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GEOPHYSICAL (GRADIOMETER) SURVEY

KING GEORGE V FIELD, KEAL HILL
OLD BOLINGBROKE, EAST LINDSEY

NGR TF 35468 64649

REPORT PREPARED BY DAVID BUNN

ON BEHALF OF

PCAS ARCHAEOLOGY & OLDS BOLINGBROKE AND HAREBY PARISH COUNCIL

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Non technical summary

- *A fluxgate gradiometer survey was undertaken on King George V Field, Keal Hill, Old Bolingbroke in the East Lindsey District of Lincolnshire.*

- *Concentrations of magnetic anomalies were recorded in the northern survey area, and these could be associated with pottery production in the medieval period. The anomalies encountered include some with magnetic signatures that are typical of actual kilns, and further potential kilns have been identified in close proximity to the eastern boundary.*

- *Beyond these zones, the survey results are more muted.*

- *Modern responses include those induced by tree guards and livestock troughs. An array of parallel and magnetically weak linear anomalies probably indicates land drains of relatively recent origin.*

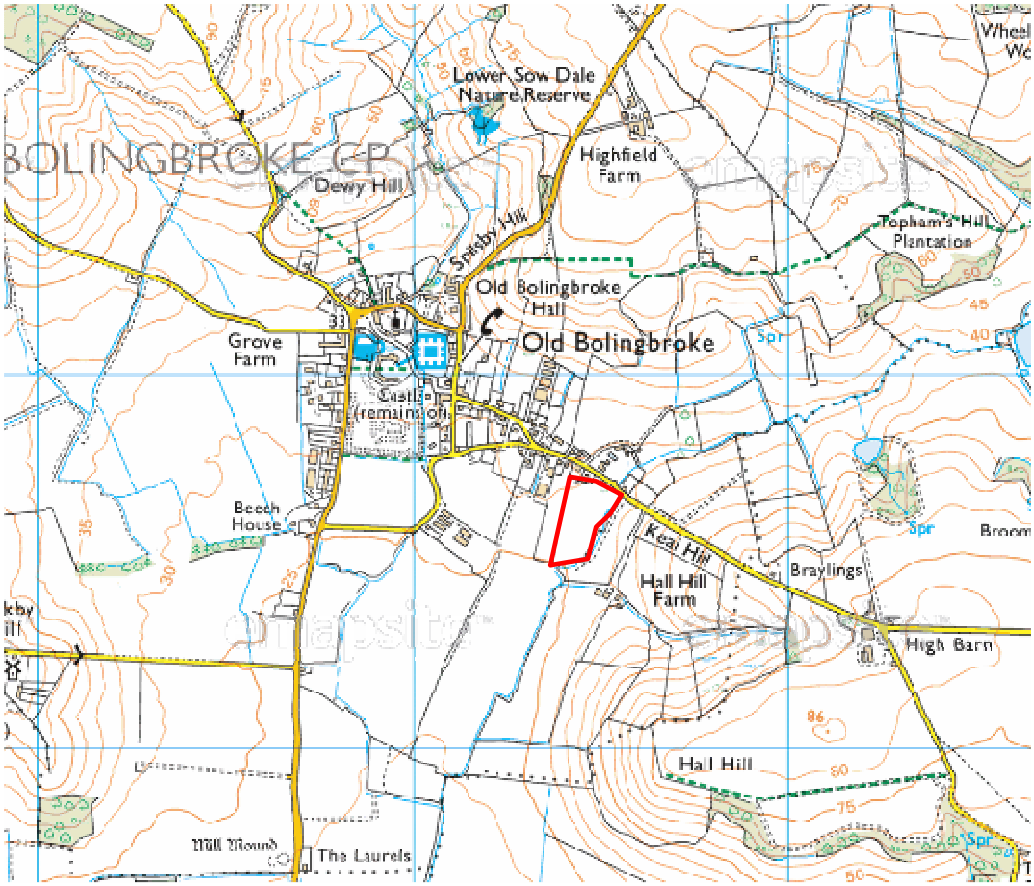

Fig. 1: Location of site

1.0 Introduction

Acting for Old Bolingbroke and Hareby Parish Council PCAS Archaeology Ltd. (PCAS) commissioned a geophysical survey on King George V Field, Keal Hill, Old Bolingbroke in the East Lindsey District of Lincolnshire. This survey was undertaken in conjunction with an earthwork survey prior to a scheme of tree planting, and extracts from the earthwork survey report (Brocklehurst, 2021) are included within this document.

