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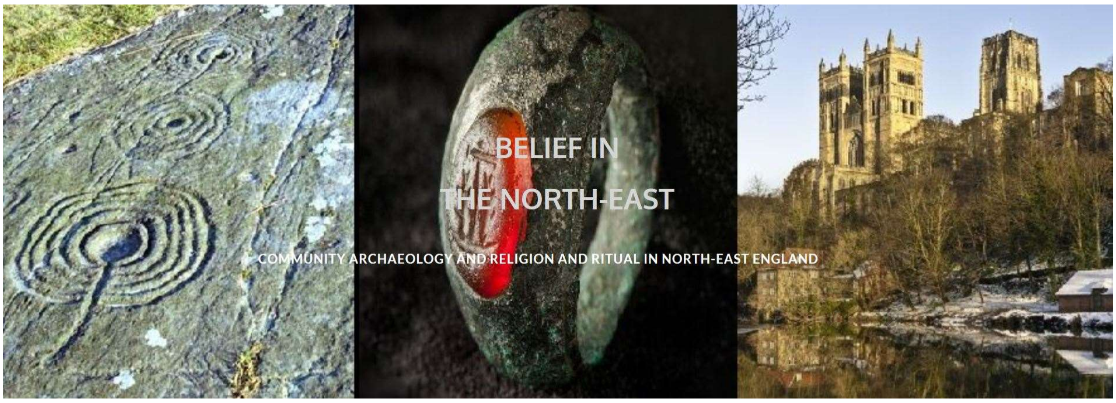

Land at Low Broadwood Hall
Allendale Town
Northumberland

geophysical surveys

report 6083
January 2024

HERITAGE FUND
Belief in the North East
Durham University

Contents

Figures

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1. Summary

The project

1.1 This report presents the results of geophysical surveys conducted on land at Low Broadwood Hall, Allendale Town, Northumberland, as part of a larger research project *Belief in the North-East*, a community archaeology project led by the Department of Archaeology at Durham University. The project aims to explore the archaeology of religion, ritual and belief across the north-east of England from prehistory to the modern day, with funding from the National Lottery Heritage Fund. The surveys were commissioned by Dr David Petts, the project director, and were planned and delivered in collaboration with Altogether Archaeology.

1.2 The overarching aims of the fieldwork were twofold: to provide training and engagement opportunities for community volunteers, and to determine the nature and extent of any features of potential archaeological origin in the fields west of Low Broadwood Hall, where part of a henge-like earthwork was discovered during examination of LiDAR imagery in 2015.

1.3 The works reported here comprised magnetometer, electrical resistance and ground-penetrating radar (GPR) surveys.

Results

1.4 The magnetometer and resistance surveys have confirmed the presence of a substantial ditch on the inside edge of the upstanding bank in the north-west quadrant of the site. There is also limited evidence for a ditch in the upper part of the GPR data from the north of the site.

1.5 The resistance survey has also detected a probable continuation of the northern part of the ditch eastward into the adjacent field. The ground there appears to have been truncated by ploughing and the construction of two lynchets and the resistance anomaly appears to reflect the narrower, lower, surviving fills of the ditch there. Based on the geophysical surveys, the monument appears to have been broadly circular with a radius of approximately 55m to the centre of the ditch. Earlier analytical field survey indicated that the enclosure could be elliptical or egg-shaped.

1.6 A probable causewayed entrance is present at the westernmost part of the enclosure, where there is no upstanding bank and no geophysical evidence for a ditch in either the magnetometer or resistance surveys.

1.7 The surveys confirm the henge-like nature of the enclosure, with an external bank, internal ditch and one surviving probable causewayed entrance.

1.8 The surveys have not shed any further light on the nature of a circular earthwork feature within the enclosure, other than to determine that the feature retains more moisture than the surrounding soils. Whilst further anomalies are present within the enclosure, no additional probable archaeological features have been identified.

