# Decoding the Bakewell Crosses

## A Geophysical Survey at Hassop Crossroads, Near Bakewell, Derbyshire


Processed geophysical survey with OS map and photograph of study area

**ARS Ltd Report 2012/32**
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## Contents

## List of Figures

## EXECUTIVE SUMMARY

*This report details the results of a geophysical survey undertaken in a plot of land at Hassop crossroads, near Bakewell, Derbyshire as part of the 'Decoding the Bakewell Crosses' project. This is a community heritage project funded by the Heritage Lottery Fund and undertaken by a partnership of the Bakewell Parochial Church Council, Bakewell and District Historical Society and Archaeological Research Services Ltd.*

*The geophysical survey, as well as an analytical earthwork survey, follows an archaeological excavation conducted around the early medieval high cross in the churchyard of All Saint's Church, Bakewell, Derbyshire. The field was the focus of the investigation as documentary and cartographic evidence has demonstrated it contains the intersection of various major trackways and local legend suggests that it may have been the original location of a free-standing cross.*

*The survey revealed six different characters and classes of magnetic anomalies including likely positive linear anomalies as well as possible positive and negative linear anomalies (potentially ditches and track surfaces). Isolated high contrast anomalies (potentially pits or areas of disturbance), possible mixed anomalies and traces of ridge and furrow were also identified. These results appear to demonstrate the confluence of a number of different trackways and various enclosures. Two of these trackways are relatively coincidental with those known from the 1810 Enclosure Award map though with a south-west aligned trackway, observable as extant earthworks, absent from the geophysical survey. There are at least two reasonably well-defined roughly rectilinear enclosures to the west of the probable trackway, the larger of which appears to have ephemeral internal features, and an anomaly which can indicate industrial activity. Ridge and furrow observed as ephemeral extant remains during the earthwork survey has been confirmed by the geophysics results, principally towards the western end of the field.*

# 1 INTRODUCTION

## 1.1 Background

1.1.1 This report details the results of a geophysical survey undertaken by Archaeological Research Services Ltd (ARS Ltd) in April 2012. The survey was conducted in a plot of land immediately to the south-west of the A6020/B6001 roundabout, Derbyshire (SK 21707 70660) (Fig 1). The survey covered 3.25 hectares in 39 30m x 30m grids. The project also included participation by volunteers and training in archaeological investigation and field skills.

1.1.2 Both the geophysical and analytical earthwork survey are elements of the 'Decoding the Bakewell Crosses' project funded by the Heritage Lottery Fund. These non-intrusive surveys follow an archaeological excavation which was undertaken around the early medieval cross shaft in the churchyard of All Saint's Church, Bakewell, Derbyshire (Mora-Ottomano 2012). One of the aims of the project was to determine if the churchyard was the original site of the cross shaft. The excavation concluded that the cross was in fact moved to the churchyard from the site at which it was originally erected.

1.1.3 This particular field was the focus of the investigation as it is believed to have once been the intersection of various major trackways and according to the antiquarian William Wood, may have been the original location of a cross shaft (Hall and Taylor 2012). Extant earthworks towards the eastern limit of the field are thought to represent the former road network and junction described by Wood (Fig. 2). The visible features certainly correspond with at least two roads which are illustrated on the 1810 Enclosure Award map for Holme which go towards validating Wood's suggestion (Fig. 3). The geophysical survey, in conjunction with the analytical landscape survey, was therefore conducted to establish possible locations where a cross base may have been positioned. The survey will lead into a programme of targeted archaeological excavation utilising data from both non-intrusive surveys.

1.1.4 The lead partner on this project is the PCC of Bakewell Church supported by Bakewell and District Historical Society, Archaeological Research Services Ltd and the Peak District National Park Authority (PDNPA).

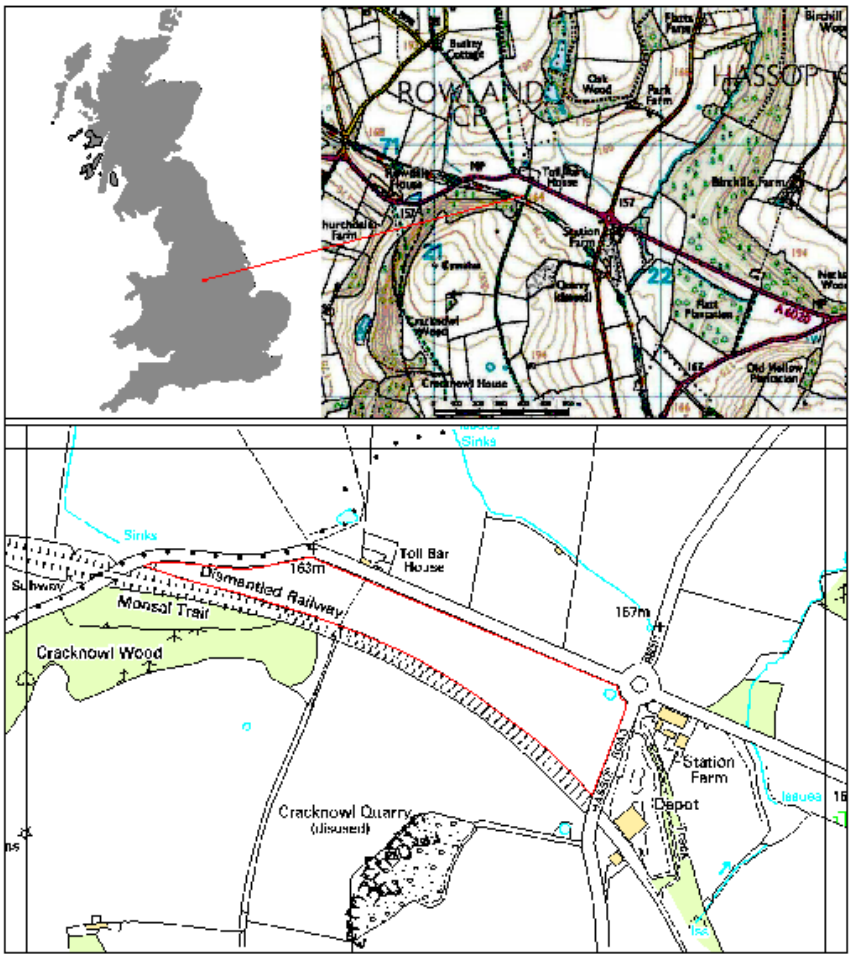


Figure 1: Site location

## 1.2 Location, Geology and Topography

1.2.1 Roads to the north and the east of the field as well as the defunct railway to the south (now part of the Monsal Trail foot and cycle path) have shaped the modern field into an irregular shape. The field is oriented north-west to south-east and gradually becomes narrower towards the west. Intrusive agricultural activity does not appear to have been on-going in the field, at least since the adoption of mechanisation, and it seems to have only been used for grazing in recent history.