2.0 Site Description (Fig. 1)

The site, King George V Field, is approximately 2ha in area (centred around TF 35468 64649) and is located around and behind Ramsden Village Hall on Keal Hill, on the eastern side of Old Bolingbroke, approximately 9km southeast of Horncastle.

The village lies at the southern edge of the Lincolnshire Wolds, surrounded by higher ground to the north, west and east, and looks southwards over a gentle incline towards low lying fenland. The settlement is arranged around the west, north and east sides of the earthwork monument of Bolingbroke Castle, which formed a focus of the medieval village.

3.0 Geology and topography

The bedrock geology of the area comprises mudstone (Kimmeridge Clay Formation), formed approximately 152 to 157 million years ago during the Jurassic Period in a local environment previously dominated by shallow seas. (BGS, 2021). River Terrace deposits of sand and gravel are recorded close to the southern edge of the site, and these formed up to 3 million years ago during the Quaternary Period in a local environment previously dominated by rivers.

The site is situated on a natural slope slanting west to east, with the highest ground in the northern and western regions.

4.0 Archaeological Context and Earthwork Survey results (Brocklehurst, 2021)

4.1 Evidence of early human activity in the Old Bolingbroke area is limited to worked flint and stone tools, recovered from the general vicinity. There is a noted concentration of such finds from the summit of Hall Hill, 1km southeast of the site, largely dating from the late Neolithic – Bronze Age periods (e.g. LHER ref: 40933), but with a small number of earlier artefacts also identified, for example a Palaeolithic Acheulian handaxe (LHER ID: 40903). Roman pottery and coins have also been recovered from this hilltop.

The only evidence for Roman activity within Old Bolingbroke itself is a single sherd of pottery recovered unstratified during a watching brief on the eastern periphery of the modern village (LHER ID 43446). In a wider area there are at least three possible Roman settlements within c1.5km of the site (LHER ref: 43158; 40945; 40964).

Occupation of Bolingbroke likely commenced during the Saxon period. The place-name derives from the Old English personal name Bula, Old English connective particle ing and the word broc, meaning stream or brook (Cameron, 1998). The prefix Old is not used until the late 19th century, to distinguish between this village and New Bolingbroke, a new post-medieval settlement lying c.8km to the southwest, close to Stickney. The settlement quickly developed into the centre of a large wapentake, and is recorded as such in the Domesday Book, but there is little artefactual evidence for the Saxon occupation of the settlement to date.

Domesday Bolingbroke, or Bolinbroc, was a large settlement of 32 households, in addition to the ploughlands, a church, three mills and 70 acres of meadow. The land had been held by the Saxon Stori of Bolingbroke but was given along with the rest of the Bolingbroke wapentake and several other manors throughout Lincolnshire to a new Norman overlord, IvoTaillebois.

Although Bolingbroke was a substantial settlement, it was one of several such agricultural villages in the area, and by no means the largest. Bolingbroke Castle was built in the 1220's by Ranulf, Earl of Chester & Lincoln after he returned from the Crusades, the stone likely quarried locally in Somerby. The castle remained a possession of the Earl of Lincoln for the next few generations, and through the marriage of Blanche (of Lancaster) daughter of the House it was inherited by John of Gaunt. Their son Henry was born at Bolingbroke Castle in 1367 (earning the nickname Henry Bolingbroke), later becoming Henry IV. The castle was a local administrative centre throughout the later medieval period, although its importance fell with the Tudor monarchy after the Wars of the Roses due to its association with the Plantagenets. The castle became a Royalist garrison during the Civil War when it was besieged by Parliamentary forces; the structure was destroyed to prevent it being used as such again when the Royalists surrendered in the winter of 1643.

The medieval parish church of Ss Peter and Paul to the north of the castle is Grade II* listed (HER 42101, NHL 1359705, 400m NW of the Site) and comprises a nave with a north aisle and a north-west tower. The church was likely to have been built by John of Gaunt, son of King Edward III at around AD1365-70, and was originally much larger, the Decorated nave was originally the south aisle of a much larger church. The church was also partially destroyed during the English Civil War of the mid-17th century, undergoing restoration in 1866 and 1890. In the 15th–18 thcentury Bolingbroke was the centre of a local pottery industry; archaeological investigation as around the village have identified at least eight kilns, scattered around the village core, those confirmed lie around Keal Road itself, Hagnaby Road and Moat Lane.