1.9 Traces of former ploughing have been detected in the two western fields.

1.10 The scant remains of two post-medieval tracks may have been detected.

1.11 Some additional anomalies almost certainly reflect field drains and a utility.

Recommendations

1.12 The results of the geophysical survey suggest that if the site ever was a complete circle, or an ellipse, then its earthworks to the south and east, and presumably also much of original internal surface, have been completely lost. Perhaps the only way to establish the nature of the earthworks that survive, and whether any associated features survive within this arc of the circle, is through a programme of excavation. This need not be extensive; just a small-scale evaluation exercise could be designed to establish the nature of the earthworks and obtain samples for analysis and possible dating, while also establishing whether the earthworks to the east are part of the enclosure as suggested in the survey by Ainsworth *et al*. (2021), or relate entirely to subsequent agricultural activity. Such work could also be designed to establish the nature of the 'internal' circular feature, and also to investigate the wider area through test-pitting. Subject to landowner consent, this could potentially be a partnership project for the Altogether Archaeology and Belief in the North East groups, with an appropriate level of professional support.

1.13 Detailed comparison with other henges throughout northern England, and elsewhere, in terms of architectural form and landscape setting, might prove rewarding.

1.14 Locally, work to clarify the nature of lithic assemblages from around Allendale might help to establish their character and chronology, potentially providing something of a local context for the creation of a henge here at some point during the 3rd millennium BC.

2. Project background

Introduction (Figure 1)

2.1 Geophysical surveys were undertaken over the Allendale 'henge' in fields west of Low Broadwood Hall, Allendale Town, Northumberland, with community volunteers, as part of *Belief in the North-East*, a community archaeology project led by Durham University. The project is directed by Dr David Petts of the Department of Archaeology at Durham University, with funding from National Lottery Heritage Fund.

2.2 The project works with local people of all ages to explore the archaeology of religion, ritual and belief across the north-east of England, from prehistory to the modern day, using a range of traditional and technological archaeological techniques to record and research selected sites. A key element of the project is to provide community engagement and training opportunities.

2.3 In 2015 a local volunteer, Roy Lawson, identified part of a presumed circular earthwork while examining Environment Agency (EA) LiDAR data for the *Allen Valleys and Hexhamshire* project (see Ainsworth 2016). Its morphology of large arcuate bank with internal ditch distinguished it from the numerous late Iron Age/Roman Iron Age enclosed settlements recognised during the project and the possibility that it was a henge was raised during the validation process (Ainsworth 2016, 25-28). A detailed analytical field survey at 1:1,000 scale was undertaken by Stewart Ainsworth and Al Oswald in 2017 (Figure 2). A description of the site 'Low Broadwood Hall' and discussion of the analytical survey are presented in Ainsworth *et al*. (2021).

Location (Figures 1 and 3)

2.4 The existing earthwork is located approximately 500m west of the River East Allen, west of Allendale Town, and is almost entirely contained within one field, being the north-west quarter of a circular monument. If indeed the earthwork was part of a circular monument its centre would have been approximately at a point where four stone field walls now meet (NGR: NY 83105 55656); it is believed that the original earthwork would have extended into these four fields.

2.5 Three complementary geophysical survey techniques were used at the site: magnetometer, earth electrical resistance and ground-penetrating radar (GPR). Details are provided in Section 4.

Objectives

2.6 The principal objectives of the surveys were:

- to encourage and facilitate community engagement in heritage
- to determine the location and extent of any geophysical anomalies of likely archaeological origin within the survey areas, in particular to determine any surviving sub-surface remains of the main ditch and any internal features
- to characterise as far as possible the nature of any anomalies identified
- to prepare and disseminate a technical report on the surveys and their results

2.7 The updated regional research framework *North-East Regional Research Framework for the Historic Environment* (NERRF 2.0) (https://researchframeworks.org/nerf/

accessed 07-12-2023) contains an agenda for archaeological research in the region. In this instance, the scheme of works was designed to address the following research questions: Neolithic and Early Bronze Age NB5: How can we better understand the distinctive forms and traditions of Neolithic enclosures in north-east England?; and NB11: How can we better understand Neolithic and early Bronze Age monumental and burial traditions?

'Henge' bank and ditch approaching fieldwall, looking south (photo: Paul Frodsham)

'Henge' bank and ditch approaching fieldwall, looking east (photo: Paul Frodsham)

Methods statement

2.8 The surveys have been undertaken in accordance with instructions from the client, a method statement provided by Archaeological Services Durham University and national standards and guidance (see para. 4.1 below).

Dates

2.9 Fieldwork was undertaken on 12th and 13th December 2023. This report was prepared for January 2024.

Personnel

2.10 Fieldwork was conducted by Xavier Carter-Roberts, Duncan Hale, Jack Mace, Archie Robson and Richie Villis (Archaeological Services Durham University), Paul Frodsham

(Project Consultant) and volunteers from the *Belief in the North East* community archaeology project and Altogether Archaeology: Lorraine Clay, Jennie Garrod, Rob Jamieson, Ron Jamieson, Allen Jones, Tara Kearney, Joan Raine, David Ranner, Rebecca Stratling, Jordon Tinniswood and Stuart White.

