Geophysical Survey at Bainbridge 'Hillfort', Bainbridge, Wensleydale

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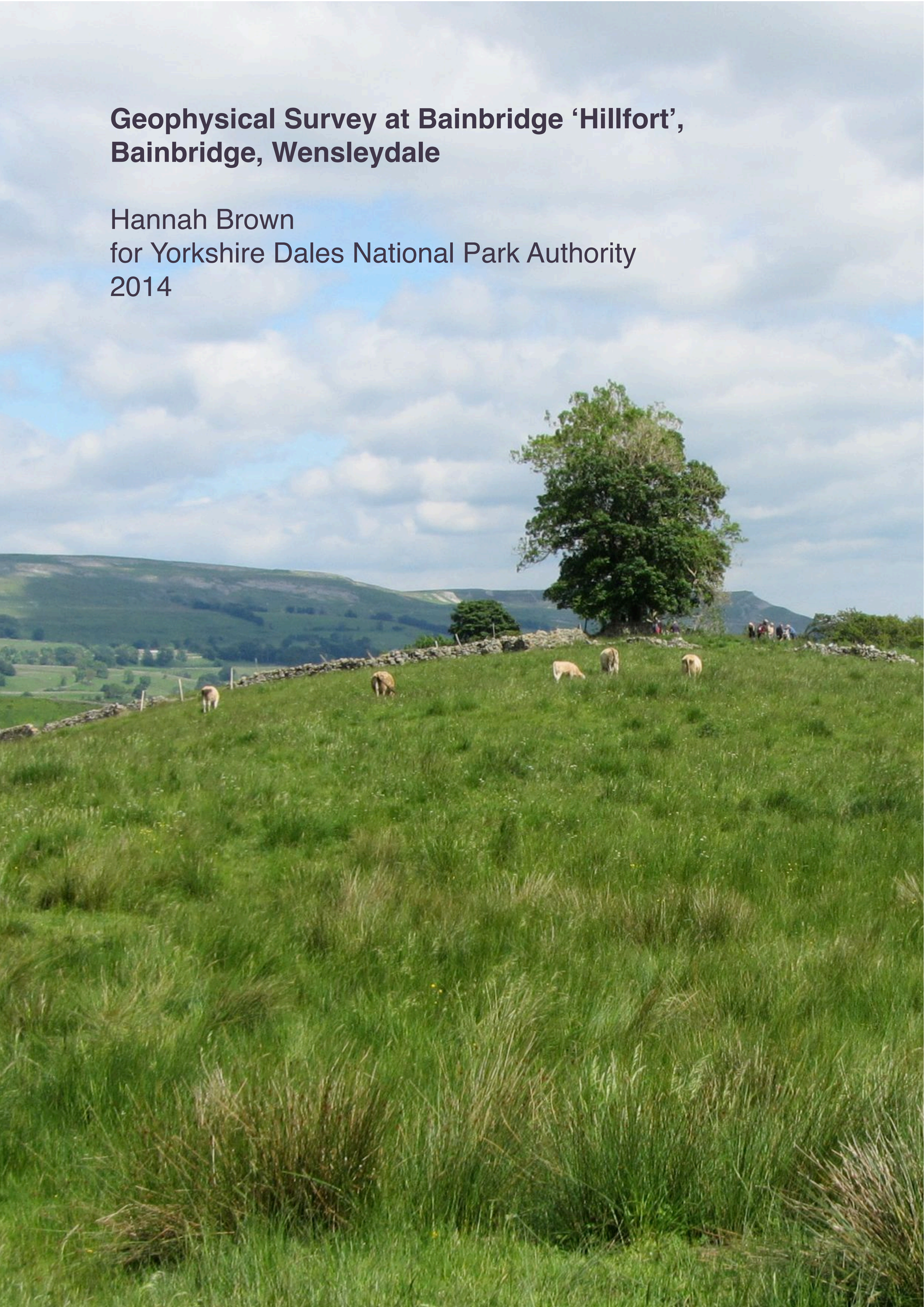
for Yorkshire Dales National Park Authority
2014