4.2 Earthwork Survey

The earthwork survey confirmed that the site lies within, although on the periphery of, the medieval settlement of Old Bolingbroke and that earthwork remains associated with this period survive within the field, especially along the northern and eastern boundaries.

There are at least two phases of activity that can be discerned from the earthworks. The ridge and furrow present along the eastern edge of the site are clearly truncated by the two ditches that run east to west across the field. This indicates that the latter were a later development, most likely post-medieval in date, although no corresponding features can be observed on historic mapping. The furrows suggest that this part of the field was primarily used for cultivation during the medieval period. The two prominent earthworks near the northern boundary are respected by the furrows, indicating that they may be contemporary. The largest of these is likely to be a possible building platform, although it is possible that this may have been an area of industrial activity. The nature of the second smaller, circular earthwork is less obvious, however due to the location on Keal Hill, in an area known for pottery production, it may be that it could be related to this activity in some way.

5.0 Methodology

5.1 The survey methodology is based on relevant heritage industry guidance and best practice advice, including the *EAC Guidelines for the use of Geophysics in Archaeology* (Schmidt et al. 2016), and the '*Standard and Guidance for Archaeological Geophysical Survey'* (Chartered Institute for Archaeologists, 2014).

5.2 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 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 via a data logger.

It should be noted that this technique only records magnetic variation in relation to natural background levels, established by careful selection of magnetically 'quiet' zones where instrument sensors are calibrated to 0nT. As such, the magnetic response of archaeological remains will vary according to geology/pedology, with a possibility that buried features could remain undetected should their magnetic susceptibility closely match that of the surrounding soils. Additionally, some remains may be buried beyond the effective 1m - 2m range of the instrumentation; for example beneath alluvium. Back-filled shallow pits or ditches might also exhibit minimal variation.

5.3 The fieldwork was undertaken by Gareth Ward Stevens and George Bunn on the 29th of October 2021.

The zigzag traverse methodology was employed, with readings taken at 0.25m intervals along 1.0m wide traverses.

The survey grid was established by Global Positioning Satellite using a Leica GS015 RTX, to an accuracy of +/- 0.1m.

The data were processed by the author using *Terrasurveyor V3*.

The raw data set are reproduced as a greyscale images on Fig. 2 (data clipped to +/-40nT). Stacked trace plot images are presented on Fig. 3 (data clipped to +/-20nT).

A '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 were clipped to +/-4nT on the greyscale images of the processed data (Fig. 4).

Anomalies in excess of +/-10nT are highlighted pink and blue on the interpretive figure (Fig. 5). These are characterised magnetically as dipolar 'iron spikes', often displaying strong positive and/or negative responses, which reflect ferrous-rich objects (particularly apparent on stacked trace plots). Examples include those forming/deposited along current or former boundaries (e.g. wire fencing), services and random scatters of horseshoes, ploughshares etc across open areas. Fired (ferro-enhanced) material, such as brick/tile fragments (often where the latter are introduced during manuring or land drain construction) usually induce a similar though predominately weaker response, closer to c+/-5nT (highlighted in pink/blue on the interpretive image). Collectively, concentrations of such anomalies typically indicate probable rubble spreads, such as backfilled ponds/ditches and demolished buildings. On a cautionary note, fired clay associated with early activity has the same magnetic characteristics as modern brick/tile rubble. As such, the interpretation of such variation must consider the context in which it occurs.

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 1 - 2m range of the instrumentation.

The report will be submitted in PDF format. Digital, geo-referenced copies of the geophysical survey plans will be supplied to the client.

A digital archive of the geophysical data and report will be retained by PCG.

6.0 Results and discussion (Figs. 2 – 5)

It is likely that most, if not all, magnetic variation recorded in the northern part of the site relates to anthropogenic activity. Whilst elements of the strongest variation (pink and blue).are associated with iron tree guards and livestock troughs (circled/boxed yellow), it is speculated that the majority of responses may relate to pottery production rather than domestic settlement. Stronger examples possibly indicate the remains of two potential kilns within this area (circled red), with other moderately strong anomalies indicating ancillary/related features such as areas containing waste materials (some potentially as backfill in clay extraction pits (e.g. red dots)).

Three zones of relatively strong variation along the eastern edge of the site are also highlighted as potential buried kilns.

The majority of the site appears to be comparatively magnetically quiet, although a small number of stronger responses are tentatively interpreted as having archaeological potential (red dots); A zone of weak anomalies in the central area and a short linear anomaly in the south-west corner are considered more likely to reflect pockets of ferro-enhanced natural deposits, though an origin as pits should not be entirely discounted (darker green on greenscale image).