1.2.2 The solid geology of the lower reaches of the valley is the Bowland shale formation which formed over 300 million years ago (bgs.ac.uk/opengeoscience). The field is on a boundary between Diamicton till and alluvial clay silt and sand.

1.2.3 Situated at approximately 160m AOD, the field has a noticeable slope from the south to the lower part of the field at the north where the A6020 follows the valley bottom. The highest part of the field is a barely perceptible ridge which progresses from Toll Bar House and across to the disused railway line. The most noticeable undulations in the field are towards the east where the earthworks are clearly visible.

1.2.4 At times the field becomes quite narrow with metallic fencing and roads encroaching into the survey grids. Preventative measures intended to keep clear from fences and passing

heavy good vehicles, which would skew the survey, have resulted in an almost straight line delineating the northern edge of the survey area.

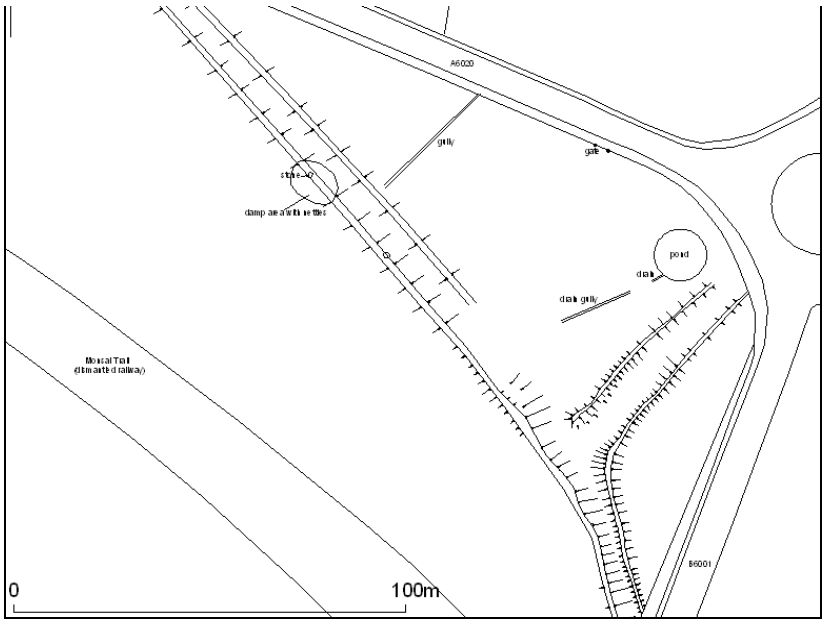


Figure 2: Plan of earthworks in the eastern part of the field

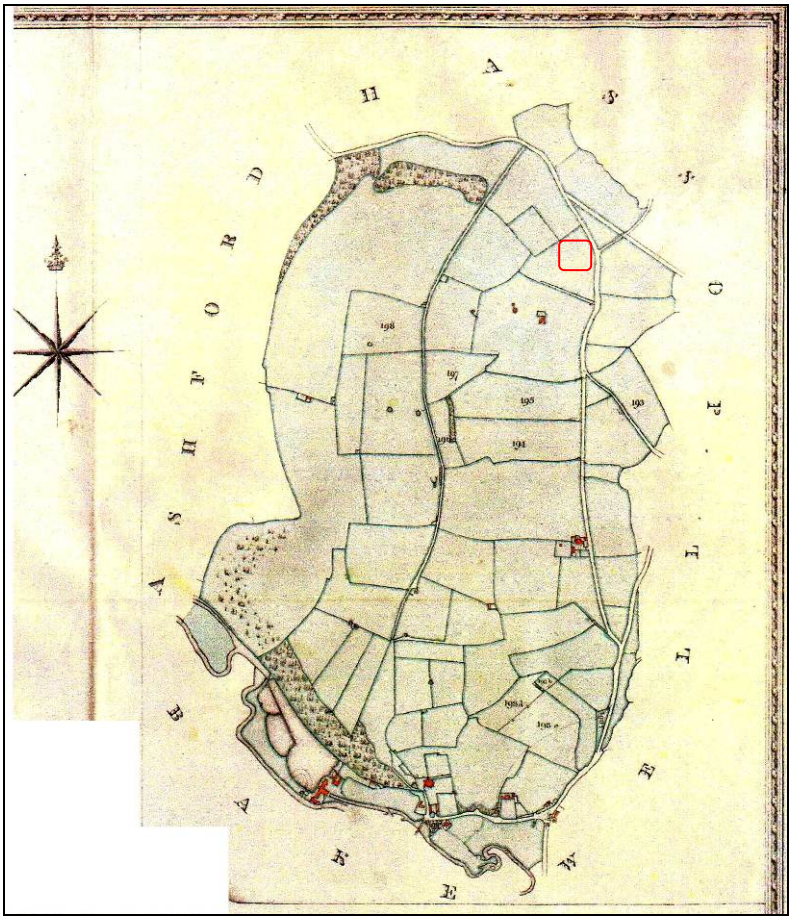

Figure 3: 1810 Enclosure Award map

# 2. METHODOLOGY

## 2.1 Geophysical Survey

2.1.1 Magnetometry, using fluxgate gradiometer instruments, is the preferred geophysical technique utilised for the detection of buried features such as iron-based features and objects, or those subjected to firing such as kilns, hearths and even the buried remains of brick walls. It is also used to locate more subtle features such as boundary or enclosure ditches, pits and post holes which have been gradually in-filled by more humic material. The breakdown of organic matter through microbiotic activity leads to the humic material becoming rich in magnetic iron oxides when compared with the subsoil allowing features to be detected. In addition to this, variations in the magnetic susceptibility between the topsoil, subsoil and bedrock have a localised effect on the Earth's magnetic field enabling the detection of features such as backfilled ditches or pits due to the fact that the top soil has more magnetic properties than the sub-soil or bedrock, resulting in a 'positive' magnetic anomaly. Conversely, earthwork or embankment features can also be identified as 'negative' magnetic anomalies due to the action of placing less magnetic subsoil on top of more magnetic top soil.