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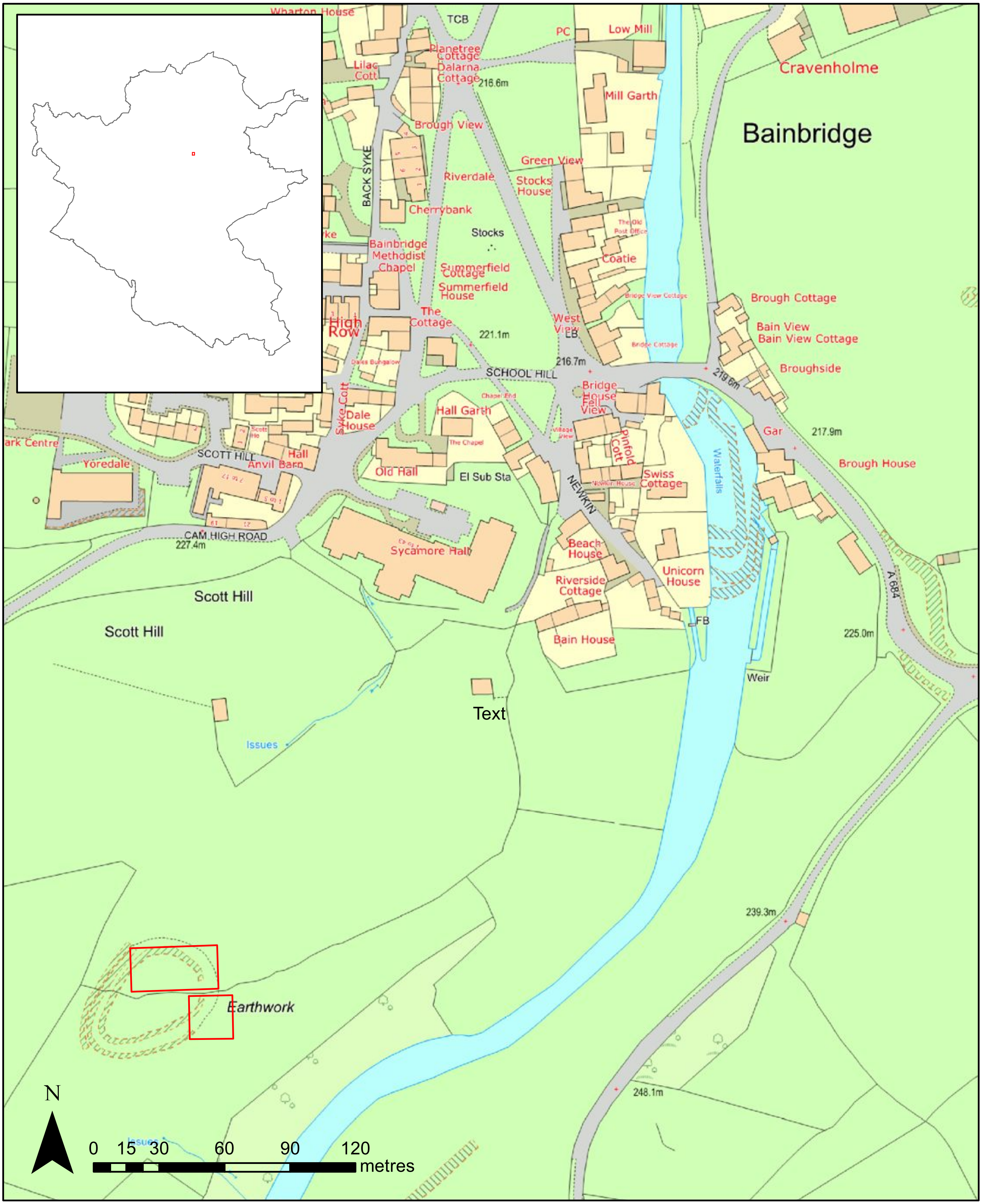

Fig. 1. Location of the survey site (red border) in Bainbridge and the Yorkshire Dales National Park

1. INTRODUCTION

1.1. Project Background

This geophysical survey was conducted as a practical element in one of a series of training days organised by the Yorkshire Dales National Park Authority for members of local archaeology groups. The Site is identified in the HER as ‘Bainbridge Univallate Hillfort’ and as such was of potential archaeological interest in addition to being conveniently located close to the National Park offices.

1.2. Survey Objectives

The primary aim of the survey was to teach participants how to conduct a geophysical survey, employing magnetometry and resistance techniques and laying out grids. It was, however, noted that no previous geophysical survey or excavation had been carried out on the site, so it was hoped that this survey would also add to the archaeological record by identifying and characterising any detectable archaeology.

1.3. The Site

1.3.1. The Site is centred on NGR SD 9335 8958, and lies approximately 370m south-west of the village of Bainbridge, in Wensleydale, North Yorkshire, and within the Yorkshire Dales National Park. The area of interest is on the top of a small hillock, located between Cam High Road and the River Bain (see fig. 1).

1.3.2. The Site is located at approx. 250m aOD. The surrounding land slopes generally away into Wensleydale to the north (see fig. 2), and more steeply into the valley of the River Bain, a tributary of the Ure, to the south. The underlying geology is Alston formation limestone, overlain by glacial till.

