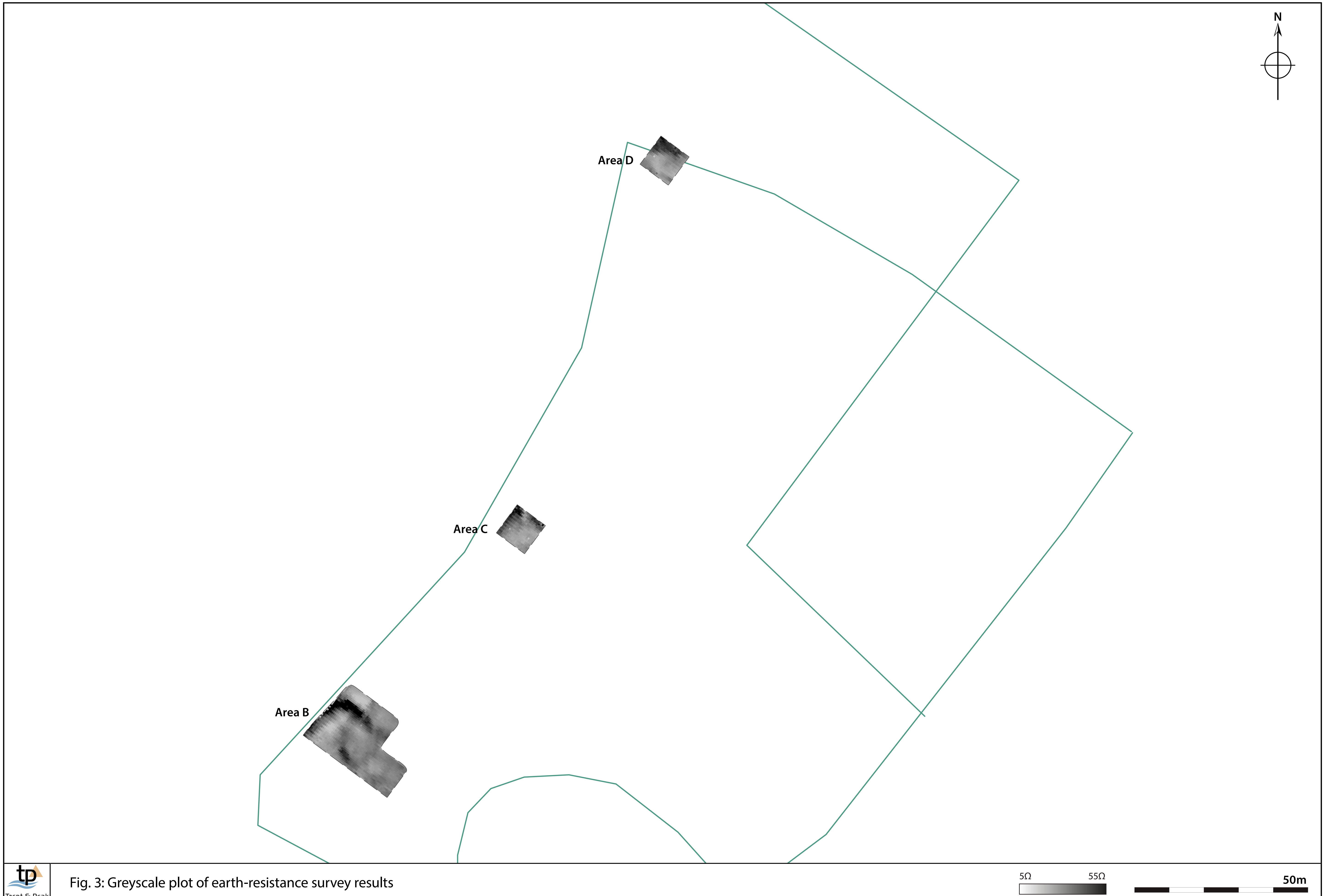

Fig. 3: Greyscale plot of earth-resistance survey results

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Fig. 4: Vectorised plan of geomagnetic survey results