2.1.2 The strength of the present magnetic field in the United Kingdom is approximately 50,000nT (nanotesla) and most buried archaeological features usually result in very weak changes of less than 1nT to the magnetic field. However, changes as low as 0.03nT can be detected by using a fluxgate gradiometer such as the Bartington Grad 601.

2.1.3 The Instrument used in this survey was a Bartington Grad 601-2 two sensor fluxgate gradiometer which has a typical depth penetration of approximately 0.5m-1m (however this would increase with stronger magnetic anomalies). The instrument has two sensor tubes mounted 1m apart and two fluxgate magnetometers are contained within each tube at 1m vertical separation. By having two sensors positioned one vertically above the other; the gradiometer can measure the earth's magnetic field with the top sensor while at the same time the lower sensor measures the same magnetic field but is affected by any buried feature that is closer to it. By removing the first reading from the second it is possible to detect the anomaly caused by the buried feature.

2.1.4 Each of the areas was divided into 30mx30m grid squares (Fig 4), each grid being surveyed at 1m traverse intervals with the sampling at 0.125m intervals equating to 7200 samples in a full grid. The survey was carried out in 'zigzag' mode with precautions to minimise heading error on site. The range of the instrument was set at 100nT (0.01nT resolution). A total of 39 grids, 29 of which were complete with the remaining 10 being partial, were surveyed across the study area totalling 3.25 hectares (see Fig 3).

2.1.5 The survey was carried out in April 2012. The weather during the survey ranged between reasonable mild conditions with clear skies to persistent heavy rain storms. The same grid which was established for the topographic survey was extended and utilised for the geophysical survey.

2.1.6 The data were captured in the internal memory and then downloaded into a computer and archived on the ARS Ltd server. The data were downloaded using Bartington Instruments' *Grad 601 Communication Application* and processed using the DW Consulting ArchaeoSurveyor software. The data were minimally processed to remove any instrument error or survey effects in order to enhance any more subtle anomalies associated with archaeological features.

2.1.7 The data are presented as plots of raw data both a grey-scale plot (Fig 5) and a trace plot (Fig 6), together with a grey-scale plot of the processed data (Fig 7). The processed data has been clipped at a maximum of +5 and -5 absolute units and the palette used was grey99.ptt. Magnetic anomalies have been identified and presented separately on an interpretation of anomalies plots (Figs 7-8).

# 3 GEOPHYSICAL SURVEY RESULTS

## 3.1 Introduction

3.1.1 The geophysical survey has identified a number of anomalies which are illustrated on figures 5-11. The anomalies will be discussed in turn in the following section by numeric identifier. An overall plot of the numbered and interpreted anomalies is provided on figures 8-11.

## 3.2 Anomalies

3.2.1 The survey revealed six different characters and classes of anomalies including likely positive linear anomalies as well as possible positive and negative linear anomalies (probably banked areas and boundary ditches). Isolated high contrast anomalies, possible mixed anomalies (discrete features such as pits etc) and traces of ridge and furrow were also identified.

*Linear anomalies*

3.2.2 The majority of anomalies identified in the survey have been grouped in the possible positive linear class. These occur across the entire study area but noticeably in a much higher frequency towards the eastern half of the field. All of these anomalies, specifically **1**, **2**, **3**, **4**, **5**, **7**, **8**, **9**, **11**, **13**, **14**, **15**, **17**, **18**, **19**, **20**, **21**, **22**, **23**, **24**, **25**, **27**, **28**, **29**, **32**, **33**, **34**, **35**, **36**, **39** and **40** all display a positive magnetic response and share certain formalised aspects suggesting they may represent buried banks or ditches (Figs 9 and 10). The likely positive linear anomalies include **6**, **12, 16** and. These have been classed as being likely anomalies as there are earthworks which largely correspond to these features. Located to the centre of the survey, anomalies **30**, **31**, **37** and **38** demonstrate negative magnetic characteristics. These anomalies could represent anything from the remnants of a stone built wall through to shallow cut features.

3.2.3 Many of the possible positive linear anomalies appear to represent buried ditch or bank systems. With the exception of **8** and **1** the remaining possible features in the eastern part of the study area, specifically **2, 3**, **4**, **5**, the majority of **7**, **9**, **11**, **15**, **17**, and **20** are oriented either north-north-west or north-west. Interestingly, the anomalies oriented north-north westerly **2**, **3, 4**, **5**, **9** and **11**, are not only on the same alignment but are also tightly grouped suggesting possible functional homogeneity and potential contemporaneous shared use. Alternatively, each component of this section of the ditch/bank system may indicate successive events of re-organisation. If this hypothesis is correct, then aspects of the former alignment must have been partially extant to construct such formalised earthworks in such compact quarters. Arguably, the consistent 23m wide space between **3** and **5** is relatively clear and could be part of one of the trackways which is documented as being located on this site, though any track surface would have been much narrower than this. The 90 degree bend west at the northern end of **3** could represent an entranceway from the north-east onto a seperate trackway.

3.2.4 The large trackway defined by earthworks, and surveyed as part of this project (**6**), runs down the northern edge of the north-west to south-east trackway. This bank most likely represents one phase of the trackways on site, and accords most closely with the known routes depicted on the 1810 map. Due to the complexity of the linears on the geophysical survey it is

probable that the identified features represent many phases of trackway and enclosure on the site. Features such as **1**, **8**, **12**, **13**, **14**, **16** and **21** could all be different components of realignments and successive re-organisations of the landscape.

3.2.5 Both of the curving anomalies to the north of the surveyed area, **28** and **32** probably represent large ditched features. It is possible that they were once joined beneath the modern roadway, and that they form a continuation of the linear features defining the northern edge of the probable trackway (**3** and **5**).

3.2.6 When combined, anomalies **4**, **8** and **11** can form one arrangement, potentially appearing as the corner of an enclosure, or more likely different phases of linear boundaries.