1.3.3. The top of the hillock forms a plateau, roughly 45m in diameter, encircled by a shallow but pronounced ditch and slight bank (see figs. 3-4).

1.3.4. The Site provides an excellent view of Bainbridge Roman fort (MYD4272), approx. 600m to the northeast. On the slopes to the immediate east of the hillock, the remains of a field system of unknown date are visible on aerial photographs and recorded in the HER.

1.5 The Survey Area

1.5.1. 0.12ha of magnetometer and earth resistance survey were conducted. The plateau that forms the Site is bisected by a modern drystone field wall, topped with wire fencing; several mature trees are located here.

1.5.2. Current landuse is meadow and rough grazing. To the north of the modern wall, grass was roughly shin height with patches of taller nettles and thistles; to the south of the wall, the grass was close cropped with thistle patches.

2. METHODOLOGY

2.1. Magnetometer and survey was conducted over 2 separate areas 20x60m (Grid 1) and 20x20m (Gird 2) respectively. The survey was conducted in accordance with English Heritage guidelines (2008).

2.2. Magnetometer survey was employed due to the anticipated nature of potential archaeology: this technique has been shown to be very successful in detecting cut features and burning (Aspinall et al. 2008) which could reasonably be expected on a hillfort site. Similarly, resistance survey has been shown to be successful in detecting ditches and banks such as those enclosing the site (Schmidt 2013).

2.3. Field work took place on 2nd June (Grid 1) and 22nd July (Grid 2) 2014. Conditions on site were good on both days, with sunshine and a light breeze; the first survey followed a period of heavy rain, while the weather preceding the second survey had been hot and dry.

2.4. Both grids were positioned with the intention of covering the interior of the site; while it would have been preferable to survey a greater area in order to provide context, this was not practical as the pace of survey was decreased by the training element of the project.

2.5. A baseline was established running parallel to the north face of the modern field wall, off which 20 x 20m grids were laid out using tapes. For practical reasons, the grids on the southern side of the wall were laid out from a second base line, running along the southern face of the same wall. A Leica 300 Total Station was used to tie in the corner points of this grid. The same grids were used for both types of survey.

2.6. Magnetometer survey

2.6.1. Magnetometer survey was conducted using a Bartington Grad601 dual sensor fluxgate gradiometer. This instrument has a vertical separation of 1m between sensors and is sensitive to 0.03nT over a range of 100nT.

2.6.2. A sampling interval of 0.25m was employed, along traverses spaced 0.5m apart and running just off north-south. Data was collected in a zig-zag manner, beginning in the north-east corner of each grid.

2.6.3. The data was subject to minimal correction processes using Geoplot 3.0. A zero mean traverse function was used to correct any variation in sensor alignment, and a de-stagger function was applied to reduce variations in sample position caused by adverse ground conditions/topography and inexperience of instrument operators.

2.7. Earth resistance survey

2.7.1. Earth resistance survey was conducted using a Geoscan RM15 earth resistance meter with MPX15 multiplexer and PA5 frame set up in parallel twin configuration with 0.5m electrode separation.

2.7.2. A sampling interval of 1m was employed, along lines spaced 1m apart (i.e. traverse interval of 0.5m) and running just-off north-south, starting in the northeast corner of each grid. Data was collected in a zig-zag manner.

2.7.3. The data was subject to minimal correction processes using Geoplot 3.0. Data has been despiked and interpolated once in the y direction.

3. RESULTS & INTERPRETATION

3.1. Magnetometer survey

3.1.1. The magnetometer data is displayed as a greyscale plot in fig. 7 and interpreted in fig. 8. (For XY trace plot, see appendix.)

3.1.2. The data is dominated by strong ferrous responses along the southern edge of Grid 1 and the northern edge of Grid 2. These are explained by the presence of metal fencing along the top of the stone wall that divided the grids. A number of smaller ferrous sources are distributed across both grids; these are most likely to be of modern origin. Although not considered 'archaeological' per se, the strength of the ferrous responses will serve to mask any potential archaeological responses in the vicinity.

3.1.3. A series of positive magnetic anomalies are apparent at A, B and C, which, given the corresponding known location of the ditch, can be interpreted as being generated by the increased susceptibility of this feature. The section in Grid 2 is particularly well defined.

3.1.4. An amorphous area of weakly negative responses arcs around between A and B, roughly following the line of the ditch. It is possible that this may represent the remains of an internal bank, as discussed in the HER record, although this is speculative.

3.1.5. A positive magnetic anomaly, consisting of 2 parallel linears are visible in the northwest corner of Grid 2, running northeast into the southeast corner of Grid 1. As the curve of the ditch is relatively shallow at this point, it is difficult to tell whether the linear anomaly is associated with it or generated by a track that predates the modern wall.