2.11 The geophysical data were processed by Xavier Carter-Roberts, Duncan Hale and Richie Villis. This report was prepared by Duncan Hale, with a Discussion (Section 5) and recommendations provided by Paul Frodsham and illustrations by Dr Helen Drinkall. The project manager was Peter Carne.

Archive/OASIS

2.12 The site code is **AAH23**, for **A**llendale **A**llendale '**H**enge' 20**23**. The survey archive is held at Archaeological Services Durham University. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID for this project is **archaeol3-522185**.

Acknowledgements

2.13 Durham University would like to thank the landowners Ron Jamieson and Keith Reed for access and support, Stuart White for help with project planning and Dr Jan Harding for a very useful on-site discussion of northern henges.

General view of work in progress (photo: Paul Frodsham)

3. Landuse, topography and geology

3.1 At the time of fieldwork the survey areas were in four fields of pasture, though all have been under plough at different times. The fields were bound by drystone walls.

3.2 The site occupies the gentle east- and south-east-facing slopes of a spur at the south-east end of a ridge. The centre of the site lies at approximately 253m OD. The surviving arc of earthwork bank measures approximately 10m in width and up to 0.4m high, with an internal ditch averaging 6m wide and 0.3m deep (Ainsworth *et al*. 2021); there is a break in the bank (a possible entrance) at its most westerly point. A circular platform measuring approximately 10m in diameter was located within the north-western quadrant of the site.

3.3 The underlying solid geology of the study area comprises mudstone, sandstone and limestone of the Stainmore Formation; no superficial deposits are recorded at this location.

Resistance survey

4. Geophysical survey

Standards

4.1 The surveys and reporting were conducted in accordance with the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for archaeological geophysical survey* (2020); the *EAC Guidelines for the Use of Geophysics in Archaeology* (Schmidt *et al*. 2016); the Archaeology Data Service & Digital Antiquity *Geophysical Data in Archaeology: A Guide to Good Practice* (Schmidt 2013); and the European GPR Association's Code of Practice (www.eurogpr.org/codeofpractice.htm).

Technique selection

4.2 Geophysical survey enables the relatively rapid and non-invasive identification of sub-surface features of potential archaeological significance and can involve a suite of complementary techniques such as magnetometry, earth electrical resistance, ground-penetrating radar, electromagnetic survey and topsoil magnetic susceptibility survey. Some techniques are more suitable than others in particular situations, depending on site-specific factors including the nature of likely targets; depth of likely targets; ground conditions; proximity of buildings, fences or services and the local geology and drift.

4.3 In this instance, it was known that cut features such as ditches were present on the site, and that other types of features such as pits, trackways and possibly fired structures (for example ovens and hearths) might also be present.

4.4 Given the anticipated nature and depth of targets, and the non-igneous geological environment of the study area, three complementary geophysical survey techniques were considered appropriate: magnetometer, earth electrical resistance and ground-penetrating radar (GPR).

4.5 The magnetic technique, fluxgate gradiometry, involves the use of magnetometers to detect and record anomalies in the vertical component of the Earth's magnetic field, which can be caused by variations in magnetic susceptibility or permanent magnetisation; such anomalies can reflect archaeological features.

4.6 When a small electrical current is injected through the earth it encounters resistance which can be measured. Since resistance is linked to moisture content and porosity, stone and brick features will give relatively high resistance values while soil-filled features such as ditches and pits, which retain more moisture, will provide relatively low resistance values.

4.7 Similarly, ground-penetrating radar (GPR) survey was considered appropriate for detecting smaller features, as well as the remains of cut and built features and potentially providing profiles across features. GPR generates a short high-frequency radar pulse which is transmitted into the ground via an antenna; the energy is reflected by buried interfaces and the return signal is received by a second antenna. The amplitude of the return signal relates to the electromagnetic responses of different sub-surface materials and conditions, which can be features of archaeological or historic interest. The time which elapses between the transmission and return of radar pulses to the surface can be used to estimate the depth of reflectors. As well as conducting traditional 2D area surveys, GPR also has a depth component and so can be used to create 3D models of the data, provided sufficient data are collected at closely-spaced intervals; these models can then be viewed in plan at selected depths known as 'time-slices' (or 'depth-slices' where time has been converted to estimated depth).