Further strong responses were induced by tree guards along the western edge of the site and by a manhole cover in the south-east corner.

Slight indications of probable NS-aligned land drains were registered in the central part of the survey (dotted purple lines).

The described anomalies were recorded against a backdrop of weak, natural, variation (greenscale).

7.0 Conclusions

Concentrations of magnetic anomalies in the northern region could well be associated with medieval pottery production, including at least two possible kiln sites. Further potential kilns were detected in close proximity to the eastern boundary.

Beyond the northern and eastern regions of the site, the survey results are more muted and suggest that there are relatively few areas containing potential archaeological remains.

Modern responses include those induced by tree guards and livestock troughs, and an array of parallel magnetically weak linear anomalies probably signifies land drains.

8.0 References

British Geological Survey. 2021. Geology of Britain viewer, 1:50,000 geological mapping, bedrock and superficial - http://mapapps.bgs.ac.uk/geologyofbritain/home.html

BrockleHurst, L. *2021 Ramsden Village Hall, Keal Hill, Old Bolingbroke Archaeological Earthworks Survey*. PCAS Archaeology Ltd., JoB No. 2527

CIFA 2014 *Standard and Guidance for Archaeological Geophysical Survey.* Chartered Institute for Archaeologists.
English Heritage. 2008 *Geophysical Survey in Archaeological Field Evaluation*. London, English Heritage.

Schmidt, A; Linford, Linford, P; N; David, A; Gaffney, C; Sarris, A; & Fassbinder, J; 2016. EAC *Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider. EAC Guidelines 2.* Euopae Archaeologiae Consilium.

