

**Geophysical Survey**

**at**

**Mill Lane**

**Stowmarket**

**Suffolk**

**NGR: TM 06800 58000**

**ASE Project no: 8215**

**HER Event No: CRP 012**

**OASIS No: 184988**

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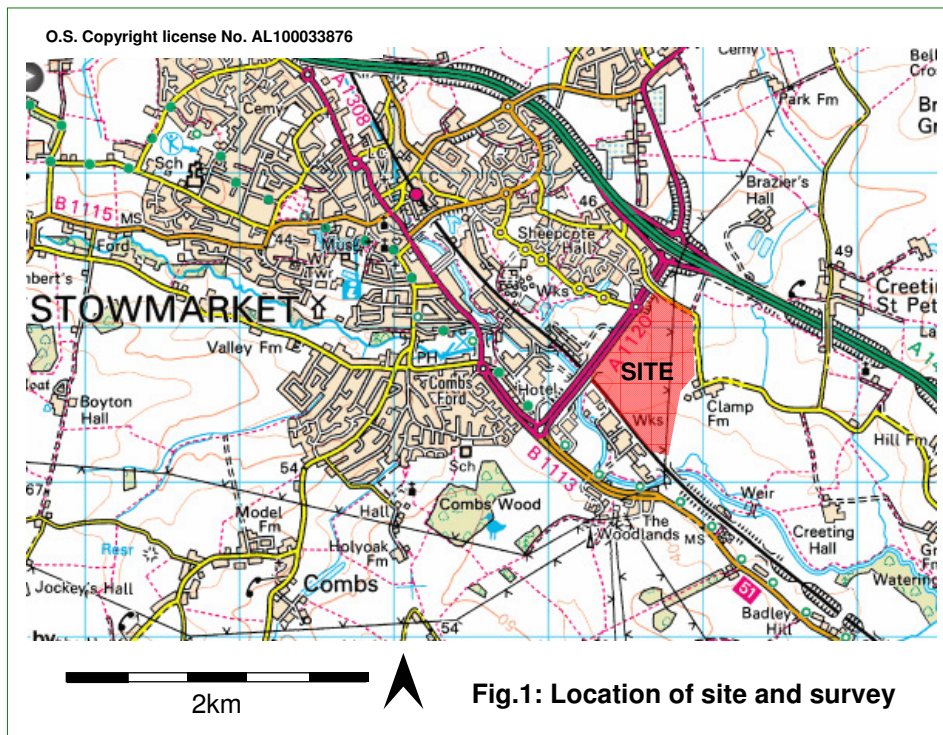
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### Non technical summary

- A fluxgate gradiometer survey was undertaken on land of Mill Lane, Stowmarket in Suffolk.
- The survey detected potential ditches and pits, predominately situated in the central and western parts of site. A number of ditches in the central area appear to encompass the eastern extents two conjoined enclosures (one with internal features), whilst examples in the western part of site possibly bounding a narrow, partially enclosed strip of land.
- The majority of linear anomalies/trends correspond to recently removed field boundaries. Other examples possibly indicate recent land divisions, although this hypothesis is not corroborated by cartographic evidence.
- The survey detected residual remains of features clearly associated with a former explosive factory. Other linear and discrete anomalies potentially represent further industrial remains.
- It is likely that most (if not all) strong variation represents modern and recent ferrous-rich materials/objects, including debris deposited along former and current field boundaries; iron objects and fragments of ceramic materials contained within the plough soil; pylons and electricity poles and residual remains of the explosives facility.
- Distinct, albeit magnetically weak, zones of variation in the south-eastern part of the site reflect pockets of ferrous-rich alluvial deposits.



## 1.0 Introduction

Archaeology South-East (ASE) commissioned Pre-Construct Geophysics Ltd to undertake a fluxgate gradiometer survey on land off Mill lane, Stowmarket in Suffolk (centred at NGR TM 06800 58000).

The fieldwork and reporting were undertaken accordance with a Written Scheme of Investigation for a Geophysical Survey prepared by ASE (ASE, 2013).

This report also incorporates information that has been selectively extracted from a Desk Based Assessment prepared by ASE (ASE, 2014).

## 2.0 Location and description (Figs. 1 – 2)

The c.42ha proposed development site lies to the east of the Stowmarket. It is bounded to the north by Mill Lane, the west by the A1120 and the south by the London-Ipswich-Norwich railway line.

The area is currently agricultural land, the majority under arable cultivation. A number of power lines, some on pylons, extend across the site.

Geophysical survey was undertaken of all available land within the development, excluding land previously investigated in 1993. A total area of 33.5ha within two fields (F1 & F2) was surveyed (including replicated survey grids).

## 3.0 Geology and topography

The solid geology of the northern and central part of the site comprises sand (Crag Group), with a band of chalk (Newhaven Chalk Formation) across the southern southernmost region<sup>1</sup>.

Superficial deposits comprise Till in the majority of the site, with River Terrace Deposits in the south-east corner of F1 and alluvium in F2.

The response of archaeological remains within chalk is generally good, though variable for overlying deposits sand and gravel and average to poor for Till and alluvium.

The site is situated on the northern side of valley of The River Gipping. The ground level falls towards the river floodplain and railway line from approximately 45m AOD to 25m AOD.

## 4.0 Archaeological Context

*Edited extracts of the DBA (ASE, 2014):*

*Two previous archaeological field investigations have been undertaken within the site*

- An archaeological trial trenching evaluation was undertaken in 1993 towards the south west of the site. This evaluation was undertaken to establish if the remains on an explosives works survived within an area that was to be stripped of topsoil and used for soil disposal. The evaluation did not identify any structural remains of the works or remains pre-dating them;*
- In the northern part of the site fieldwalking was undertaken along Phase 1 of the route of an Anglian Water Pipeline. Fieldwalking identified a flint flake, burnt flint, slag and ceramic building material in low quantities in the site area.*

*The assessment has concluded that:*

- There are no designated assets within the site;*
- No significant setting issues have been identified with regard to designated assets;*

- *The site lies within an Archaeological Priority Area and the development has an archaeological condition attached;*
- *The site has the potential for non-designated heritage assets (below-ground archaeological remains) to be present;*
- *Those that pre-date the post-medieval development of the site, including terrace deposits and alluvium, are likely to be buried at depth;*
- *Post-medieval industrial remains may be more shallowly buried but are likely to have been disturbed by subsequent activity;*
- *The impact of the development is likely to be low given the depth of deposits, foundation type (piled) and previous disturbance.*

## 5.0 Objectives

The objectives of the geophysical survey were to establish, by using non intrusive techniques;

- The nature, extent and location of any archaeological features, should any lie within the proposed development;
- The presence/absence of any modern features, such as services, that may impact on the survey results and any archaeological features in close proximity.

## 6.0 Methodology

The survey methodology is based upon English Heritage guidelines: '*Geophysical Survey in Archaeological Field Evaluation*' (English Heritage, 2008).

**Fluxgate Gradiometry** is a non-intrusive scientific prospecting tool that is used to determine the presence/absence of some classes of sub-surface archaeological features (e.g. pits, ditches, kilns, and occasionally stone walls).

The use of gradiometry should help to establish the presence/absence of buried magnetic anomalies, which may reflect sub-surface archaeological features, and may therefore form a basis for a subsequent scheme of archaeological trenching.

The use of magnetic surveys to locate sub-surface ceramic materials and areas of burning, as well as magnetically weaker features, is well established, particularly on large green field sites. The detection of anomalies requires the use of highly sensitive instruments; in this instance the Bartington 601 Dual Fluxgate Gradiometer. This is accurately calibrated to the mean magnetic value of each survey area. Two sensors, mounted vertically and separated by 1m, measure slight, localised distortions of the earth's magnetic field, which are recorded by a data logger.