4.8 Magnetometer surveys totalling 2.76ha were undertaken in all four fields. Electrical resistance survey was used in three of the fields, covering 1.32ha, targeting locations where sub-surface traces of the monument might survive. Two ground-penetrating radar (GPR) surveys were also undertaken across the bank and ditch, extending across the interior towards the presumed centre of the site; these surveys covered 0.19ha. Details are presented in the table below.

Area	Magnetometer (ha)	Resistance (ha)	GPR (sqm)
1	1.00	0.64	1: 740, 2: 1170
2	0.60	0.40	-
3	1.02	0.28	-
4	0.14	-	-

Field methods

4.9 A 20m grid was established across each survey area and related to the Ordnance Survey (OS) National Grid using a Leica GS15 global navigation satellite system (GNSS) with real-time kinematic (RTK) corrections typically providing 10mm accuracy.

4.10 Magnetic gradient measurements were determined using Bartington Instruments Grad601-2 dual fluxgate gradiometers. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was effectively 0.03nT, the sample interval was 0.25m and the traverse interval was 1m, thus providing 1,600 sample measurements per 20m grid unit.

4.11 Measurements of earth electrical resistance were determined using Geoscan Research RM15D Advanced resistance meters with MPX15 multiplexers and mobile twin probe separations of 0.5m. A zig-zag traverse scheme was employed and data were logged in 20m grid units. The instrument sensitivity was 0.5ohm, the sample interval was 1m and the traverse interval was 1m, thus providing 400 sample measurements per 20m grid unit.

4.12 GPR data were collected using a Malå GeoScience Ramac X3M radar control unit, mounted directly onto a 500MHz centre-frequency shielded antenna. The antenna and control unit were mounted in a rugged cart with a RAMAC XV monitor attached and an odometer on one wheel to trigger the GPR pulses. A sample profile was collected to test potential signal penetration, following this the time window was set to 36.5ns. Returned energy wavelets were recorded from many depths in the ground to produce a series of reflections at each location, called a reflection trace. Series of traces collected along each transect produce a radar profile or radargram. For these surveys, data traces were logged at 0.05m intervals along parallel traverses spaced 0.5m apart. The start and end points of each traverse were related to the OS National Grid using a Leica GS15 global navigation satellite system, as above.

4.13 Magnetic and resistance data were downloaded on site into a laptop computer for initial inspection; GPR data were inspected on site using the Malå Ramac XV11 system. All datasets were backed up on removable media and subsequently transferred to a desktop computer for processing, interpretation and archiving.

Resistance survey

Data processing

4.14 Geoplot v4 software was used to process the magnetic gradient and electrical resistance data and to produce continuous tone greyscale images of the raw (minimally processed) and filtered data. The greyscale images are presented in Figures 4, 5, 7 and 8; positive magnetic and high resistance anomalies are displayed as dark grey, while negative magnetic and low resistance anomalies are displayed as light grey. Palette bars relate the greyscale intensities to anomaly values in nanoTesla/ohm, as appropriate. Trace plots of the data were also prepared and examined but are not presented in this report.

4.15 The following basic processing functions have been applied to the magnetometer data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
zero mean traverse	sets the background mean of each traverse within a grid to zero; for removing striping effects in the traverse direction and removing grid edge discontinuities
de-stagger	corrects for displacement of geomagnetic anomalies caused by alternate zig-zag traverses
de-spike	locates and suppresses iron spikes in gradiometer data
interpolate	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m by 0.25m intervals

4.16 The following filter has been applied to the magnetometer data:

low pass filter	(applied with Gaussian weighting) to remove high frequency, small-scale spatial detail; for enhancing larger weak features and smoothing data

4.17 The following basic processing functions have been applied to the resistance data:

clip	clips data to specified maximum or minimum values; to eliminate large noise spikes; also generally makes statistical calculations more realistic
add	adds or subtracts a positive or negative constant value to defined blocks of data; used to reduce discontinuity at grid edges
de-spike	locates and suppresses spikes in data due to poor contact resistance
interpolate	increases the number of data points in a survey to match sample and traverse intervals; in this instance the data have been interpolated to 0.25m by 0.25m intervals

4.18 The following filters have been applied to the resistance data:

high & low pass filters	(applied with Gaussian weighting) to reduce a striping defect in the data, which can occur when data are collected with the MPX15 system in parallel twin configuration in wet conditions

4.19 ReflexW v7.5 software was used to process the GPR 2D radargrams, to stack and interpolate the radargrams to produce 3D data volumes, and to produce greyscale mages of profiles and time-slices (Figures 10 and 11).