3.1.5. Both grids are criss-crossed by faint 'trends' in the data. These indicate possible anomalies, though they are too nebulous to define as a response to an anthropological or geological feature as such. They may result from, for example, archaeology, modern or medieval agricultural activity, geology, or coincidental alignments in the data. In particular, a number of trends are found over 2 alignments at right angles to each other and are interpreted as past ploughing events.

3.2. Earth resistance Survey

3.2.1. The resistance data is displayed as a greyscale plot in fig. 9 and interpreted in fig. 10.

3.3.2 The form of the ditch is very clearly visible in the earth resistance data as a curve of low resistance, particularly between **E** and F where there is good definition between the low resistance of the ditch and the higher resistance of both the internal and external ground.

3.2.3. The curved line of increased resistance (black) on the inside of the ditch either side of **G** is suggestive of an internal bank, while the line of contrasting resistance running north-south through the ditch and ?bank at this point may reflect an entrance or similar.

3.2.4. While the area of increased resistance appears to continue into the southern survey grid where it broadens out, the ditch is less evident here. A narrow spur of strongly contrasting high resistance appears to indicate the outer edge of the ditch (as compared with the magnetic data) while the area to the south-east (probably outside the ditch) demonstrates an amorphous area of lower resistance. Although it may be expected that the ditch would produce the lowest data values, this situation may be the result of varying moisture retention due to the warm, dry conditions prior to the survey of Grid 2, as opposed to recent rain prior to the survey of Grid 1.

4. CONCLUSION

4.1. The location and alignment of the ditch are apparent in both the magnetometer and resistance datasets, and align well when compared with each other and, in places, with the visible ditch remains on the ground, strengthening the interpretation of these anomalies. The resistance data suggests the presence of internal and external banks (i.e. high resistance anomalies), a possibility supported by the magnetometer data (i.e. weakly negative anomalies) and discussed by previous field observation (see HER notes).

4.3. The data quality is generally moderate to good, however magnetometer survey of Grid 1 suffered from somewhat difficult terrain and strong ferrous 'noise' – this is particularly evident when comparison is made with Grid 2 data. Although variations in the data are evident inside the ditch, the magnetic 'noise' and disturbance prevent any identification of more subtle features that may be present, which could help shed light on the previous interpretation of the site as a hillfort.

REFERENCES

Aspinall, A., C. Gaffney & A. Schmidt. 2008. *Magnetometry for archaeologists*. Alta Mira: Lanham.

David, A., N. Linford & P. Linford. 2008. *Geophysical survey in archaeological field investigation*. English Heritage: Swindon.

Schmidt., A. 2013. *Earth resistance for archaeologists*. Alta Mira: Lanham.

Fig. 2. View northeast from the site over Wensleydale. Bainbridge Roman fort is visible on the hill in the middle distance.

Fig. 3. Looking east to the site: the ditch encircles the trees in the centre of the picture.

Fig. 4. Ditch profile. (The flags mark the breaks of slope of the inside and bottom of the ditch).

Fig. 5. Looking east along the northern side of the stone wall that divides the site; note the tree, uneven ground and nettles!

Fig. 6 Looking east along the southern side of the stone wall that divides the site; note the cropped grass.