It should be noted that this technique only records magnetic variation (relative to natural background levels). As such, the magnetic response of archaeological remains will vary according to geology/pedology. Additionally, remains may be buried beyond the effective of 1 - 2m range of the instrumentation (e.g. sealed beneath alluvium).

**The survey** was undertaken on 8th–15th August 2014. The zigzag traverse method of survey was used, with readings taken at 0.25m intervals along 1.0m wide traverses. One 40m x 40m grid was re-surveyed each day (Appendix).

The survey grid was established by Global Positioning Satellite using a Topcon GRS-1, with an accuracy of +/- 0.1m and subsequently geo-referenced on an Auto drawing of the site.

The data sets were processed using *ArcheoSurveyor 1.3.2.8*.

The raw data sets are presented on Figs. 4, 8 & 12 (clipped to +/-10nT to enhance resolution).

The 'Despike' function was applied to reduce the effect of extreme readings induced by metal objects, and 'Destripe' to eliminate striping introduced by zigzag traversing. The data sets were clipped to +/- 20nT on the trace plots (Figs. 5, 9 & 13) and +/-3nT on greyscale images (Figs. 2, 6, 10 & 14).

## **6.2 Character, interpretation and presentation of magnetic anomalies** (Figs. 3, 7, 11 & 15)

*The interpretation of geophysical survey results should only be regarded as an aid to establishing the true nature and origin of buried features. These can only be fully achieved by intrusive investigation*

Anomalies considered to reflect modern ferrous-rich features and objects are highlighted as blue and pink on the interpretive images. These are characterised magnetically as dipolar 'iron spikes', often displaying strong positive and/or negative responses. Examples include those deposited along existing or former boundaries (e.g. wire fencing), services and scatters of horseshoes, ploughshares etc across open areas. Ferro-enhanced (fired) materials such as brick and tile (sometimes introduced during manuring or land drain construction) usually induce a similar, though predominately weaker response. Concentrations of such anomalies will often indicate rubble spreads, such as would be used to backfill ponds or redundant ditches, or indicate the blurred footprints of demolished structures.

On a cautionary note, fired clay associated with early activity (e.g. kilns, furnaces, tile spreads) has the same magnetic characteristics as modern brick/tile rubble. Therefore, the interpretation of such variation must consider the context in which it occurs.

## **7.0 Results and discussion** (Figs. 2 - 15)

Due to the large size of F1, the survey results of the northern and southern areas are presented and discussed as two parts (F1N & F1S).

### **7.1 F1N** (Figs. 2 - 7)

The survey recorded:

- a) Residual traces of recently removed boundaries, as depicted on historic maps (ASE, 2014) (Figs. 4 & 7: solid yellow lines). Poorly-defined sections of known former boundaries are highlighted as dotted yellow lines;
- b) An isolated linear anomaly at the mid-southern edge of the survey area (dotted red line). This has tentatively been interpreted as a potential ditch, although a recent origin as cultivation is also feasible;
- c) A zone of strong variation that corresponds to a former arming facility associated with the cordite factory, as depicted on an aerial photograph dated 1945 (ASE, 2014) (1: highlighted light yellow). A number of similarly magnetic discrete zones of variation were detected to the north-west of 1 (e.g. highlighted light red). Whereas elements of these lie along or adjacent to (thus potentially relating to) former boundaries, it is speculated that some might relate to munitions production. However, given that no corresponding features are shown on historic maps and aerial photographs, an earlier origin should not be totally discounted;

Elsewhere, it is likely that most, if not all, stronger discrete and grouped anomalies signify modern deposits of ferrous-rich materials, such as near surface brick/tile rubble and iron objects (e.g. ploughshares and horseshoes) boundary fencing and electricity poles (**EP**) etc;

- d) Potential land drains (dotted purple lines);
- e) A backdrop of weak magnetic variation, indicative of natural inconsistencies within the upper geology and overlying soil ('greenscale').

## 7.2 F1S (Figs. 2, 3, 8 - 11)

The survey recorded:

- a) A group of ditches and potential pits in the central part of the field (Figs. 4 & 11: highlighted red). Some ditches appear to describe the eastern extents of at least one enclosure (**2**), with ephemeral suggestions of an annexe abutting its northern edge (**3**);

A recently removed trackway (**4**) extends across the southern part of **2** (yellow lines). It is unclear whether potential ditch **5** represents the southern edge of enclosure **2**, or that any such remains lie beneath the modern trackway. It should also be noted that putative eastern enclosure ditch (**6**) appears to abut the northern edge of the former trackway, thus implying contemporaneity. Alternatively, it is possible that the stronger magnetic response of the trackway might be masking the southernmost extent of the ditch;

A number of probable pits and at least one ditch (**7**) lie within enclosure **2**, with suggestions of a further ditch (**8**) that extends south towards and beyond the modern track. Other potential ditches and pits were also detected to the south of the track, and group of possible pits to the east of the enclosure complex (all highlighted red);

- b) The survey detected potential ditches and pits in the western part of the site. Some ditches appear to define the (partial) boundaries of a narrow enclosure/track, open at its northern end (**9**);
- c) Isolated pit-type anomalies and one potential ditch in the eastern/south-eastern regions (highlighted red);
- d) Recently removed field boundaries/tracks (yellow lines), including a curvilinear access track (**10**) associated with the former explosives factory. Other linear anomalies possibly represent further recent boundaries, with westernmost examples potentially related to the explosives factory (dashed yellow lines);
- e) Stronger responses, as discussed above, including that induced by electricity poles (**EP**) (highlighted pink & blue). A preponderance of discrete examples were detected in the south-eastern part of the field; these almost certainly signify modern near surface debris, possibly imported with manure;
- f) Weak, natural, variation (greenscale), including zones of distinct variation in the south-east corner of the field. The latter probably reflect ferrous-rich alluvial deposits (alluvium is recorded in the south-east part of the site).

## 7.3 F2 (Figs. 2, 3, 11 - 15)

The survey recorded:

- a) Widespread natural responses, almost certainly predominantly related to alluvial deposits (Figs. 3 & 15: greenscale). A relatively broad curvilinear anomaly recorded at the southern edge of the survey probably resolves as a palaeochannel (**8**);
- b) Strong variation, as discussed above, including that induced by a pylon (highlighted pink & blue).

## 8.0 Conclusions

The survey detected potential ditches and pits, predominately situated in the central and western parts of site. A number of ditches in the central area appear to encompass the eastern extents two conjoined enclosures (one with internal features), whilst examples in the western part of site possibly bounding a narrow, partially enclosed strip of land.

The majority of linear anomalies/trends correspond to recently removed field boundaries. Other examples possibly indicate recent land divisions, although this hypothesis is not corroborated by cartographic evidence.

The survey detected residual remains of features clearly associated with a former explosive factory. Other linear and discrete anomalies potentially represent further industrial remains.

It is likely that most (if not all) strong variation represents modern and recent ferrous-rich materials/objects, including debris deposited along former and current field boundaries; iron objects and fragments of ceramic materials contained within the plough soil; pylons and electricity poles and residual remains of the explosives facility.

Distinct, albeit magnetically weak, zones of variation in the south-eastern part of the site reflect pockets of ferrous-rich alluvial deposits.

## 9.0 Acknowledgements

Pre-Construct Geophysics would like to thank Archaeology South-East for this commission.