3.2.7 The cluster of features to the west, **33**, **34**, **35** and **36** probably represent further banks or ditches. As they are only partially represented, it is difficult to infer what, if any, association with the other surveyed features they have.

*Potential enclosures*

3.2.8 Anomalies **18**, **19**, **23**, **24, 39** and **40** are particularly formal and appear to be enclosures, a class of archaeological feature which is commonly associated with human activities from prehistory up to the modern day (Figs 9 and 10).

3.2.9 The roughly rectilinear anomaly **19**, probably represent an enclosure and measures approximately 24m x 16m. An additional probable enclosure, represented by at least three separate anomalies, **18**, **39** and **40,** can be seen towards the centre of the surveyed area. Although the eastern limit of the enclosure can not be detected this may be deliberate. Features **22** or **25** may have been part of this enclosure system which would have created a wide, staggered entrance to the east. Contained within this possible enclosure are features **25**, **27**, **29** and **26**. Features **30** and **31** also noted above are positive linear anomalies which may represent an extended entranceway or route leading into the large rectilinear enclosure, though they cannot be ruled out as relating to the extensive ridge and furrow and later land boundaries.

*Possible high contrast anomalies*

3.2.10 The single high contrast anomaly, **26** which is located to the centre of the survey and within the probable rectilinear enclosure represented by anomalies **18**, **39** and **40**, was the only such anomaly of its type identified. The darker area surrounded by the contrasting white halo suggests that this may have been an area of industrial activity. Industrial undertakings often create debris and fired materials which leave a high contrast signature such as the one demonstrated here. The apparent circular regularity of the anomaly suggests a feature associated with industrial connotations rather than a spread or dump of post industrial process residues.

*Possible mixed anomalies*

3.2.11 Displaying no regular shape or form, the mixed anomaly to the east, **10**, may represent a spread or dump of material which could be from any period.

*Ridge and furrow*

3.2.12 There are a series of north-north-easterly aligned anomalies, collectively grouped as **41**, which repeat at relatively consistent intervals across the study area. The morphology of the remains are consistent with those of ridge and furrow and probably post-date the other anomalies identified.

## 4. CONCLUSIONS

4.1 The geophysical survey has illustrated probable multiple phases of linear boundaries and probable trackways within the confines of the field. Two of the probable trackways are relatively coincidental with those known from the 1810 Enclosure Award map and the extant earthworks surveyed as part of this project.

4.2 There are at least two reasonably well-defined, roughly rectilinear enclosures to the west of the probable trackways, the larger of which appears to have ephemeral internal features, and a high-contrast anomaly possibly indicating industrial activity. Ridge and furrow observed as ephemeral extant remains during the earthwork survey has been confirmed by the geophysics results, principally towards the western end of the field.

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## 7 ACKNOWLEDGEMENTS

7.1 Archaeological Research Services Ltd would like to thank those involved in the project for their help and advice. In particular we would like to thank the Heritage Lottery Fund for funding the investigation, the volunteers who took part in the survey (Linda, Ann Hall, Jan Stetka), Sarah Whiteley of the Peak District National Park Authority for monitoring and providing assistance throughout the project, and the fantastic support of the Parish Church, the Bakewell and District Historical Society, and the wider community within Bakewell. ARS Ltd

would also like to thank the crew of BBC Countryfile, who visited and filmed part of the investigations.

## 9 References

Hall, A. and Taylor, A. 2012. *Routeways and other landscape features in Heathcote Close.* (Unpublished report – forthcoming)

bgs.ac.uk/opengeoscience

landis.org.uk/soilscapes

## APPENDIX I: Figures

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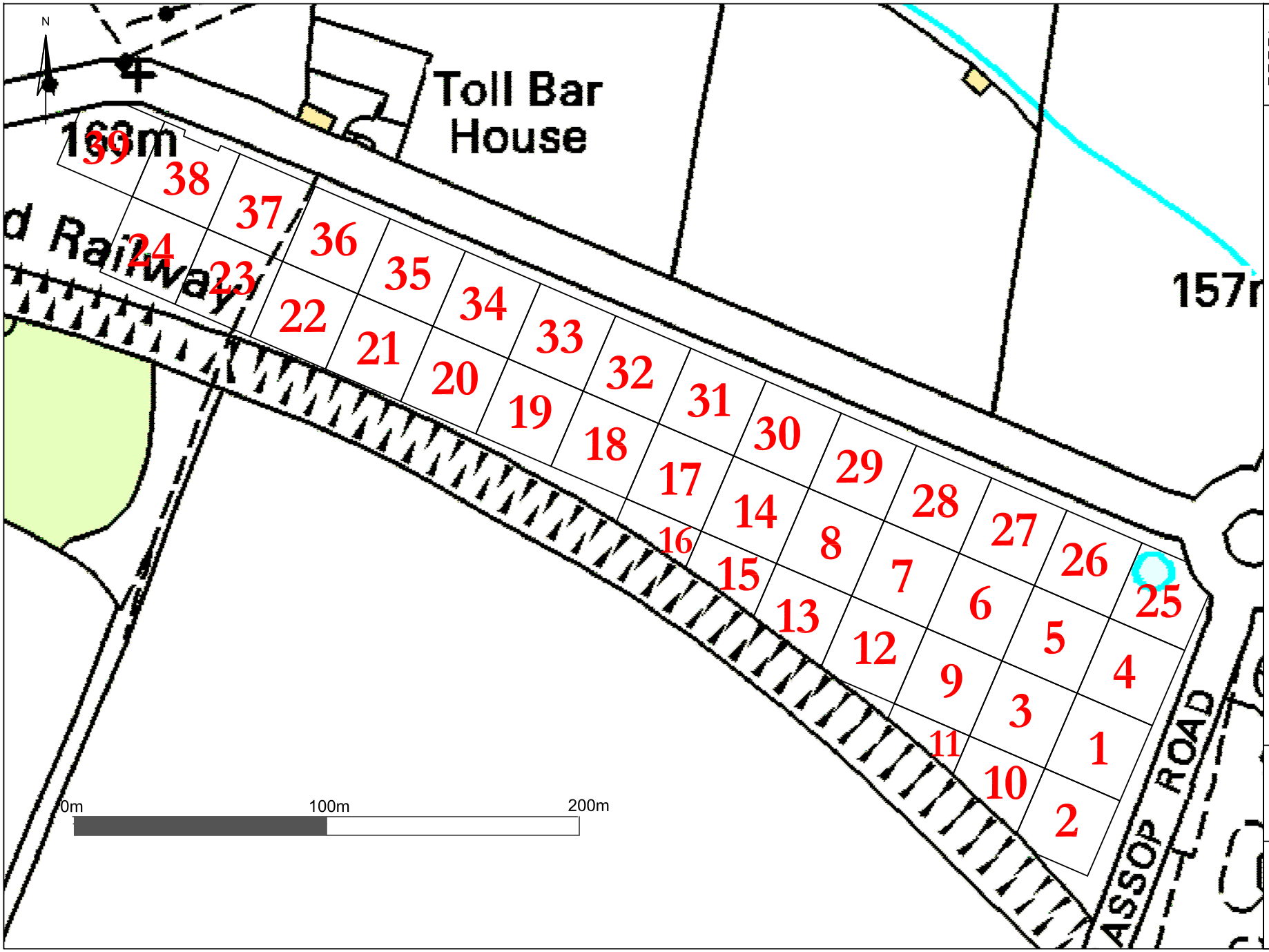