Fig. 2: Greyscale image of unprocessed data

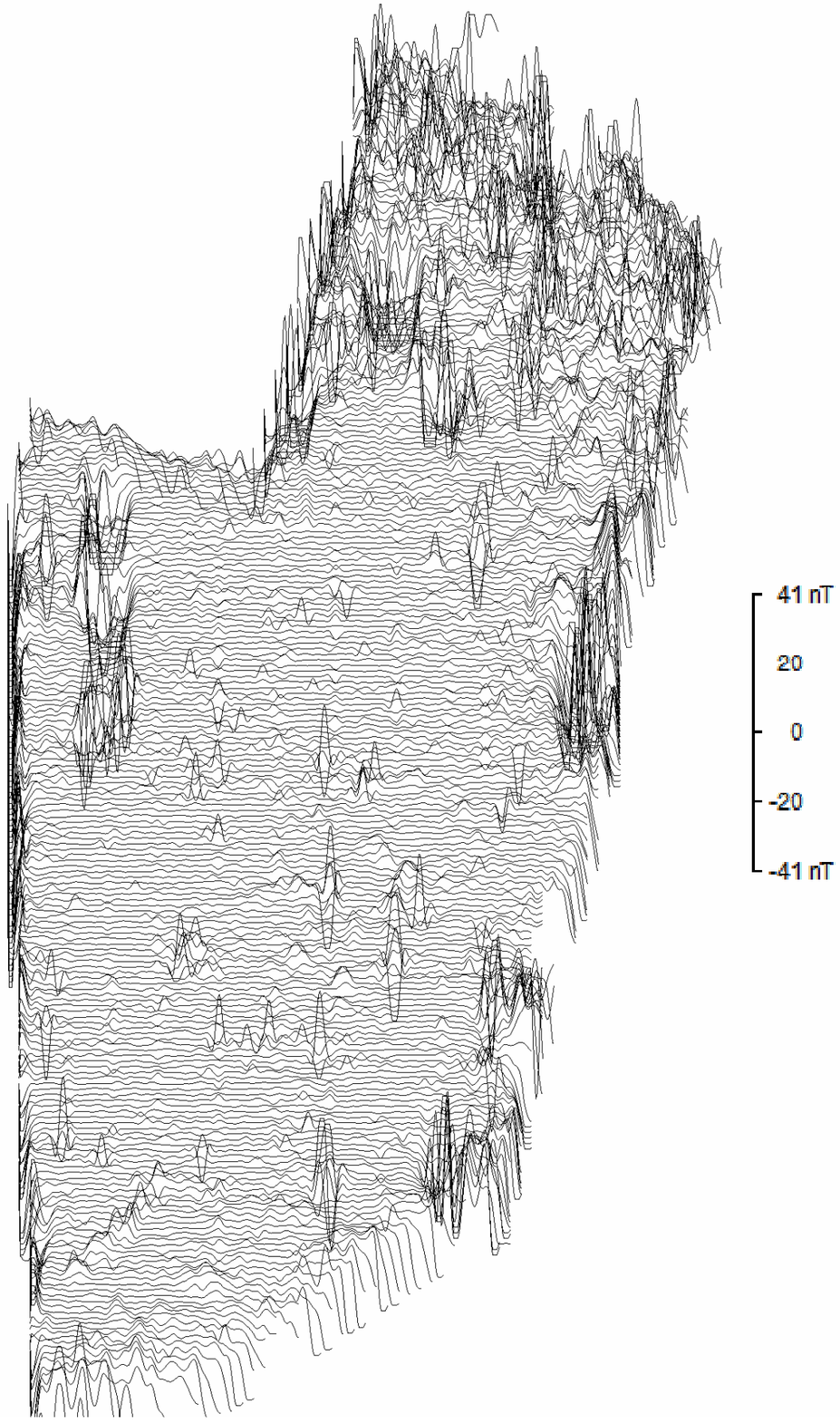

Fig. 3: Trace plot image