4.20 Combinations of the following processing functions have been applied to the 2D radargrams:

dewow	removes very low frequency components by subtracting the mean from each trace
static correction	moves the start times for traces in each profile to 0nS
gaining the data	compensates for amplitude loss as the radio pulse penetrates deeper and/or amplifies the area of interest by adding a determined value
background removal	reduces data ringing
bandpass filter	removes low-amplitude frequencies

4.21 GPR profiles and time-slices have been examined; representative time-slices are presented in Figure 9. In this instance, the time-depth conversion is based on a soil velocity of approximately 0.069m/ns; the velocity is an estimate based on the average results of a hyperbola fitting technique and therefore any depths mentioned in the text below are only approximate.

Interpretation: anomaly types

4.22 Colour-coded geophysical interpretation plans are provided for the magnetometer and resistance surveys (Figures 6 and 9). Three types of magnetic anomaly have been distinguished in the magnetic data:

positive magnetic	regions of anomalously high or positive magnetic field gradient, which may be associated with high magnetic susceptibility soil-filled structures such as pits and ditches
negative magnetic	regions of anomalously low or negative magnetic field gradient, which may correspond to features of low magnetic susceptibility such as wall footings and other concentrations of sedimentary rock or voids
dipolar magnetic	paired positive-negative magnetic anomalies, which typically reflect ferrous or fired materials (including fences and utilities) and/or fired structures such as kilns or hearths

4.23 Two types of resistance anomaly have been distinguished in the data:

high resistance	regions of anomalously high resistance, which can reflect foundations, tracks, paths and other concentrations of stone or brick rubble, voids and relatively well-drained areas
low resistance	regions of anomalously low resistance, primarily associated with areas of relatively high moisture retention, which can reflect soil-filled features such as ditches and pits

Interpretation: features

General comments

4.24 A colour-coded archaeological interpretation plan is provided (Figure 12). For ease of reference, anomaly numbers shown bold in the text below (eg **1a**, **1b**, etc) are also shown on the archaeological interpretation plan.

4.25 Except where stated otherwise in the text below, positive magnetic anomalies are taken to reflect relatively high magnetic susceptibility materials, often sediments in cut archaeological features (such as ditches or pits) whose magnetic susceptibility has been enhanced by decomposed organic matter or by burning.

4.26 Small, discrete dipolar magnetic anomalies have been detected in all of the magnetometer survey areas. These almost certainly reflect items of near-surface ferrous and/or fired debris, such as horseshoes and brick fragments, and in most cases have little or no archaeological significance. A sample of these is shown on the magnetometer geophysical interpretation plan, however, they have been omitted from the archaeological interpretation plan and the following discussion.

Area 1

4.27 The most prominent magnetic anomalies detected here are two broad positive magnetic anomalies, which together form an almost complete arc across the survey area; there is a gap between them in the west. The anomalies measure up to approximately 3.8m wide and almost certainly reflect a substantial soil-filled ditch (**1a**). These magnetic anomalies correspond to low electrical resistance anomalies, again almost certainly reflecting a ditch feature with a break in the west. In the north of this survey area the low resistance ditch is particularly well defined and measures up to 6m wide. There is strong evidence in the resistance data for an eastward continuation of this ditch into Area 3 (below, para. 4.35). In the south and west of Area 1 the resistance anomalies are less well defined. There is no clear evidence for a continuous ditch around the west side and there is a slight discrepancy between the low resistance and positive magnetic anomalies recorded here. The ditch is located on the inside of a broad low bank noted on the ground and recorded on the earlier land survey (Ainsworth *et al*. 2021). The ditch is also particularly clear in hillshade images of the EA LiDAR data, which also show an apparent causeway across the ditch in the west.

4.28 A series of straight and narrow high resistance anomalies was detected in the east of this area, within the enclosure feature, aligned east-north-east/west-south-west. The anomalies are parallel, evenly spaced at 7.5m intervals, and almost certainly reflect stone land drains (**1b**). It is likely that the drains were laid in existing furrows; earlier field survey recorded broad rig here on this alignment (*ibid*.). These drains have also been recorded in the northern GPR survey, which also indicates that they feed into another drain, aligned broadly north/south; parts of this drain are also evident in the resistance data. Occasional other linear high resistance anomalies detected in the west of this area could also reflect land drains.