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Figure 4

Key:

Notes:

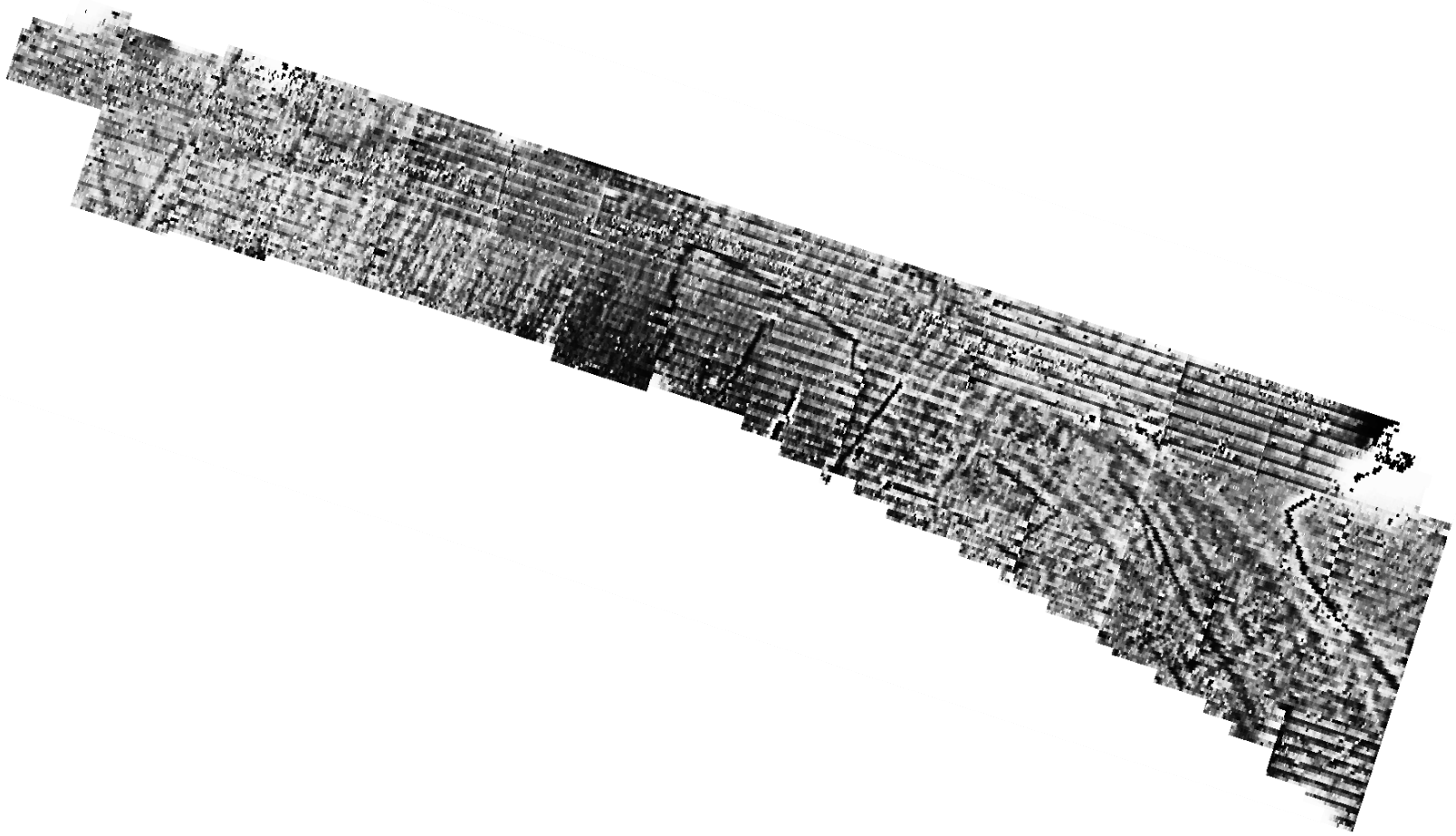

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Figure 5

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