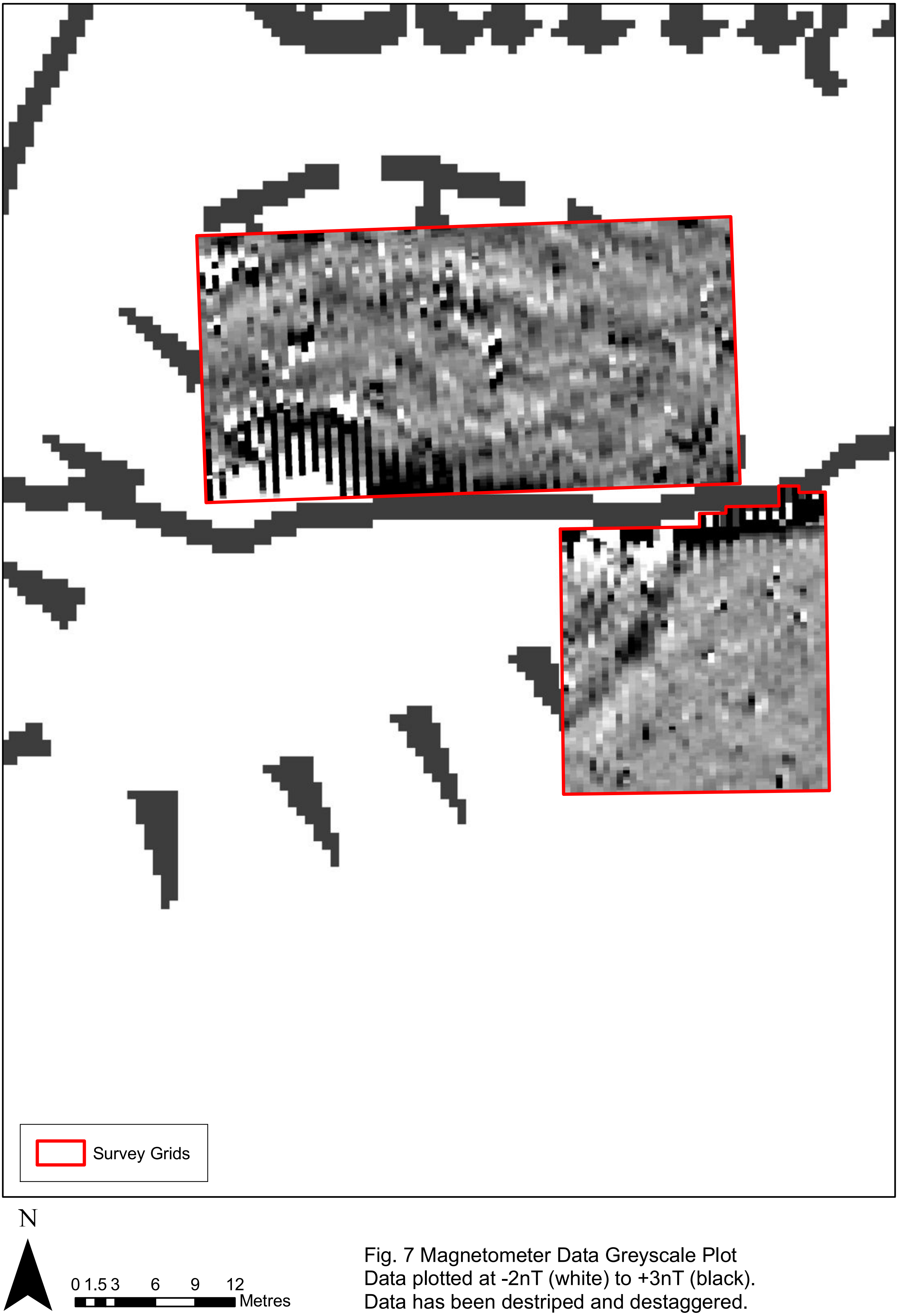

Fig. 7 Magnetometer Data Greyscale Plot
Data plotted at -2nT (white) to +3nT (black).
Data has been destriped and destaggered.

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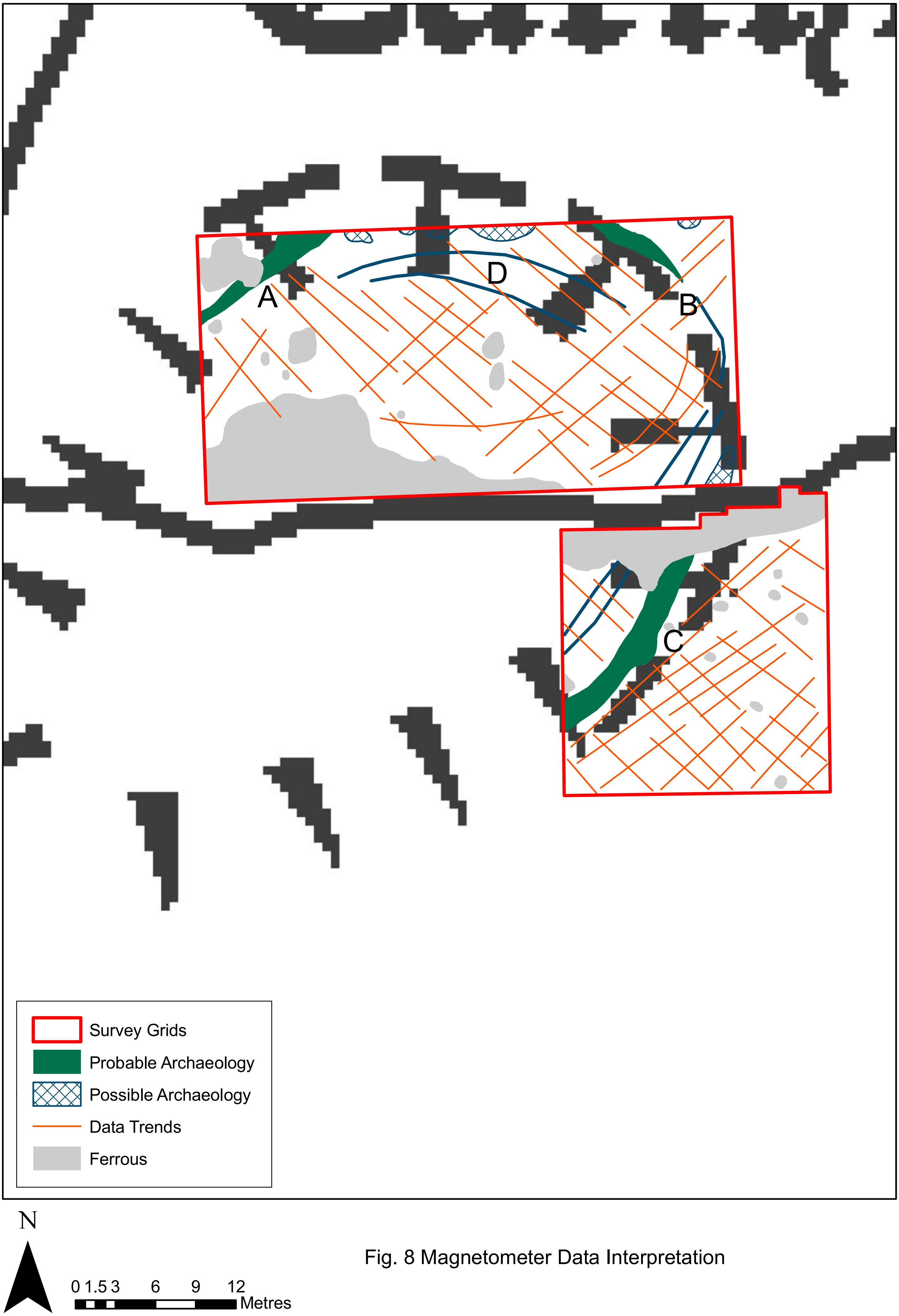