## 10.0 References

- |                        |   |
|------------------------|---|
| Archaeology South-East | 2014 <i>Written Scheme of Investigation for Geophysical Survey at Mill Lane Stowmarket Suffolk.</i> ASE |
|                        | 2014 <i>Mill Lane Stowmarket Suffolk.</i> Desk Based Assessment, ASE                                    |
| English Heritage.      | 2008 <i>Geophysical Survey in Archaeological Field Evaluation.</i> English Heritage, London             |

<sup>1</sup> [http://maps.bgs.ac.uk/geologyviewer\\_google/googleviewer.html](http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html), 1:50,000. British Geological Survey, Keyworth





Fig.2: Location of site and survey

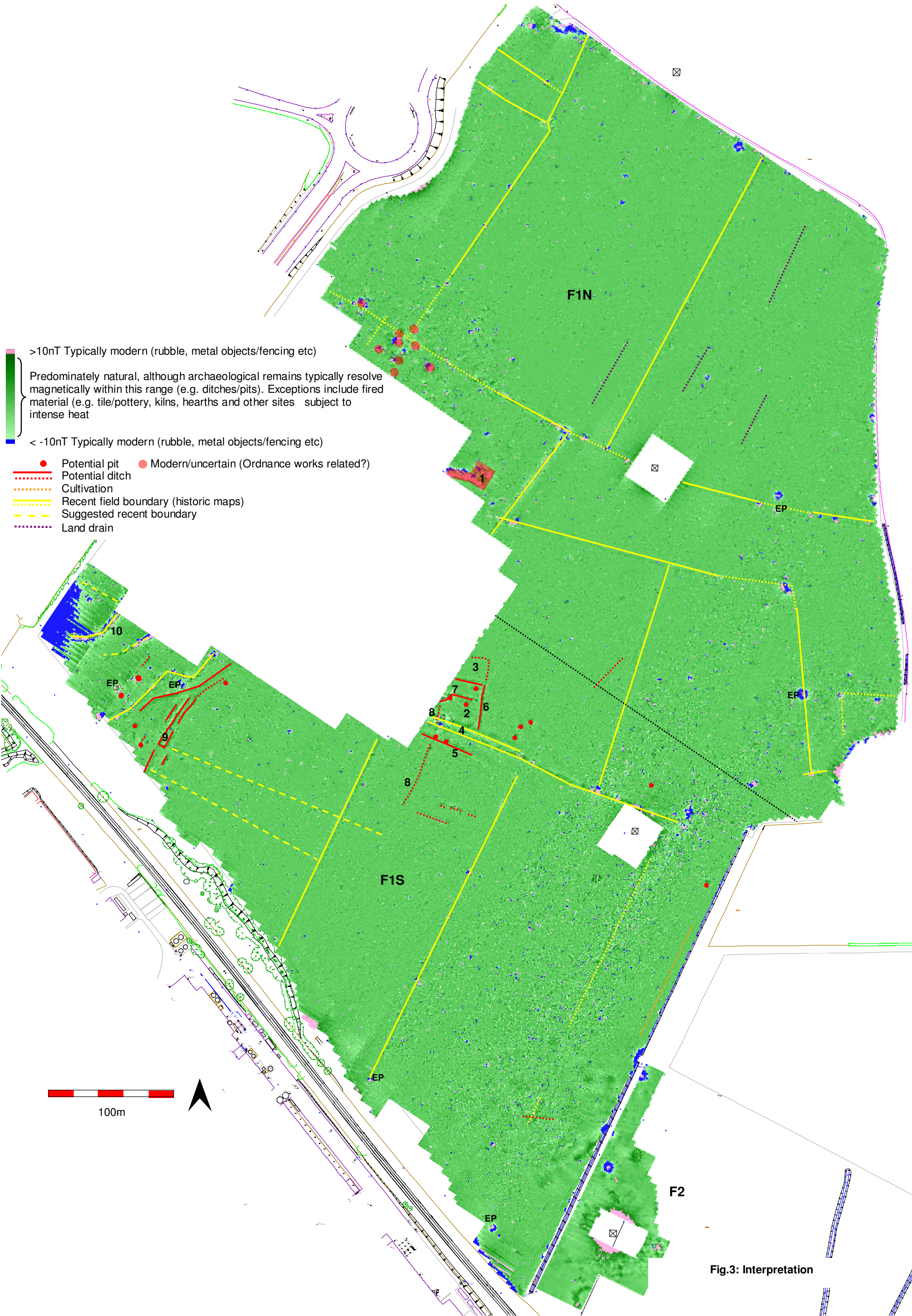


Fig.3: Interpretation

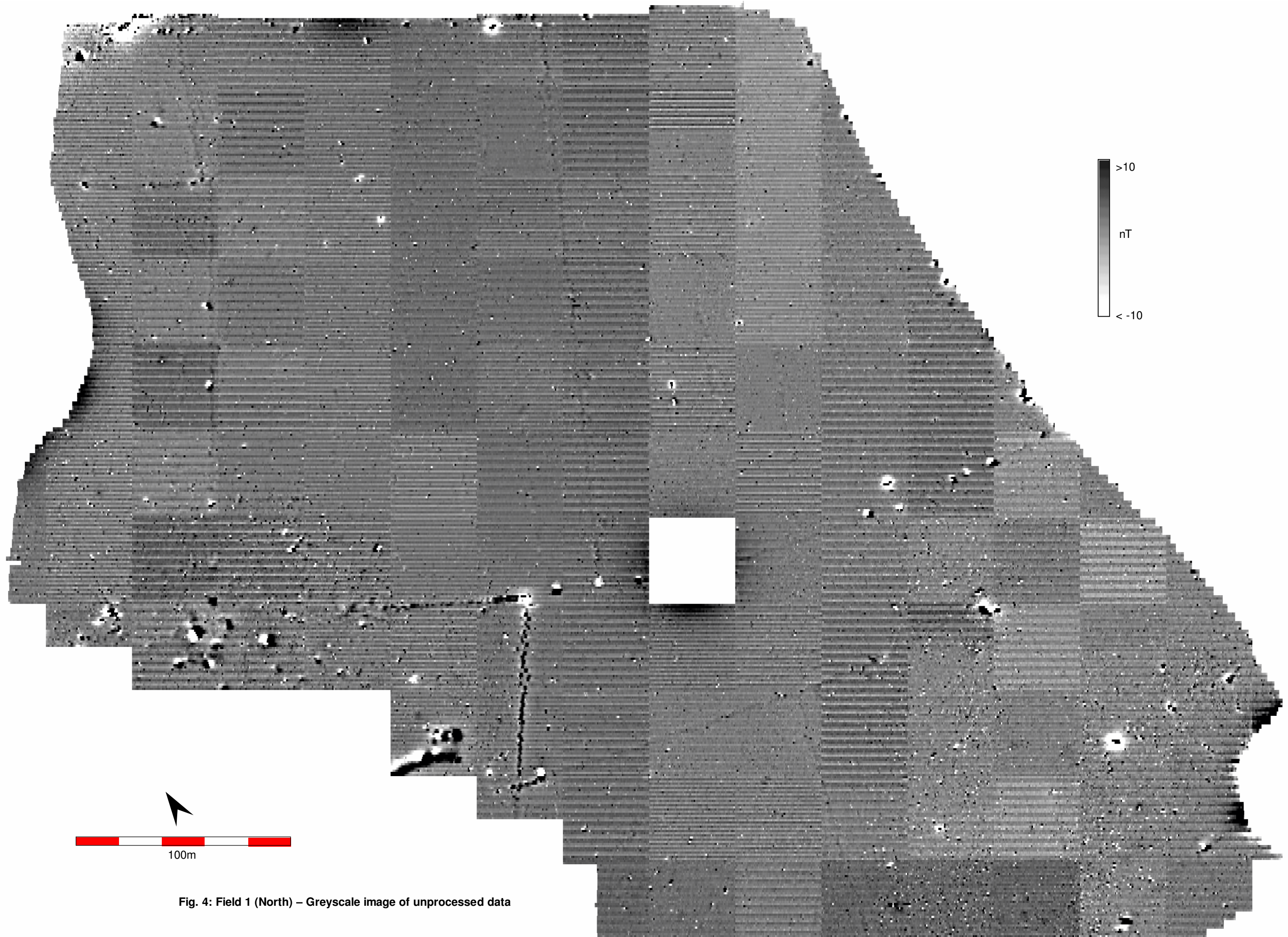
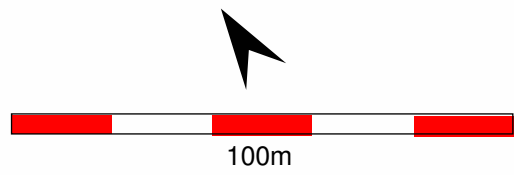
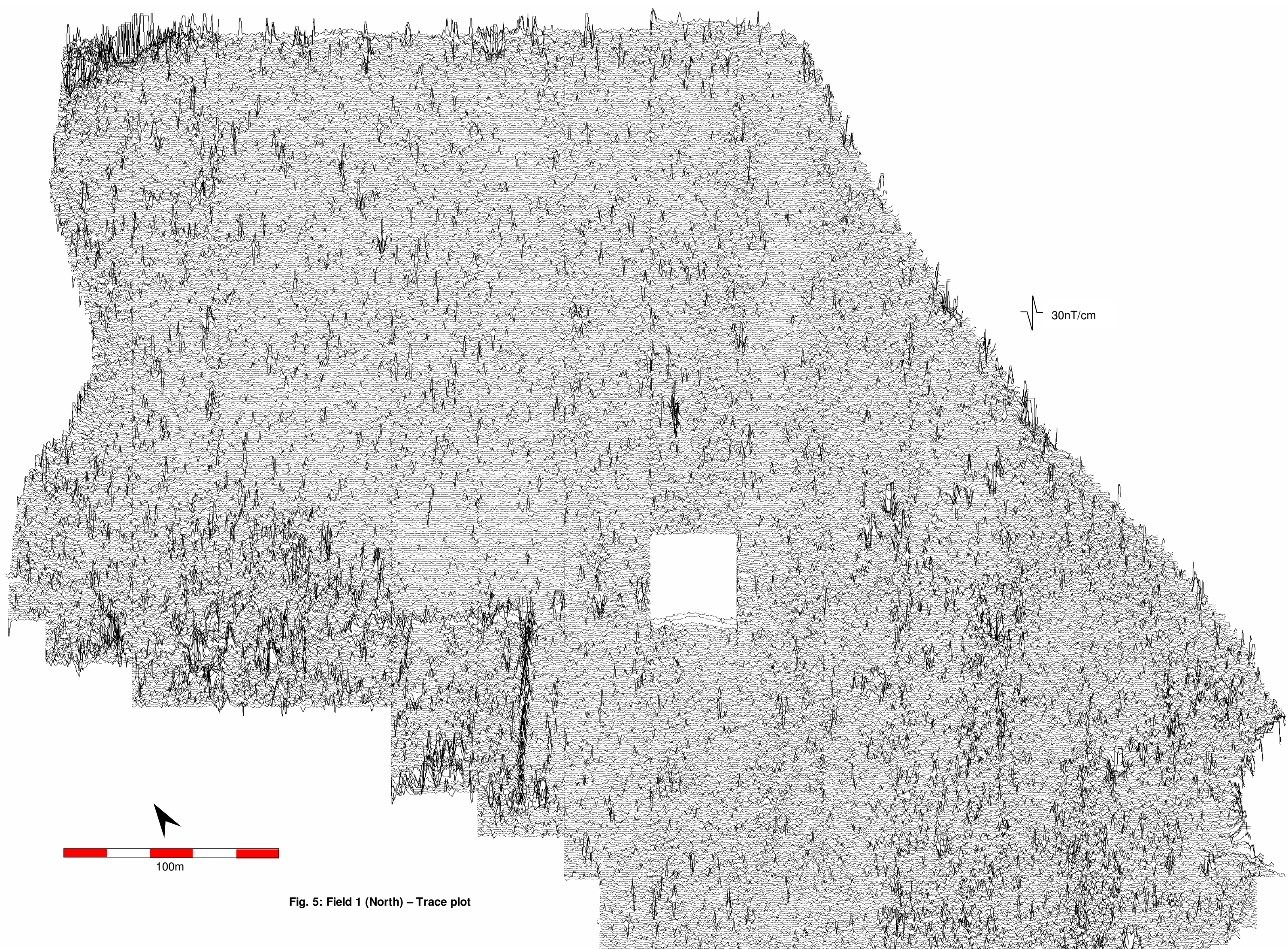