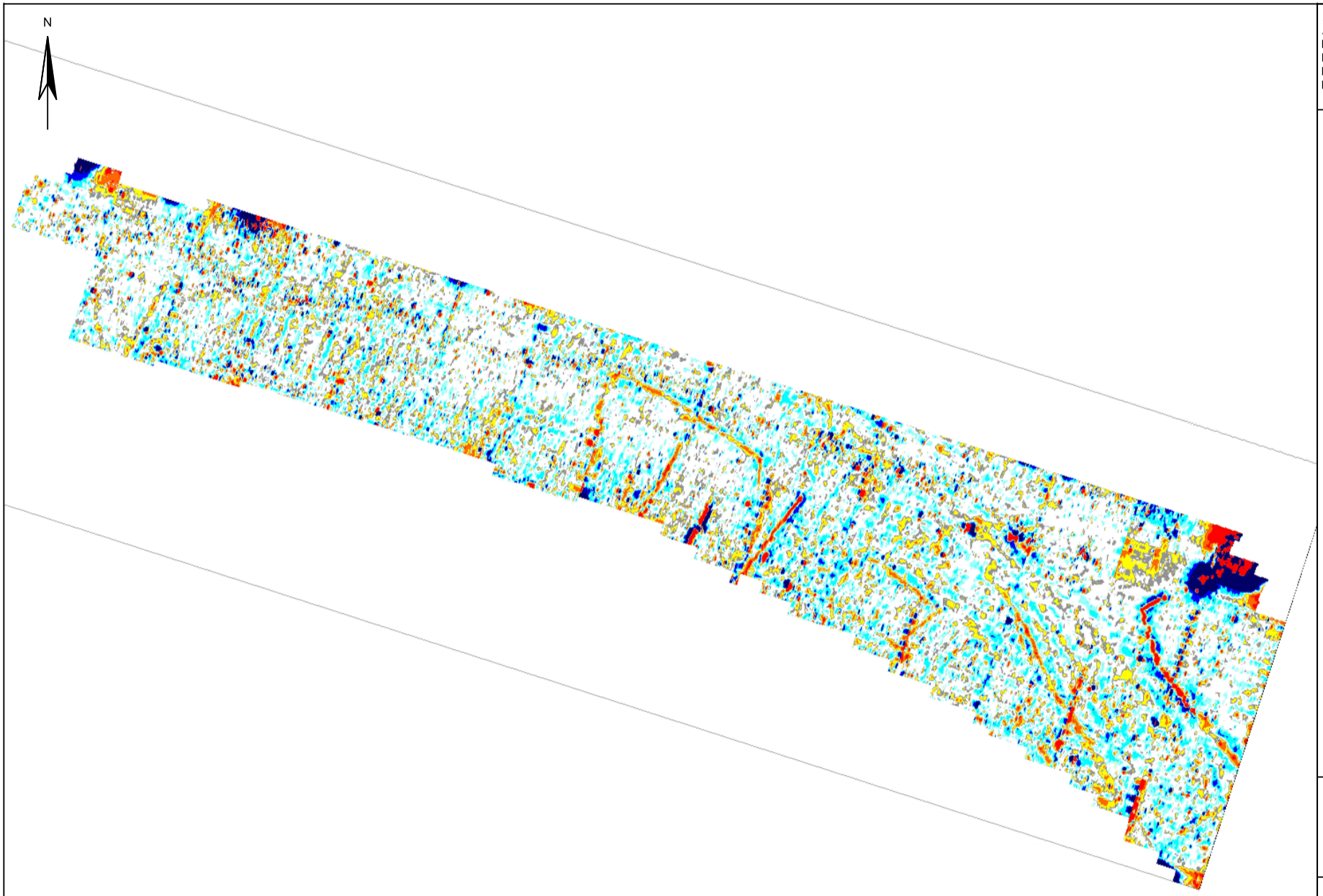


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Figure 6

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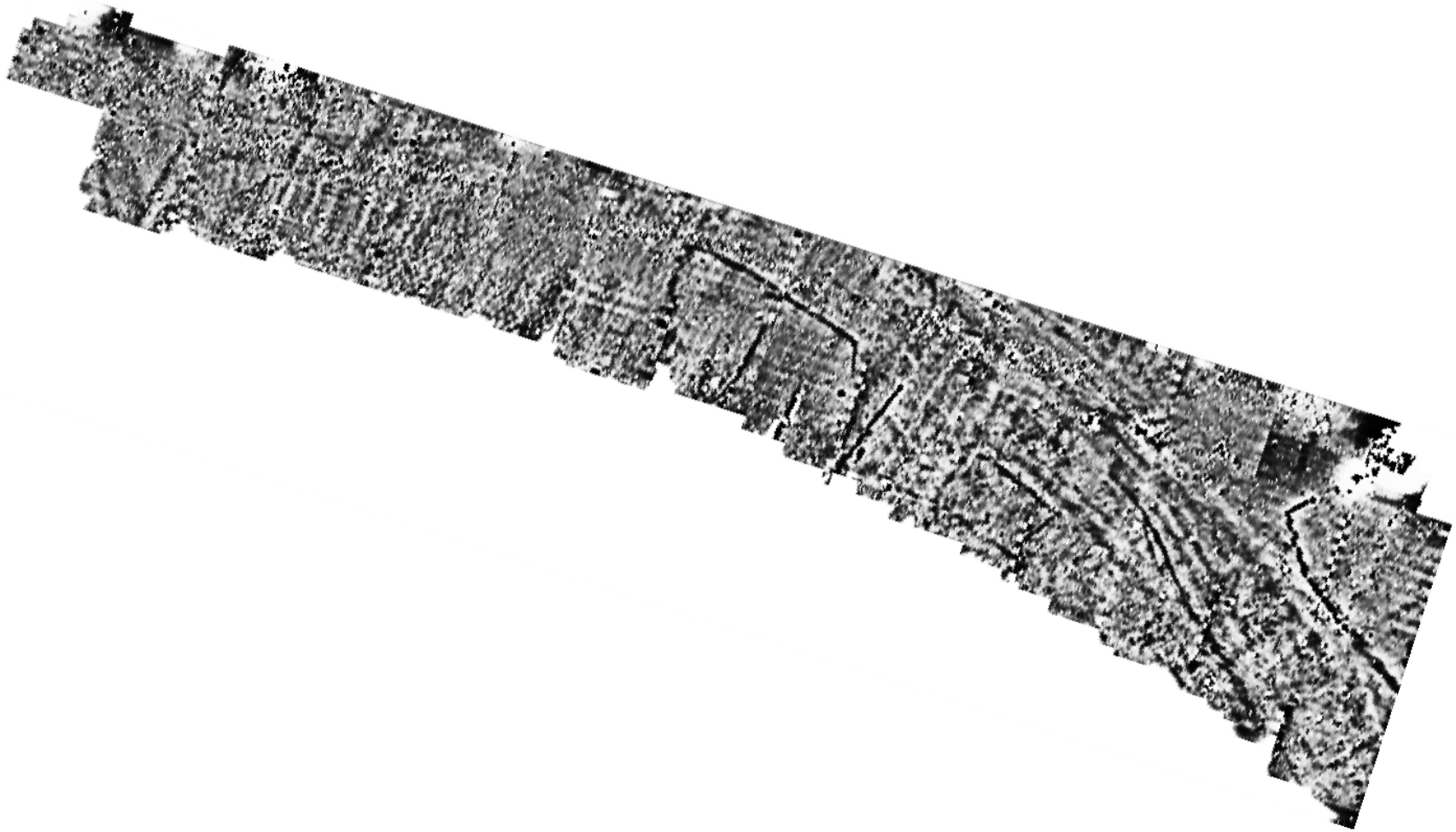