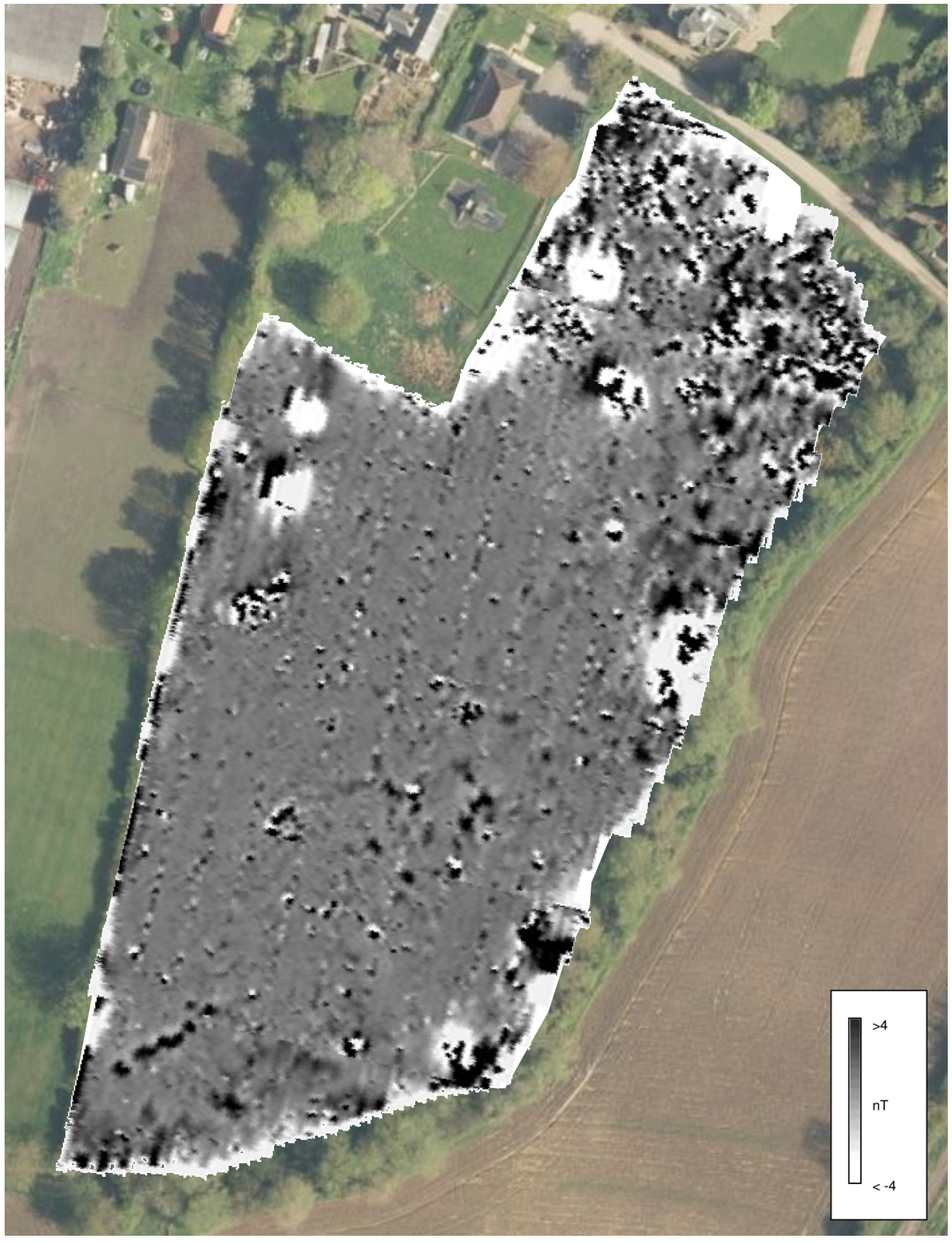

Fig. 4: Greyscale image of processed data

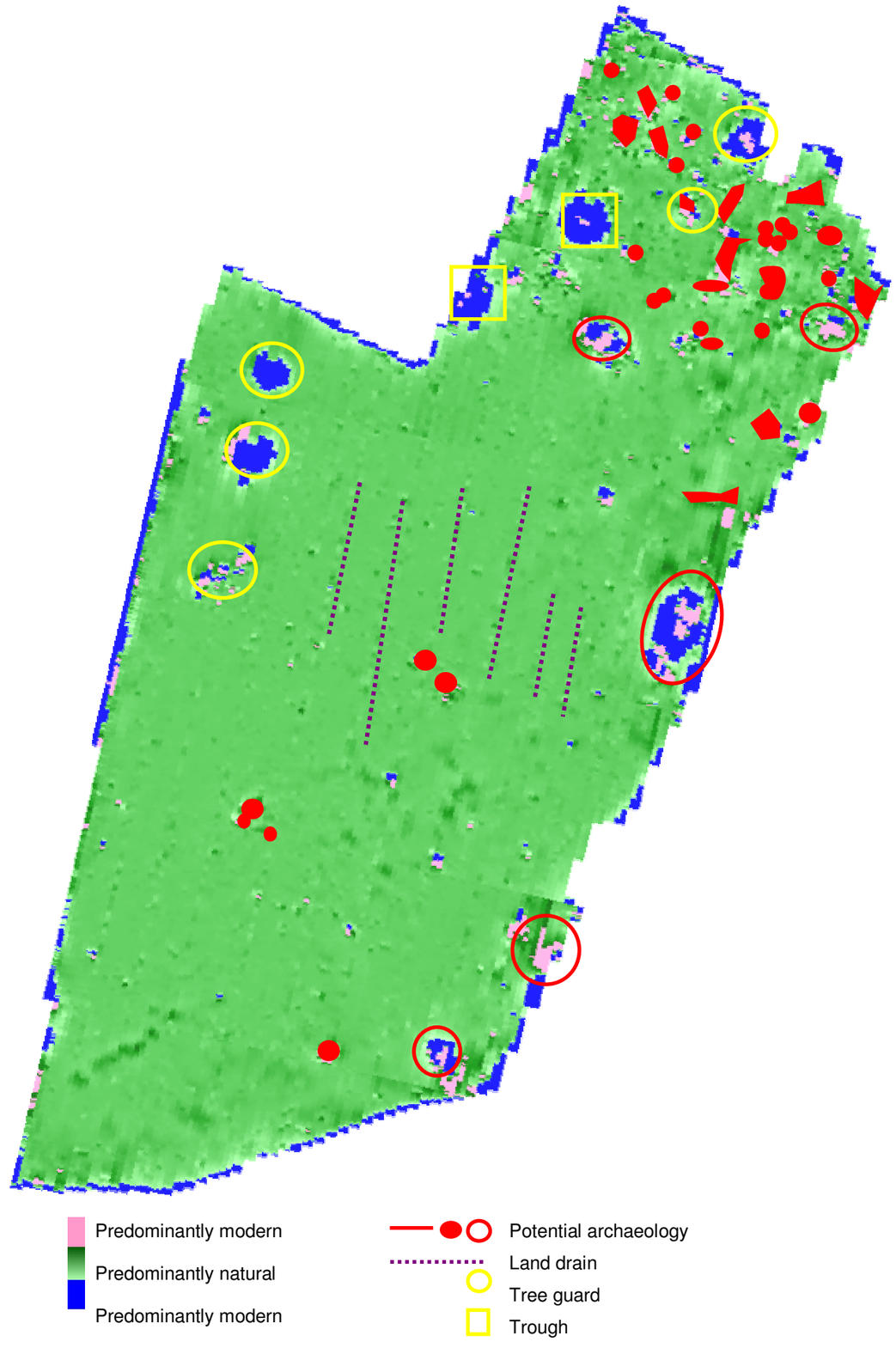

Fig. 5: Interpretation