Fig. 4: Field 1 (North) – Greyscale image of unprocessed data



30nT/cm

Fig. 5: Field 1 (North) – Trace plot

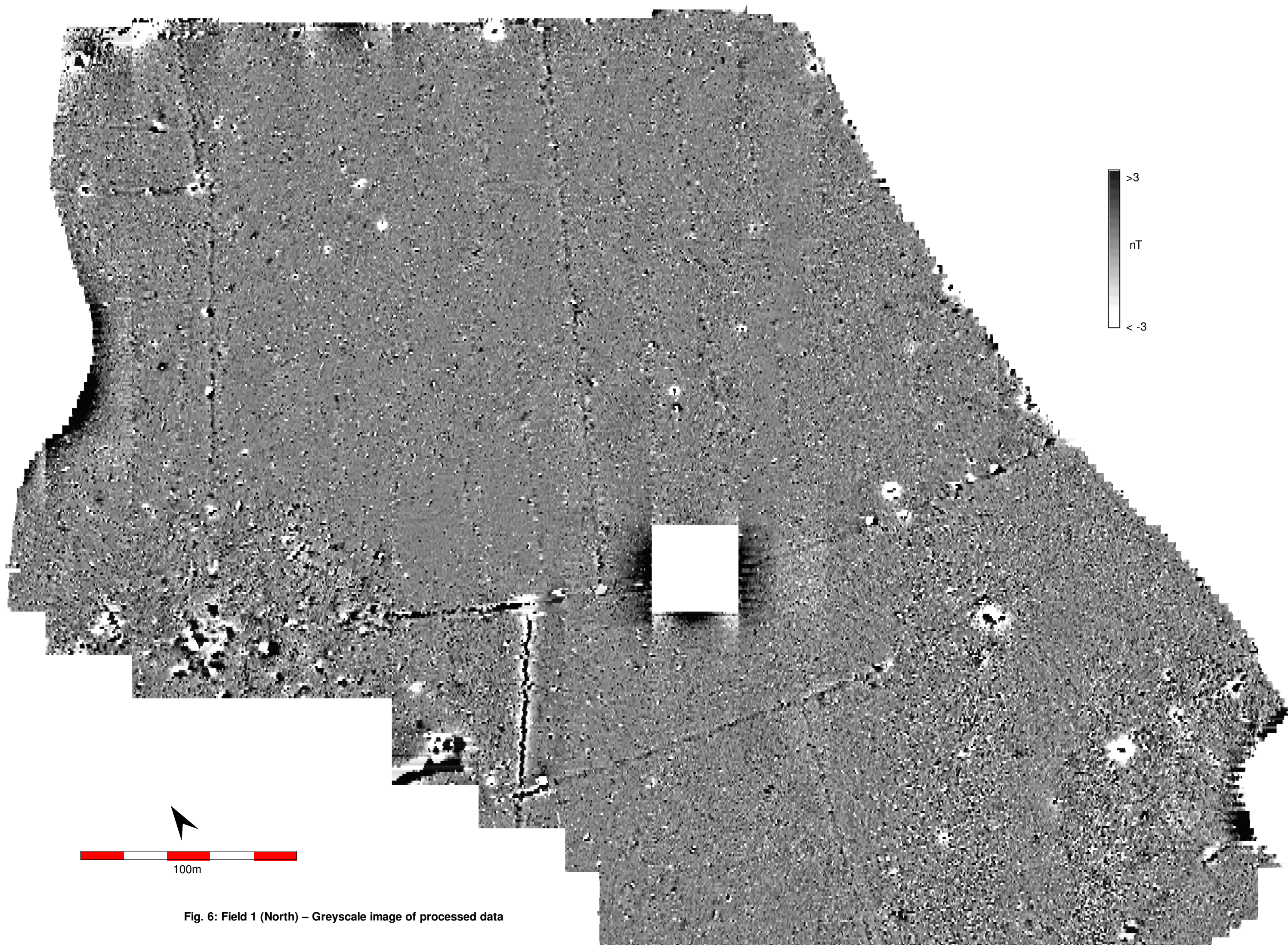


Fig. 6: Field 1 (North) – Greyscale image of processed data

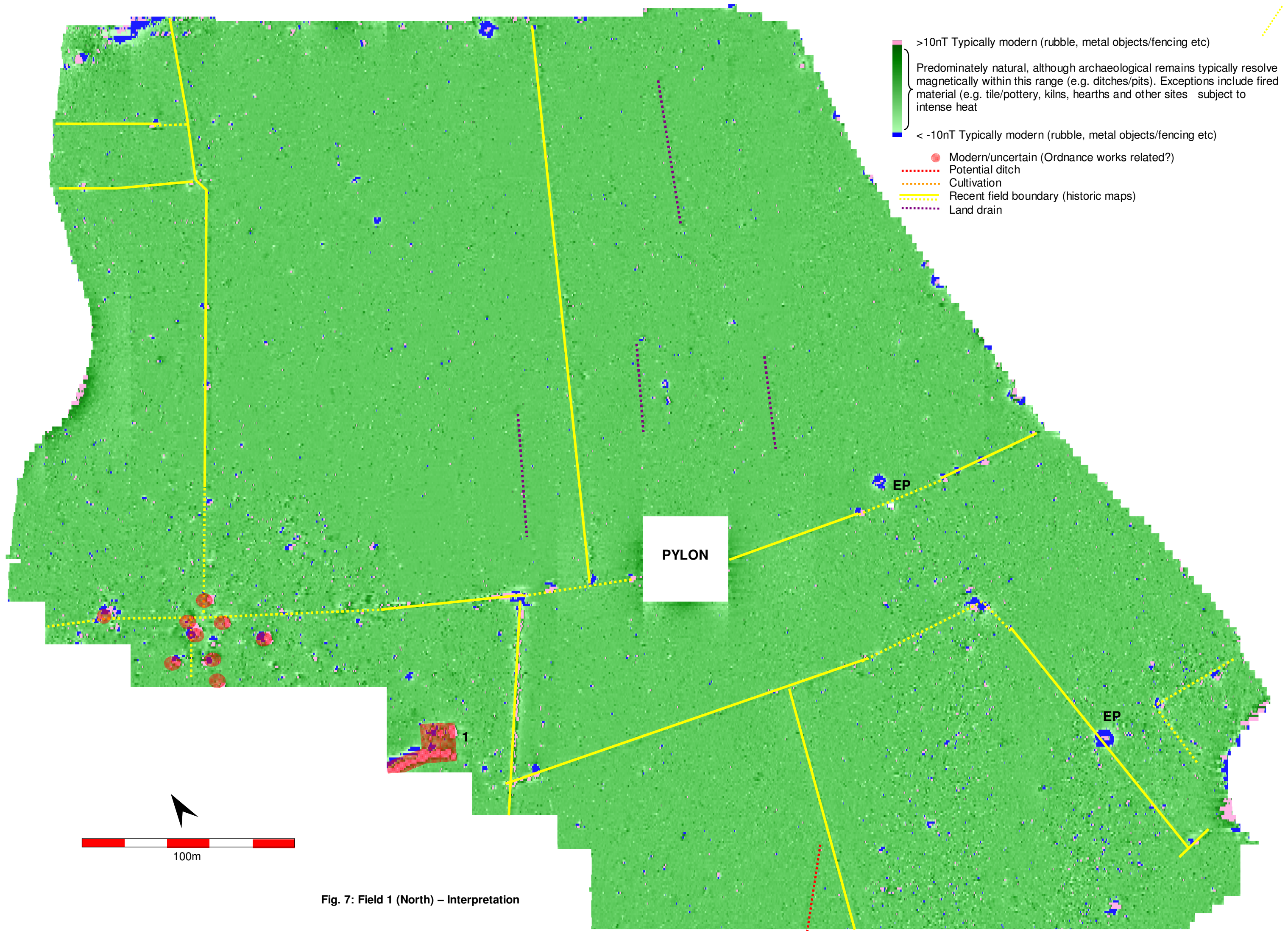


Fig. 7: Field 1 (North) – Interpretation

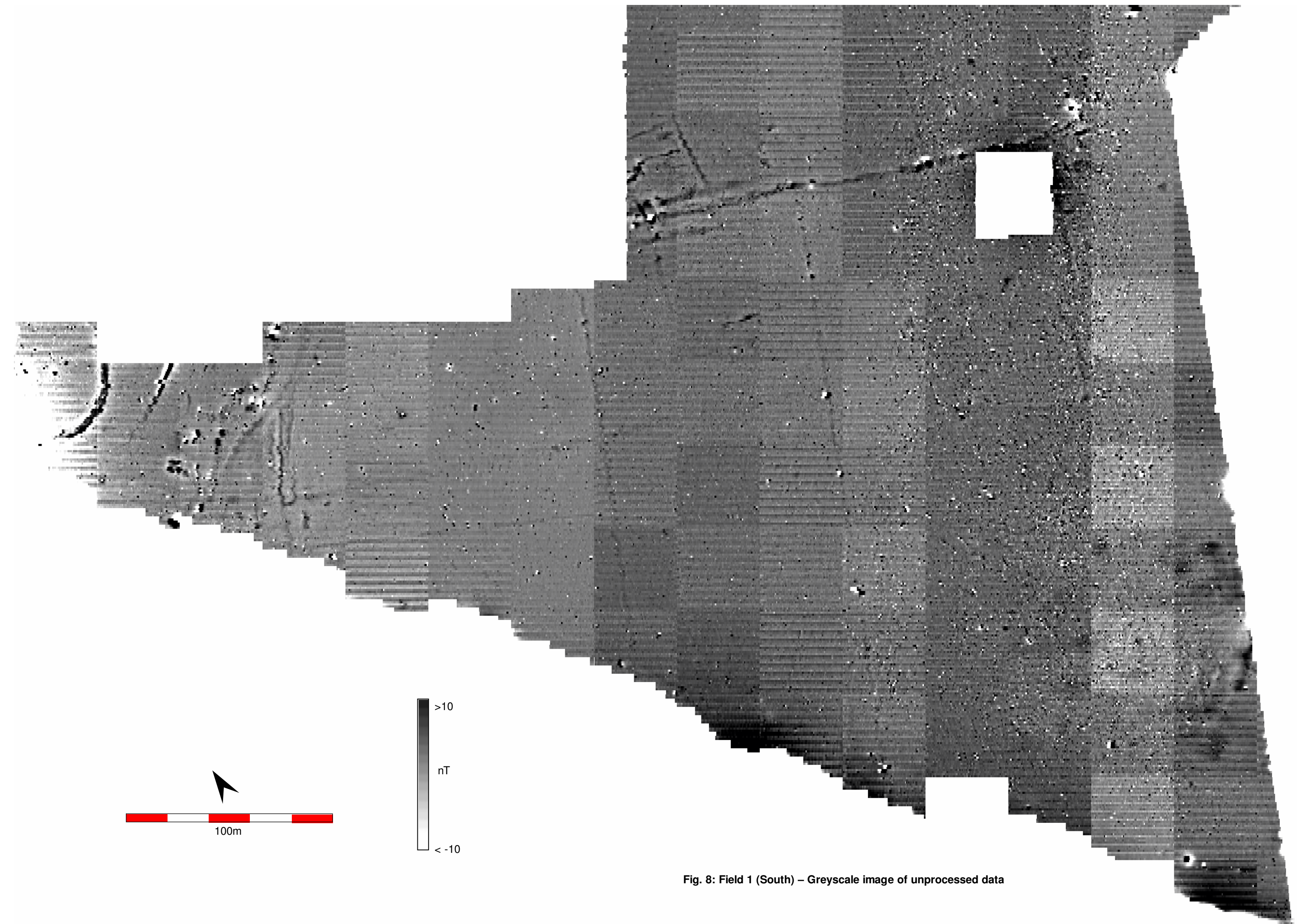