4.29 A sub-rounded low resistance anomaly and corresponding high amplitude GPR reflections in the east of this area correspond to the circular feature (**1c**) evident on the ground. The field survey reported in 2020 describes this as a “platform, *c*.10m diameter, terraced slightly into the slope, with a slight bank on the downward side” (*ibid*., 218). The interior of this feature evidently retains more moisture than its surroundings, creating a distinctive anomaly.

4.30 Several weak, high and low resistance lineations, and occasional very weak positive magnetic lineations, were detected in the north of this area, aligned north-east/south-west. It is likely that these are associated with another former plough direction (**1d**); occasional land drains are also evident on this alignment in the LiDAR data.

4.31 Two short, parallel, positive magnetic lineations which were detected in the south-west of this area could reflect the remains of a former track (**1e**), shown adjacent to the field boundary here on the 1865 OS map.

Area 2

4.32 Very weak, closely spaced, parallel positive magnetic anomalies were detected across this area. These almost certainly reflect a former plough regime (**2a**) and correspond to the post-medieval narrow rig recorded in the field survey (*ibid*.).

4.33 Two narrow linear anomalies were detected in this area, one a high resistance anomaly and the other a very weak positive magnetic anomaly; these could be a stone feature and a soil-filled gully, respectively, and may be associated with field drainage.

4.34 The only other anomalies detected here are relatively small, amorphous, high resistance anomalies of uncertain origin in the east of the area.

Area 3

4.35 The enclosure ditch (**3a**) has almost certainly been detected in the resistance survey as a band of low resistance, heading east-south-east from the field wall, continuing the arc recorded in Area 1 and giving the appearance of a circular enclosure. The ditch anomaly here is narrower that to the west of the wall, almost certainly due to truncation by the later landscaping and ploughing. It appears that only the lower fills of the ditch survive in this area.

4.36 The most prominent magnetic anomalies detected in this area comprise two bands of positive magnetic anomalies, aligned broadly north-west/south-east. The western anomaly has a corresponding low resistance anomaly flanked by areas of relatively high resistance. These anomalies are probably associated with the remains of two former lynchets (**3b**), visible on the ground and in LiDAR data and recorded by the field survey (*ibid*.). However, the southern part of the western positive magnetic anomaly also corresponds to a low resistance anomaly, which has an adjacent high resistance anomaly on its east side corresponding to a slight bank recorded in the field survey. Ainsworth *et al*. describe this as a degraded stretch of curving bank and internal ditch which could indicate the perimeter of the enclosure on this side (2021, p218), creating an elliptical or egg-shaped enclosure. The western of the two magnetic anomalies here is similar in nature to the ditch anomaly in Area 1, and could itself reflect a ditch, supporting the suggestion of an egg-shaped enclosure, however, this does not fit well with the probable eastward ditch in the resistance data in the north of this area, and the magnetic anomaly corresponds to a break in slope probably associated with the remains of a lynchet.

4.37 A linear concentration of small dipolar magnetic anomalies was detected aligned east-north-east/west-south-west across the southern part of this field. Although no former tracks or field boundaries are shown hereon early OS maps, it is probable that these anomalies reflect the remains of a former track (**3c**), possibly part-metalled; this could be a continuation of the former track (**1e**) depicted along the southern edge of Area 1 to the west.

4.38 A small concentration of intense dipolar magnetic anomalies detected in the north-west corner of the survey almost certainly reflects ferrous and possibly fired waste, and is shown on the archaeological interpretation as disturbed ground (**3d**).

4.39 Occasional very weak positive magnetic lineations were detected in the southern part of this area, similar to those in Area 2; these may reflect soil-filled gullies or similar, possibly associated with field drainage.

Area 4

4.40 Few anomalies were detected in this small wedge-shaped field in the south-east of the site. A chain of intense magnetic anomalies was detected along the northern field boundary; this almost certainly reflects a ferrous pipe (**4a**).

4.41 The only other anomalies detected here comprised dipolar magnetic anomalies near the steel wire fence to the south-east and occasional ferrous/fired debris in the near-surface.