Fig. 8 Magnetometer Data Interpretation

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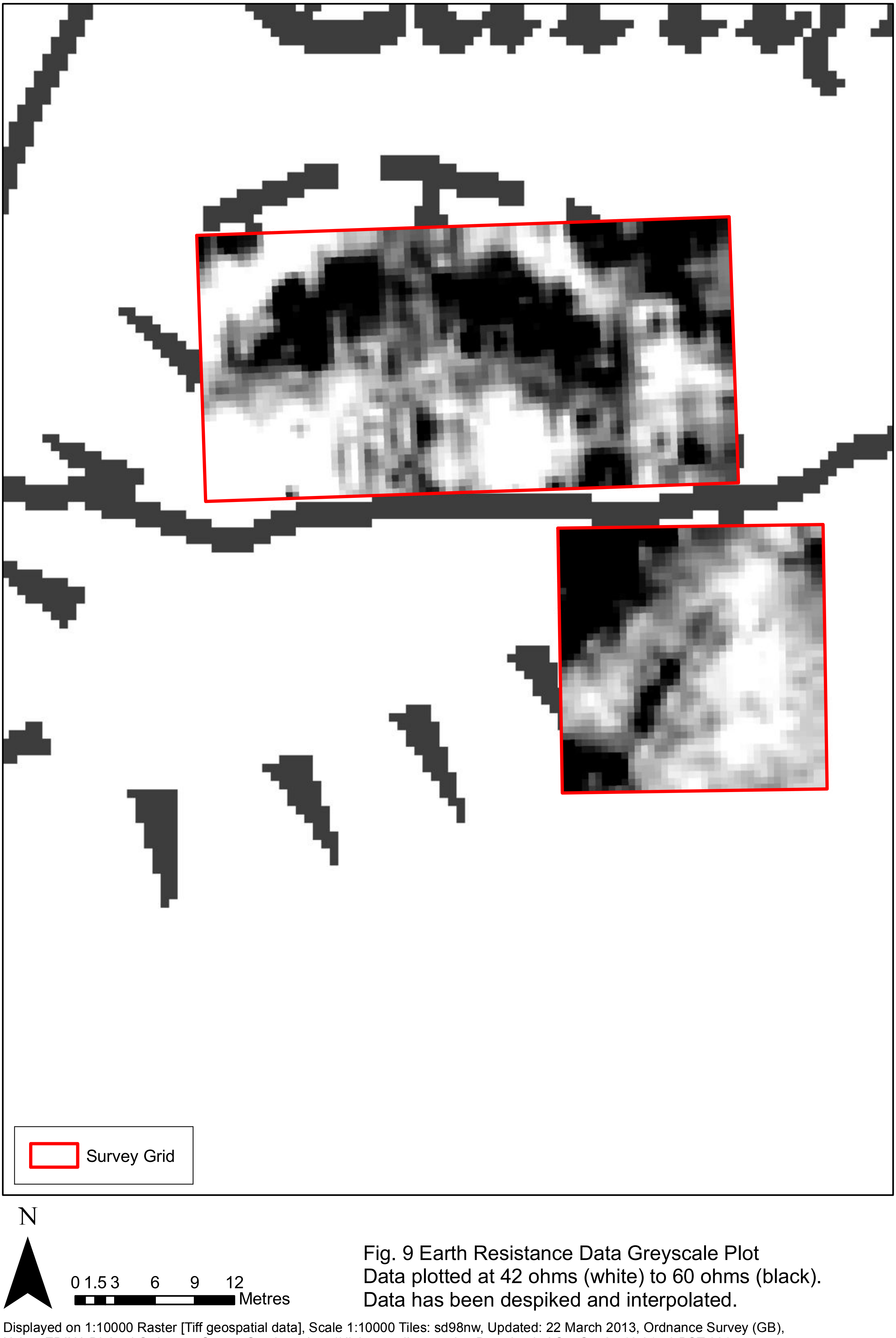