Fig. 8: Field 1 (South) – Greyscale image of unprocessed data

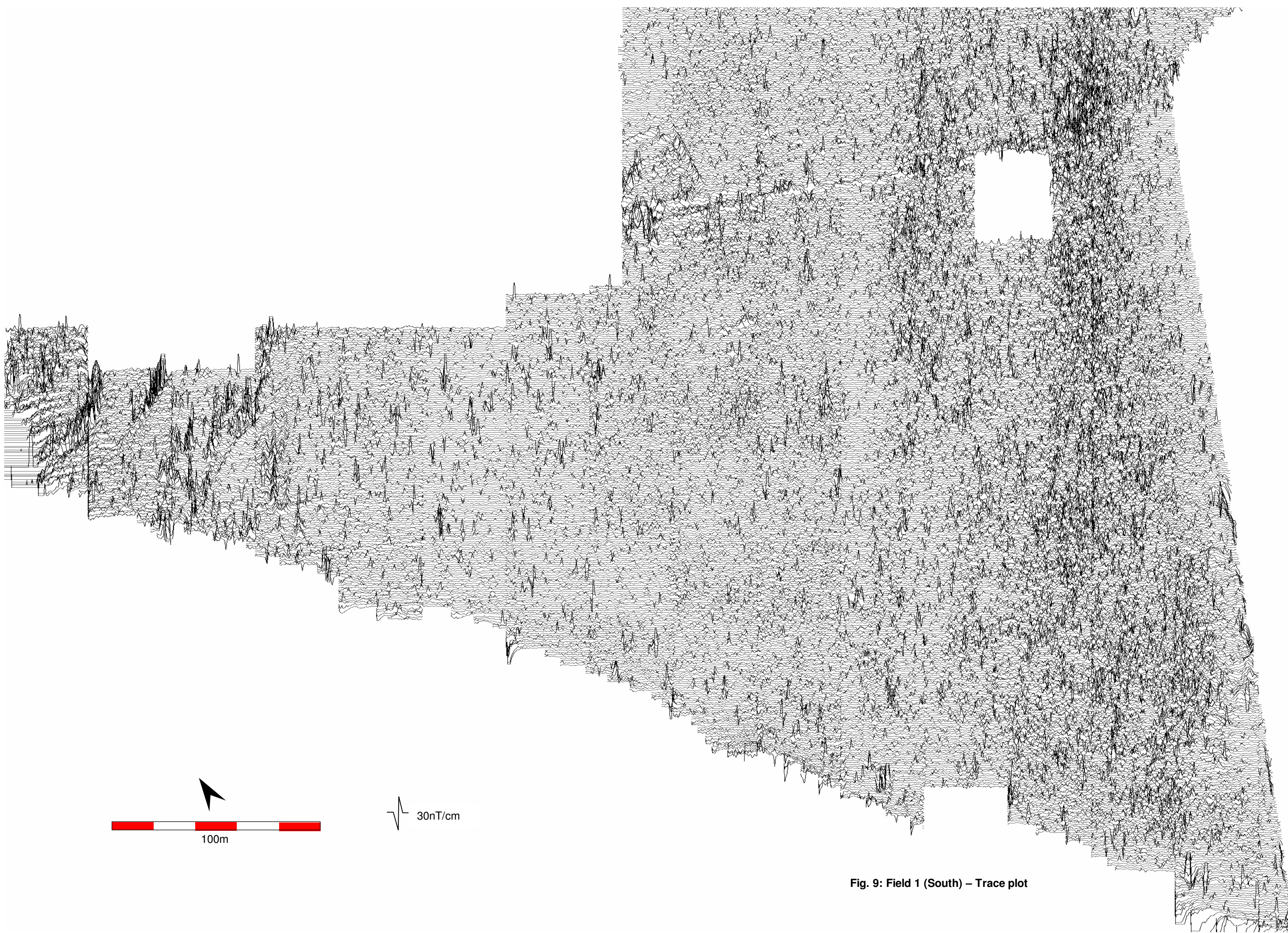


Fig. 9: Field 1 (South) – Trace plot



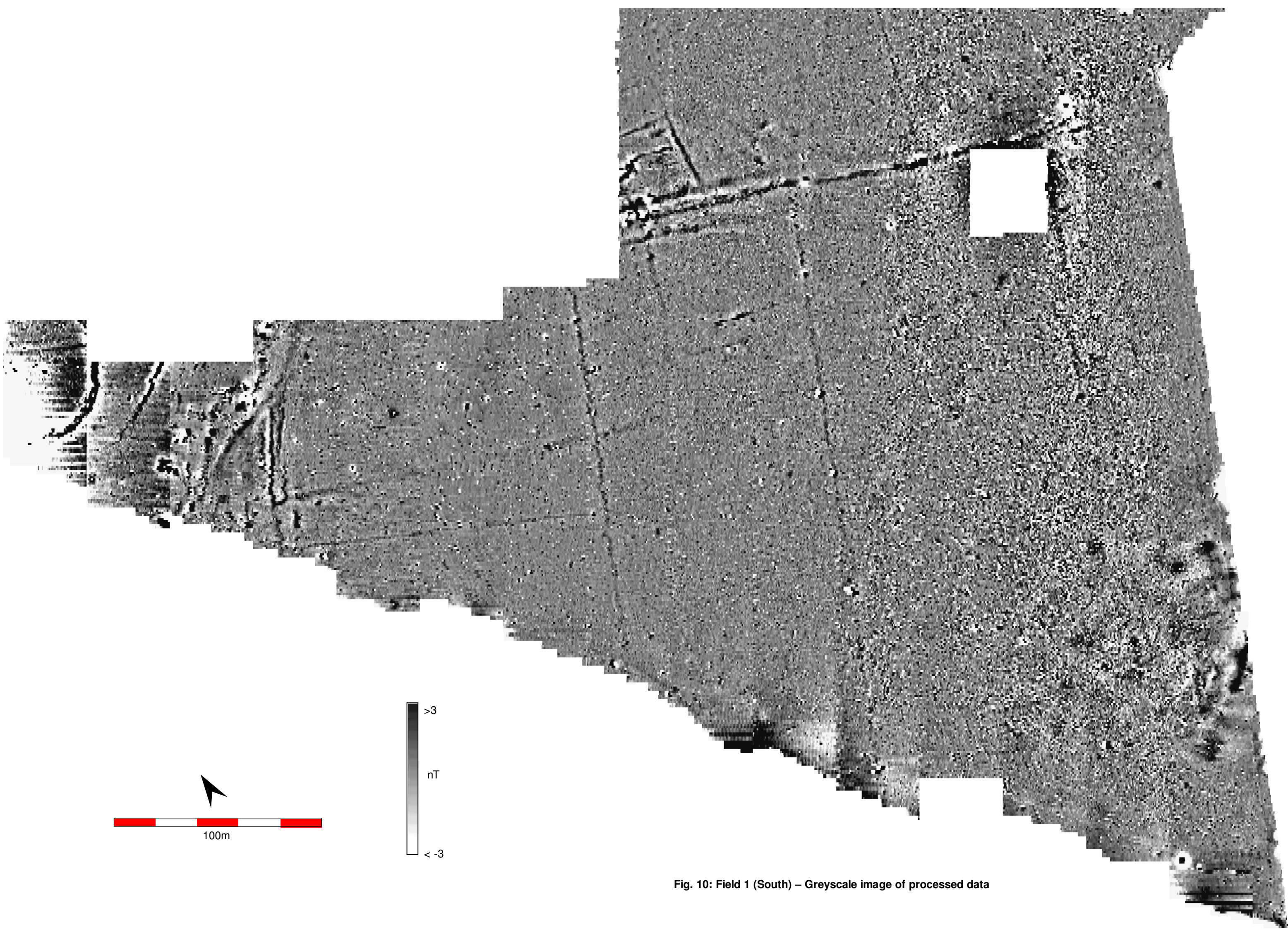


Fig. 10: Field 1 (South) – Greyscale image of processed data

- █ >10nT Typically modern (rubble, metal objects/fencing etc)
  - █ Predominately natural, although archaeological remains typically resolve magnetically within this range (e.g. ditches/pits). Exceptions include fired material (e.g. tile/pottery, kilns, hearths and other sites subject to intense heat)
  - █ < -10nT Typically modern (rubble, metal objects/fencing etc)
- Potential pit
  - - - Potential ditch
  - - - Cultivation
  - - - Recent field boundary (historic maps)
  - - - Suggested recent boundary