5. Discussion (by Paul Frodsham)

5.1 On balance, although the suggestion may initially appear unlikely given the lack of directly comparable sites throughout the North Pennines, the most probable interpretation is that the visible earthworks are remnants of a Neolithic hengiform monument. If correct, this is a very important site, adding to a network of such monuments throughout northern England (discussed below). The following thoughts are provided on the assumption that the Allendale site is a hengiform monument of some kind.

5.2 Several henge monuments have been recorded along what is sometimes referred to as the ‘A1 corridor’ extending from Ferrybridge on the Aire in the south, through the magnificent group at Thornborough on the Ure, to Chester-le-Street on the Wear in the north, with an important outlying group to the north on the Milfield Plain in north Northumberland. Nearly all these sites are close to rivers, and they seem in many cases to relate to points at which a major north/south overland route (now followed in places by the A1) crossed these rivers (Vyner 2007). A recently excavated example at Low Conniscliffe, Darlington, fits this pattern perfectly, being adjacent to

A1M where it crosses the Tees (Archaeological Practice 2023). A couple of examples in more upland settings, perhaps more analogous to that of the Allendale monument, have been recorded in the Pennines. These are the 80m diameter Castle Dykes, near Aysgarth in Wensleydale, and a much smaller (35m diameter) site at Yarnbury, near Grassington in Wharfdale. These may well relate to transport routes across the Pennines. Further possible henges have been discovered recently using LiDAR imagery, and no doubt more remain to be found throughout the north-east.

5.3 To the west of the North Pennines, three henges (including the huge and extraordinary Mayburgh) lie adjacent to the Eamont and the Lowther, south of Penrith (Topping 1992). Some of their functions may have been mirrored by those of the Cumbrian stone circles, of which several are known on the fringes of the North Pennines in the Eden Valley (Long Meg, which seems to incorporate an earthen bank linking it to the henge tradition, being the best known; others include Broomrigg and Grey Yauds).

5.4 There was thus a tradition of henge-building both east and west of the North Pennines, and people must have travelled between these areas, presumably using major rivers as much as possible, during the Neolithic. Until recently, there were no comparable sites actually in the uplands, but it is important to note here the recently investigated Dry Burn 'henge', near Garrigill at the heart of the North Pennines (Payne 2011; Ainsworth *et al*. 2021). Possibly modified in later prehistory, this seems originally to have consisted of two roughly circular concentric banks, each with an internal ditch (and seemingly a very slight internal bank). The outer bank has a diameter of *c*.95m; the inner one *c*.50m. Small-scale excavation in 2013 produced dates of *c*.2100BC from beneath the outer bank and from the primary fill of the outer ditch (Archaeological Services 2016). The Dry Burn site is located on a north-facing slope overlooking the South Tyne. It can be seen from several kilometres away on the Hartside road to the west, and from the other side of the South Tyne to the north and east. Its location suggests it was built at a nodal point and visited by people travelling across the North Pennines in various directions. The South Tyne valley gives ready access to the A69 corridor to the north, and tracks to the south and east may have linked with the upper reaches of Weardale and Teesdale. Although very different in some respects from the Allendale monument, Dry Burn demonstrates conclusively that hengiform monuments were built in the uplands, and it is possible that several similar sites still await discovery or recognition. A further possible henge has been noted on LiDAR imagery adjacent to the River Balder close to its confluence with the Tees at Cotherstone (Frodsham 2017), but this has yet to be examined in the field.

5.5 The northern English henges are not at all well dated. The Low Conniscliffe henge has been dated to a century or two prior to 3000BC, subsequently being used for burials during the early/middle Bronze (Archaeological Practice 2023). This corresponds quite closely to dates obtained for the construction of the Ferrybridge henge, thought to have occurred in about 3000BC (Roberts & Prudhoe 2005, 234), and the Long Meg stone circle (Frodsham 2021). An unusual palisaded enclosure, perhaps similar in purpose to the henges, was excavated in 2004 at Marne Barracks (Catterick), adjacent to the River Swale, and dated to 2530–2310 BC (Hale *et al*. 2009). To the north, a series of dates for three small henges on the Milfield Plain suggest their construction at around the same time as the Dry Burn monument, during the late 3rd millenium BC, making them of Chalcolithic or early Bronze Age, rather than Neolithic, date (Passmore & Waddington 2012, 188). The Coupland henge on the Milfield Plain (much larger than all the other Milfield henges) and one of the Thornborough henges both have post-abandonment dates in the first half of the 2nd millennium BC, but their construction is undated; they may well be early in the sequence of henge building, constructed within a century or two of 3000BC.