Fig. 9 Earth Resistance Data Greyscale Plot
Data plotted at 42 ohms (white) to 60 ohms (black).
Data has been despiked and interpolated.

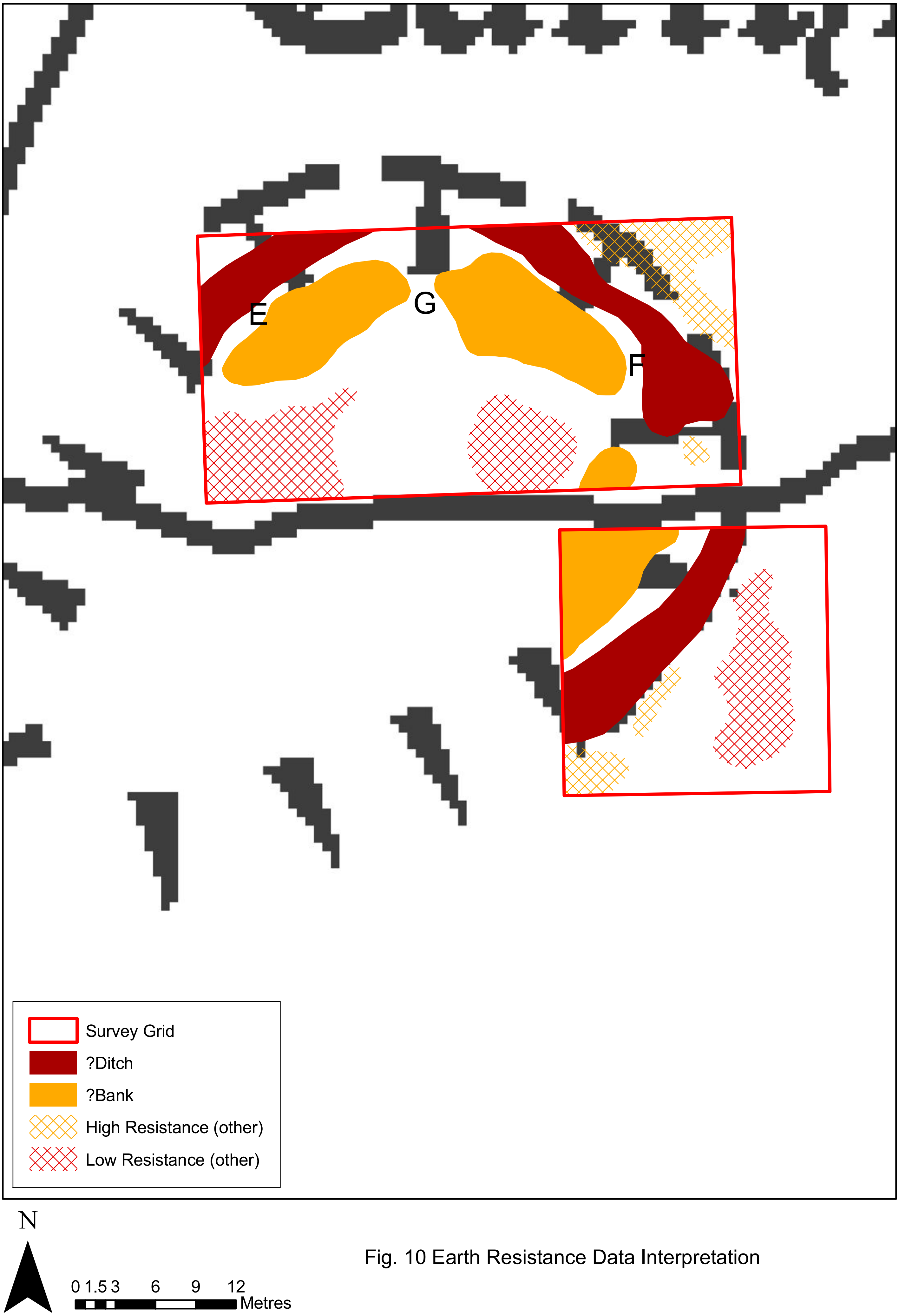