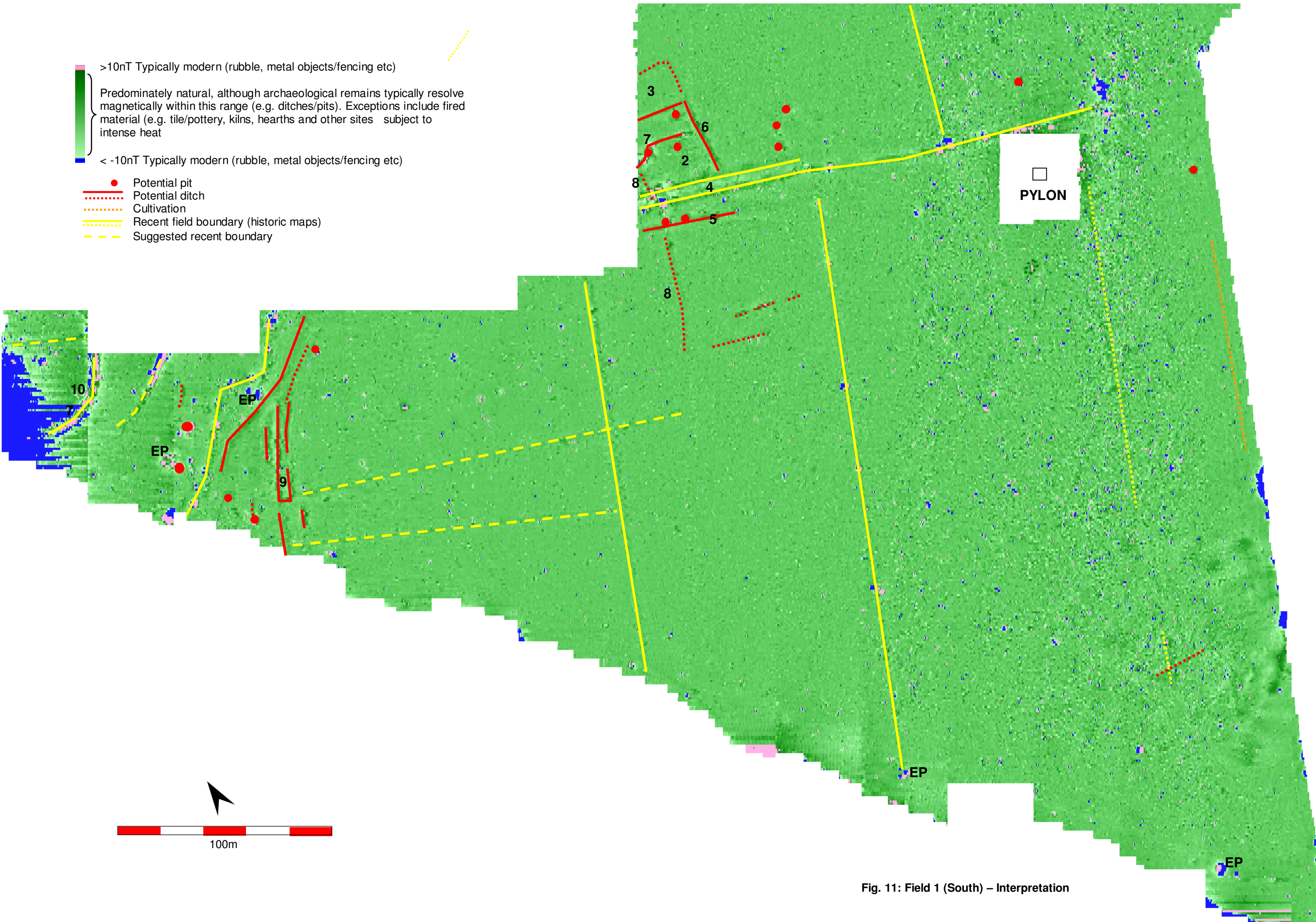


Fig. 11: Field 1 (South) – Interpretation

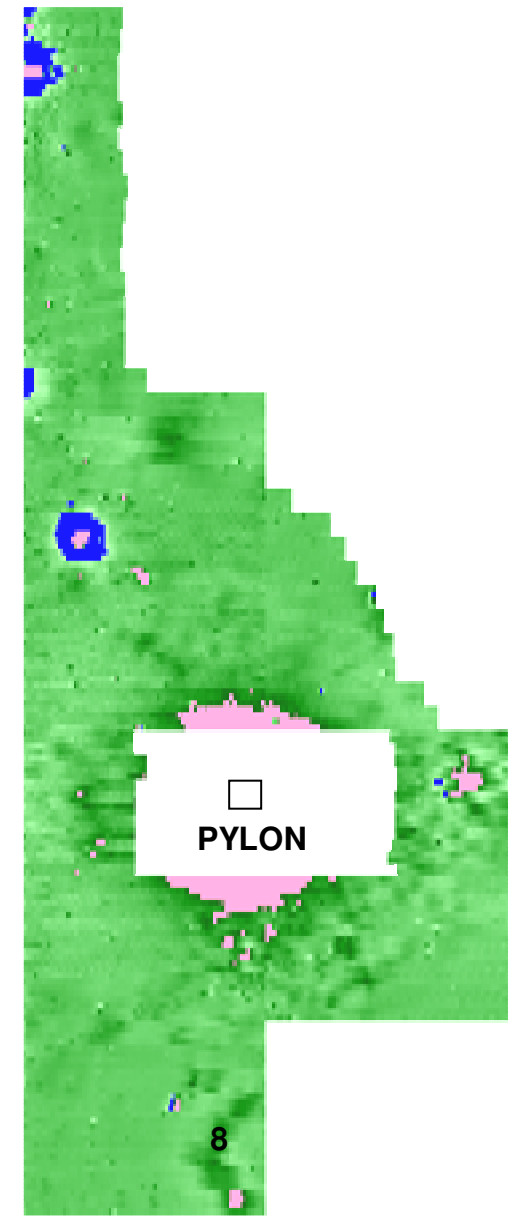
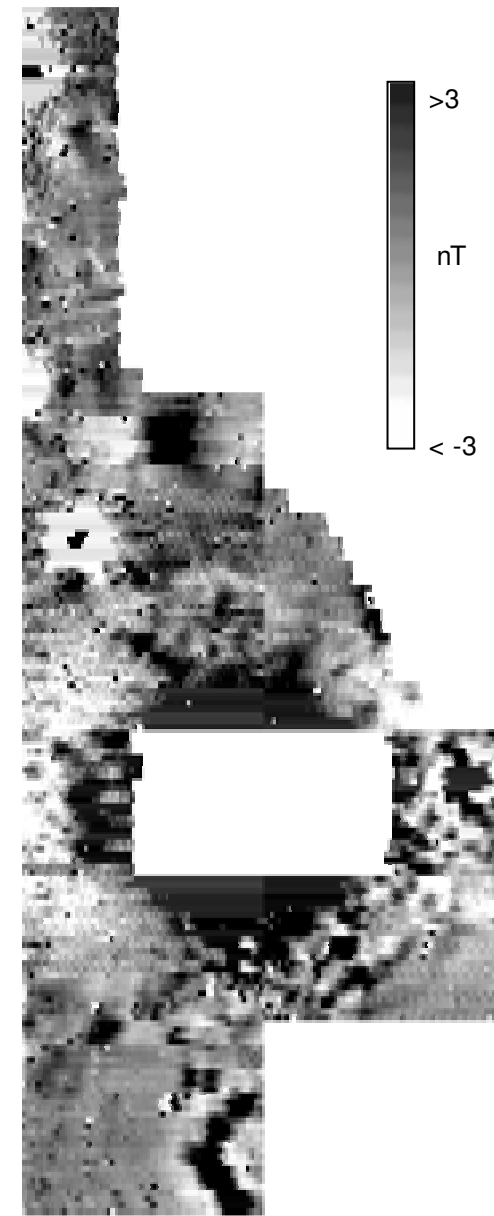
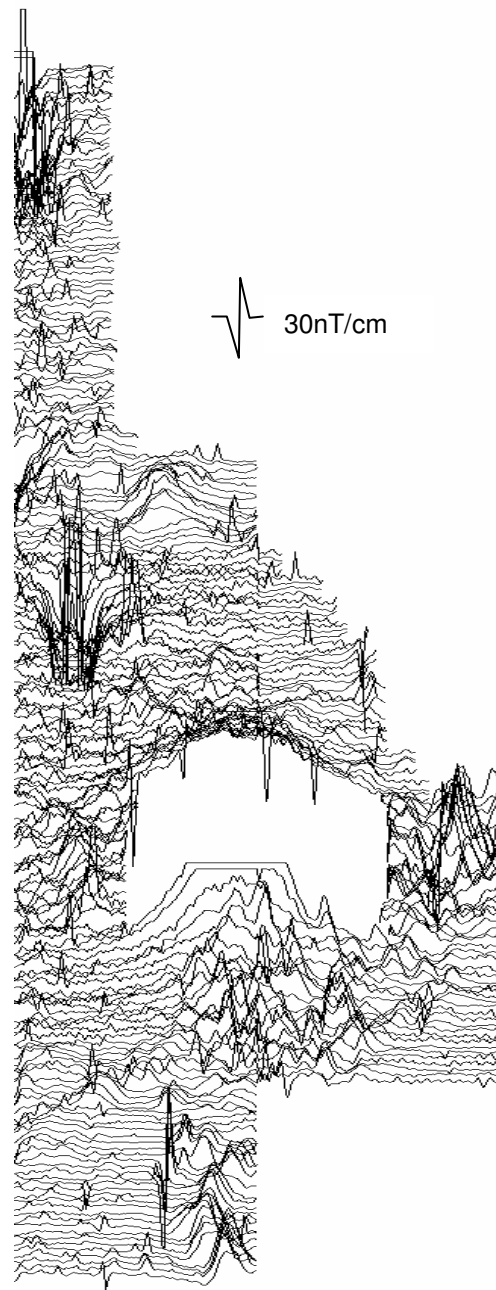
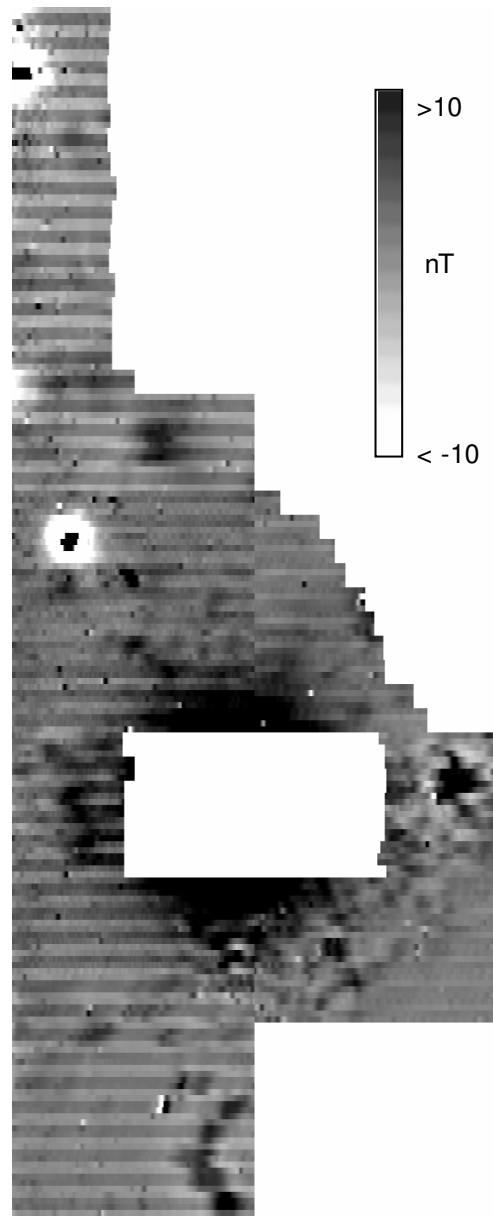
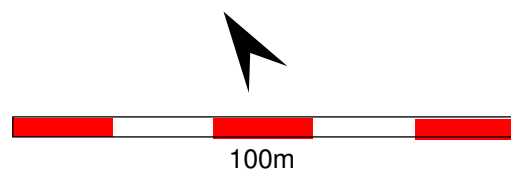


Fig. 12: Field 2 – Greyscale image of unprocessed data

Fig. 13: Field 2 – Trace plot

Fig. 14: Field 2– Greyscale image of processed data

Fig. 15: Field 2– Interpretation



APPENDIX: REPLICATED GRIDS



08/08/14



11/08/14



12/08/14



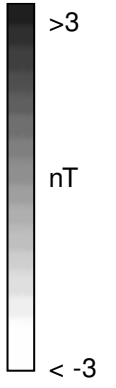
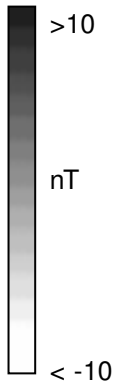
13/08/14



14/08/14



15/08/14



Greyscale images of unprocessed data

Greyscale images of processed data

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