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Figure 7

Key:

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Figure 8

Key:

- Possible positive
- Likely positive
- Possible mixed
- Possible negative
- High contrast
- Repeated parallels

Notes:Interpreted data against processed data

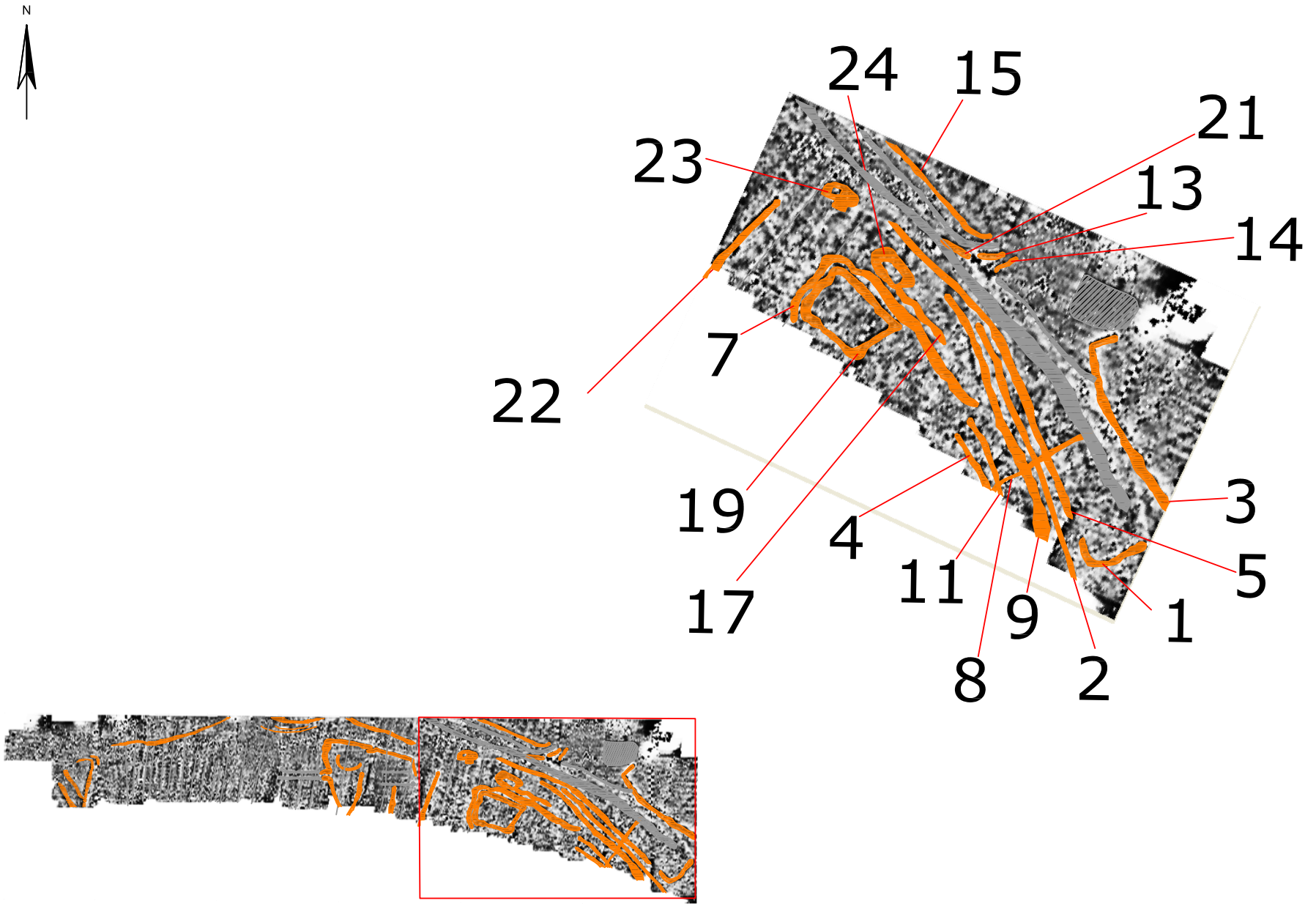


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Figure 9

Key:

Notes: Interpretation of possible positive anomalies in the eastern part of the field