Fig. 5: Vectorised plan of earth-resistance survey results

Fig. 6: Archaeological interpretation plan of geophysical survey results

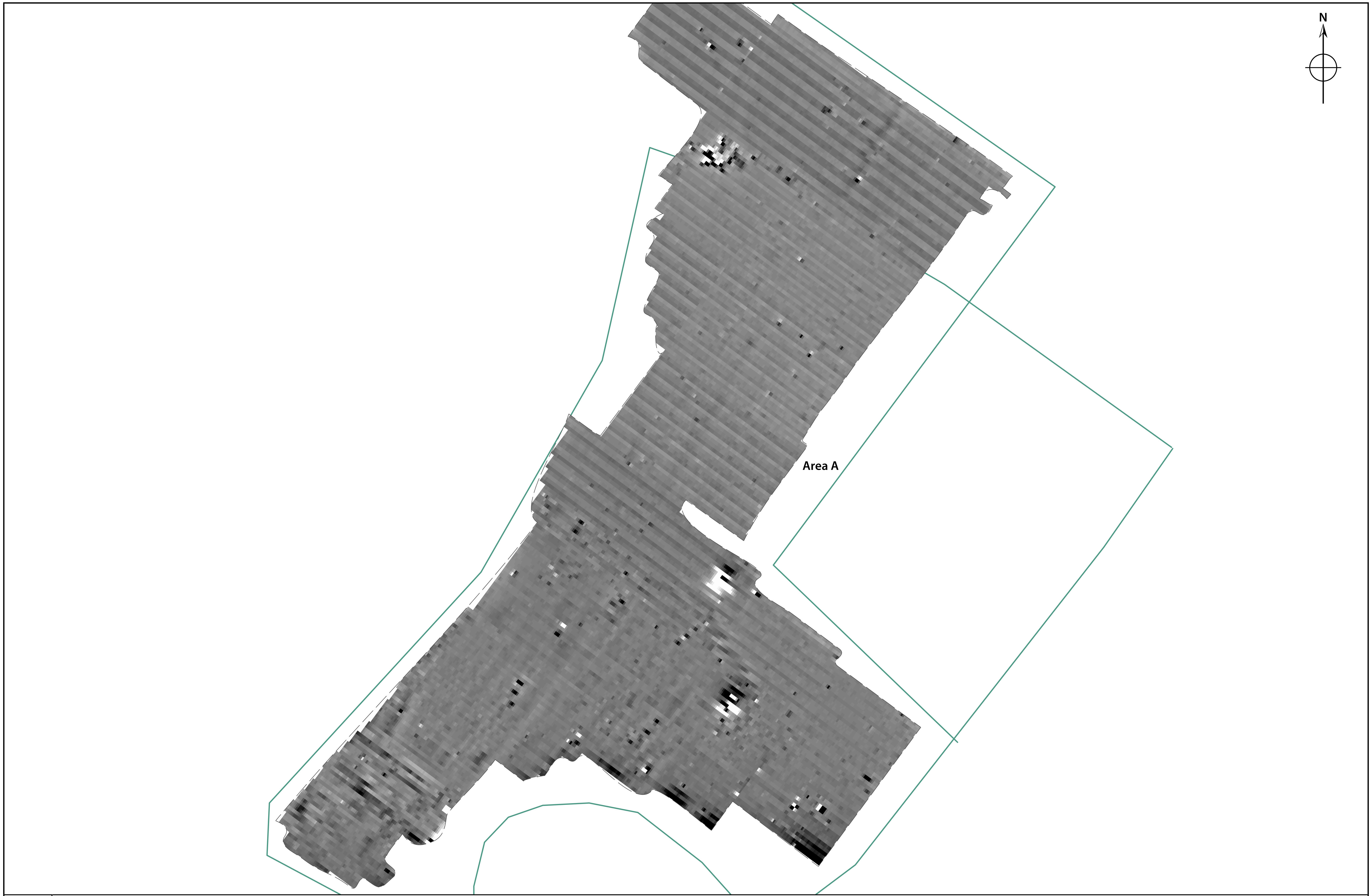