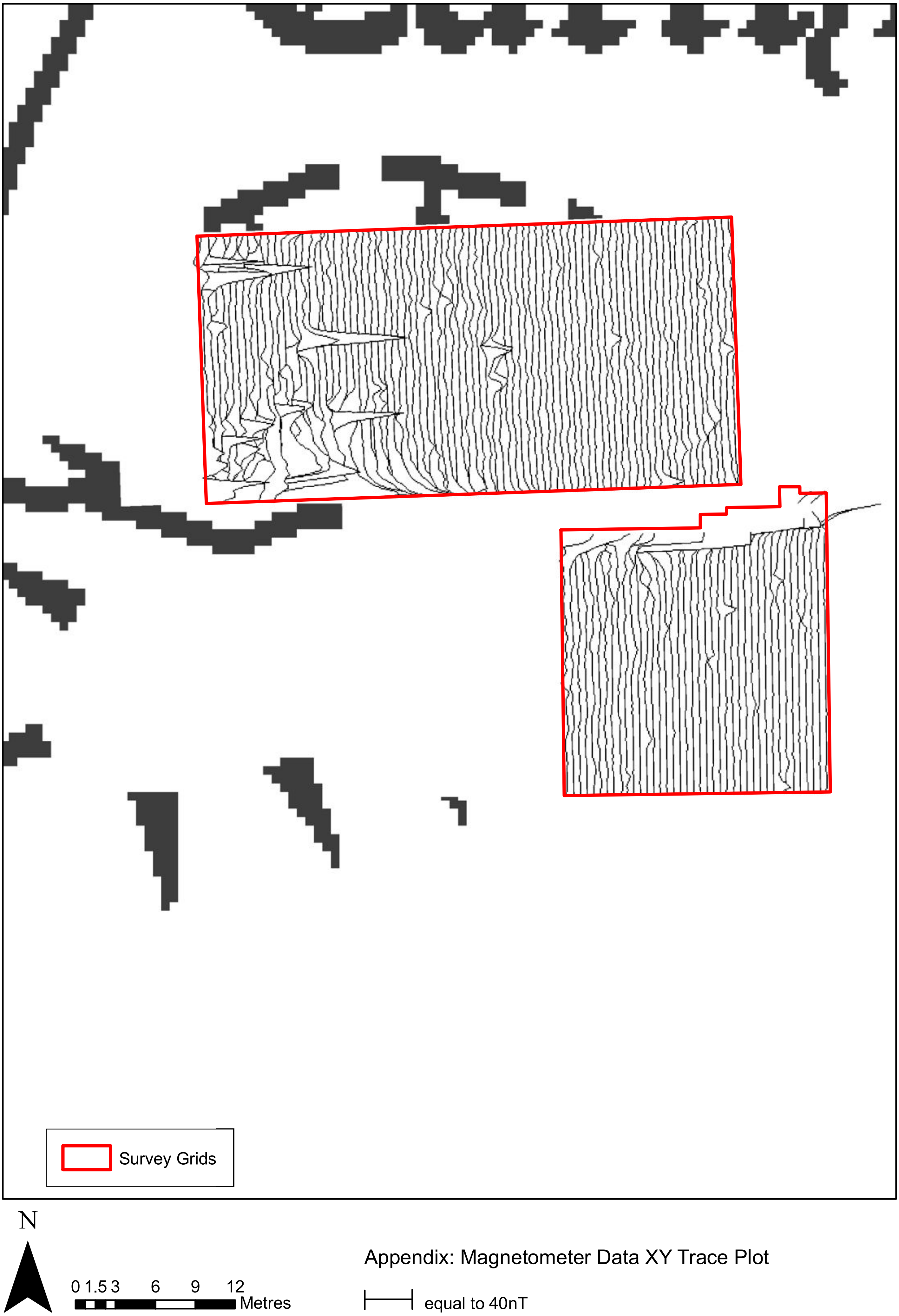


Fig. 10 Earth Resistance Data Interpretation



Appendix: Magnetometer Data XY Trace Plot

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