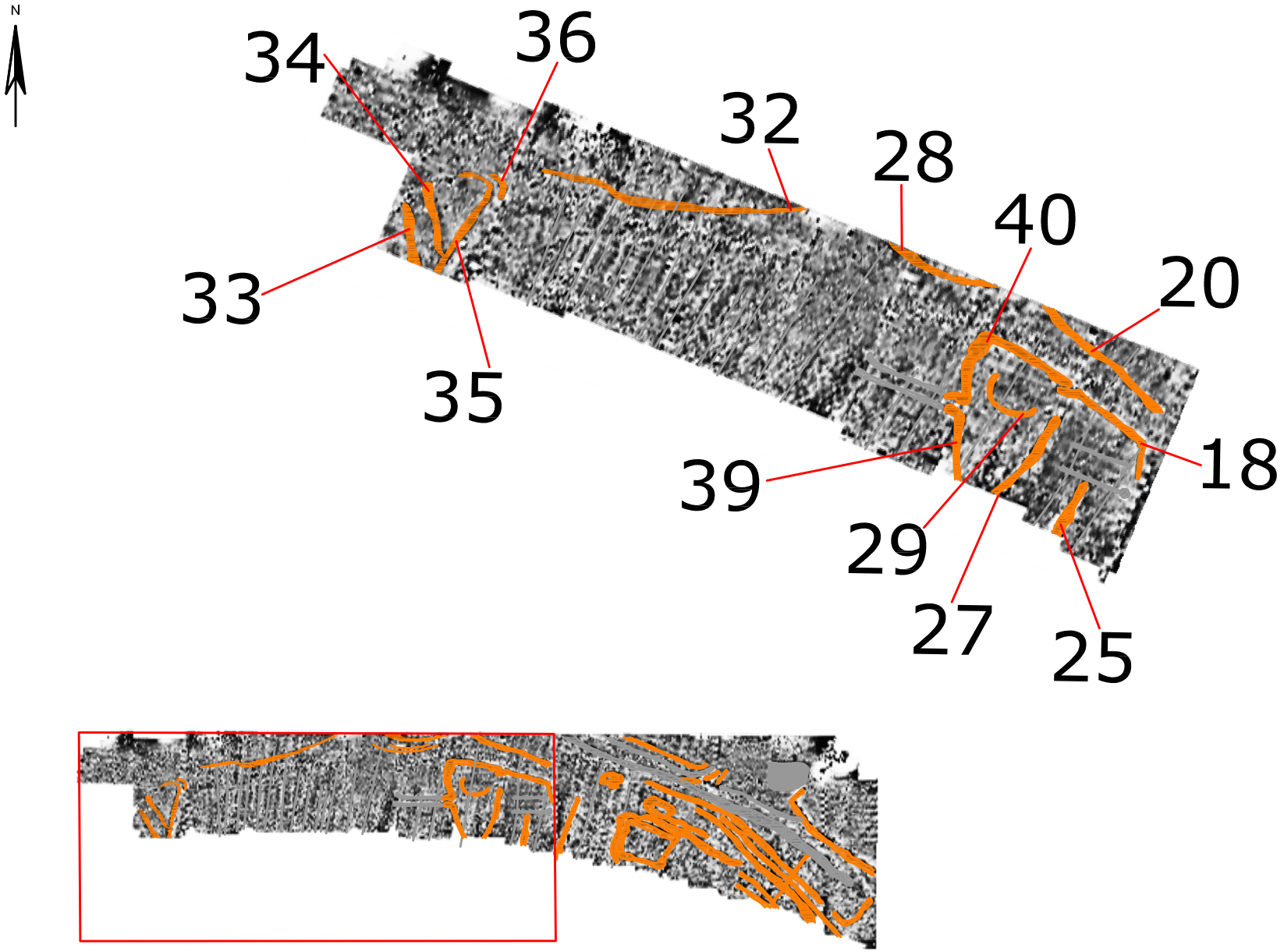


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Figure 10

Key:

Notes: Interpretation of possible positive anomalies in the western part of the field

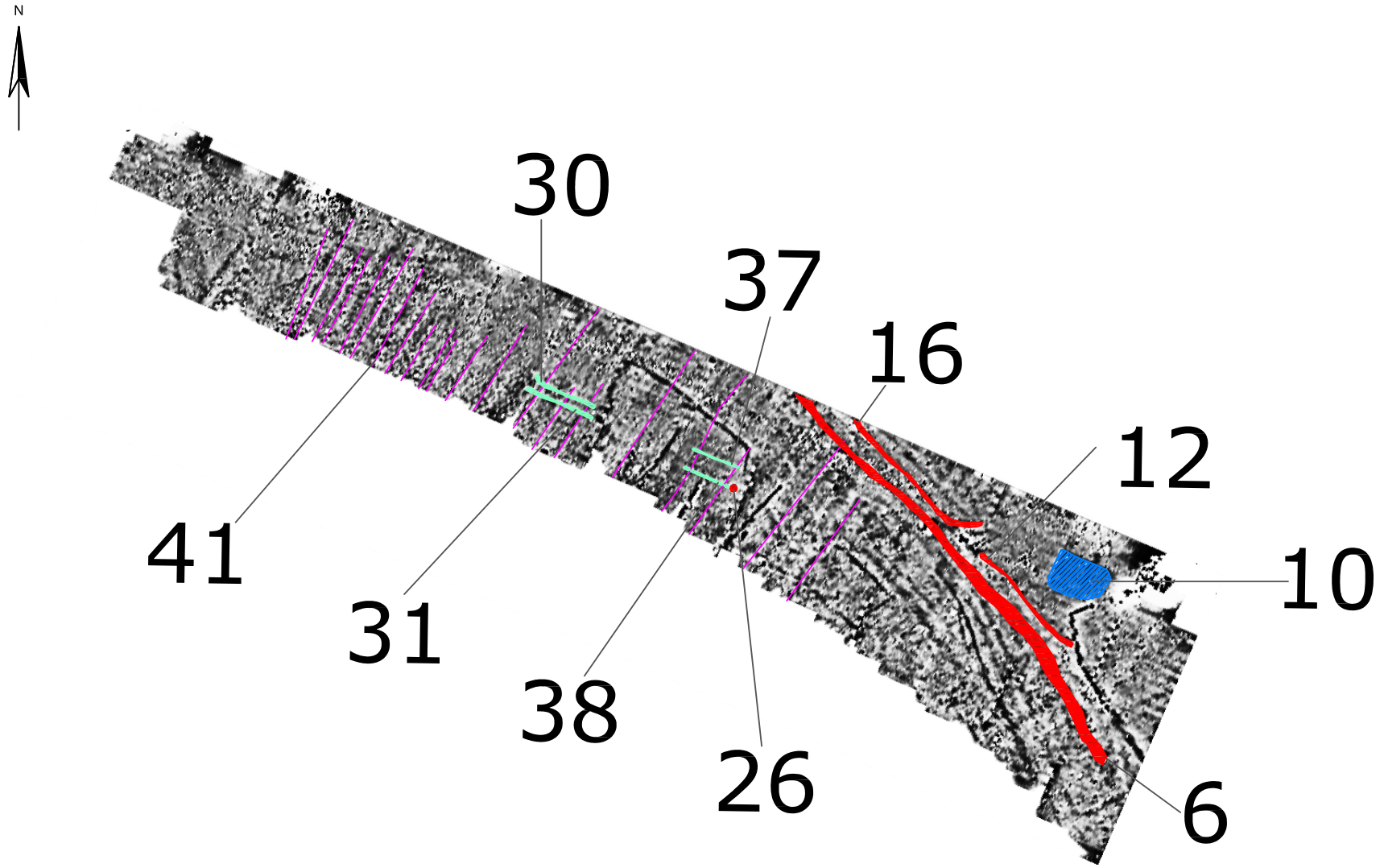


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Figure 11

Key:

Notes: Interpretation of remaining features