Fig. 7: Unfiltered plot of geomagnetic survey results

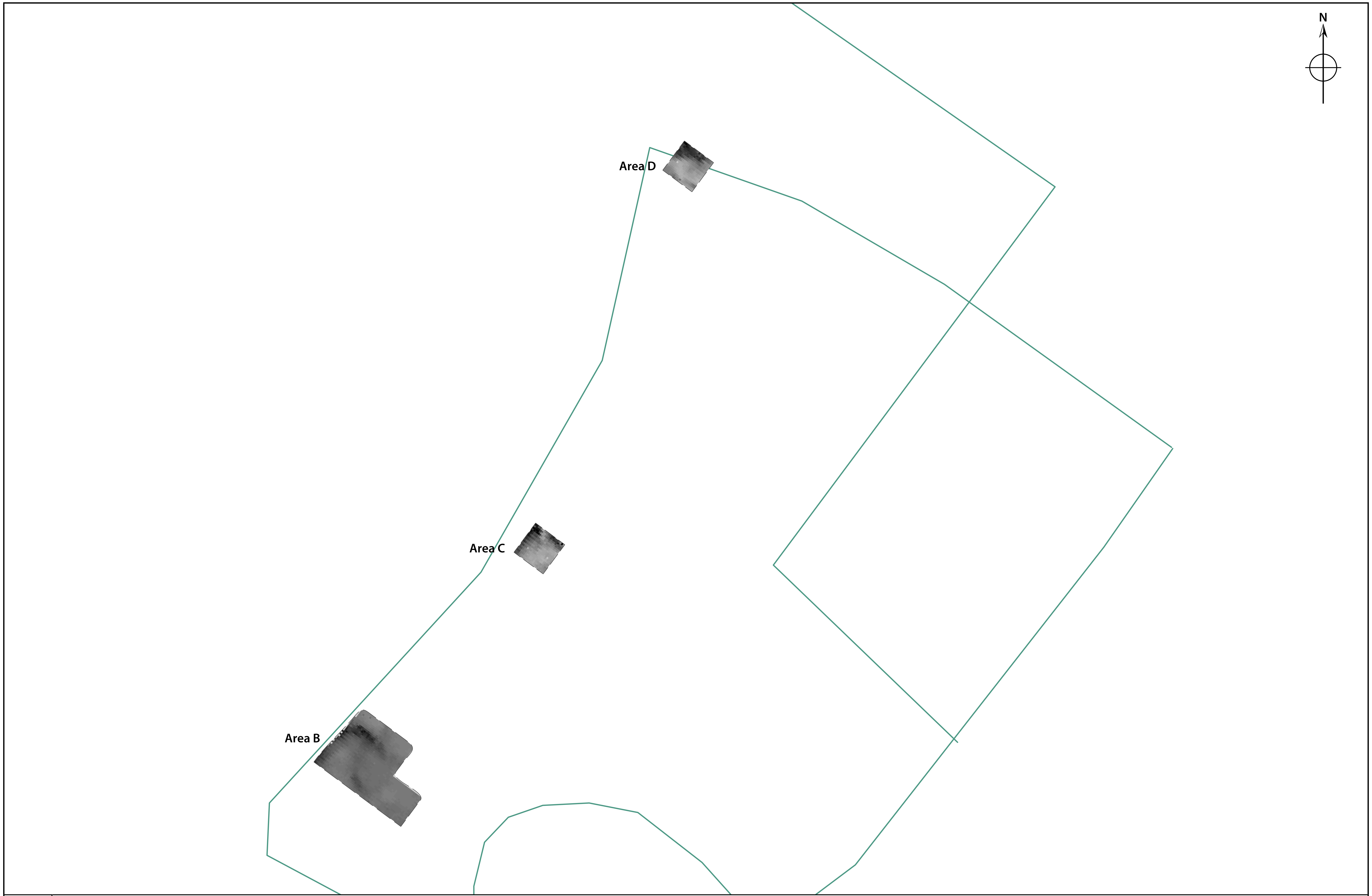

Fig. 8: Unfiltered plot of earth-resistance survey results

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