5.6 The monuments that we class together as 'henges' present much variety in form and size. The three vast Thornborough henges have internal areas *c*.90m in diameter and overall diameters of *c*.240m, while the relatively small Milfield monuments (excluding the single large example at Coupland) have interiors averaging only about 20m across. There is also much variation in form; for example, some have external ditches outside their banks, in addition to internal ones, while others do not, and while most are roughly circular, the recently recognised Moulton henge is elliptical. Almost all have internal ditches, inside their banks. These are clearly of no defensive use and must surely indicate that the sites were of ritual significance. This is not the place to consider their purpose in detail, but it should be noted that the variation in form and landscape setting suggests that they could have been constructed for different reasons, even if their essential form did relate to some common understanding. Perhaps, as has been suggested for stone circles, the act of their construction was at least as important as the resulting monument; in other words, they should be thought of in terms of 'process' as well as 'product'. Whatever their purpose (or purposes) it seems clear that their locations relate to the passage of people through the landscape, and not to centres of population.

5.7 Close links between lowland henges and rivers, such as between the Thornborough henges and the Ure, or the Penrith henges and the Eamont, have often been commented upon and seem indisputable. It has also been suggested, as noted above, that locations of the lowland henges relate to transport networks, often being in places where overland routes crossed with rivers. The Allendale monument is located within 300m of the River East Allen, which it overlooks. The valley of the East Allen provides access downriver to the lowland route now occupied by the A69, linking east and west coasts, and upriver towards the heart of the North Pennines, potentially linking with other valleys radiating outwards from the uplands. This is therefore a far from inappropriate location for a henge. It is similar in some respects to that of the Dry Burn site noted above.

5.8 Activity in this general area during the Neolithic and early Bronze Age is demonstrated by finds of lithics, notably from Dryburn Moor (note – to avoid potential confusion: a completely different Dry Burn to the site noted above), just 2.5km to the south-west, at a height of 450m OD on the interfluve between the West and East Allens. Here, chimneys took fumes from the Allendale Smeltmill, and the surrounding vegetation around them was poisoned, leading to erosion of the surrounding peat. The Rev W Howchin described the site towards the end of the 19th century, noting that it had long been known as a good location for finding prehistoric flints (Howchin 1880). Although many artefacts must have been lost without having been recorded, in excess of one thousand (a large percentage of which could be Neolithic and/or early Bronze Age, though many are certainly earlier) are known from this locality. And this, of course, only relates to the relatively small area of eroded peat; there must surely be comparable, and potentially very large, lithic concentrations in other nearby locations. Indeed, other potentially relevant lithics are known from the vicinity, about which further information is currently being sought (Jan Harding pers. comm.). So, although more work is needed, it does seem that the area around Allendale Town may have been quite busy during the Neolithic, potentially a place visited by people travelling through the landscape since Mesolithic times.

5.9 The link with the river, as noted above, is probably crucial. Another factor which may be significant is almost level horizon in all directions when seen from the site. This was pointed out by Jan Harding who visited during the survey; as soon as it was pointed out, everyone commented on how obvious it was, though no-one had previously noticed it. It is quite remarkable how the landscape, although hilly, produces this effect in all directions at the point where the distant horizon meets the sky (Figure 13). Harding noted that this brings to mind the horizon at many lowland henges with which he is familiar (Harding 2003, 2013). It offers an unimpeded view of the heavens in all directions, which may well have been significant to those using the monument in the Neolithic.

5.10 During the geophysical surveys, an apparent cupmarked stone was found lying to the north side of the fieldwall that runs east/west across the site; it had presumably been built into this wall and had fallen out of it. A rapid search of the wall did not reveal any further examples. The purpose of cupmarks like these is not known, but they are often found at Neolithic and early Bronze Age ritual and burial sites. Also, many have been found in fields where no such monuments have been recorded; in such cases it possible that a monument such as a burial mound has been ploughed away. Frustratingly, especially on a well-weathered stone surface, it can sometimes be impossible to distinguish between artificially produced cupmarks and naturally weathered hollows. In this case, the cupmark looks convincing, but there is also a sharply defined cone-shaped hollow on the opposite face of the stone which looks relatively recent and suggests that the stone may have been used for some unknown purpose in recent times, thus casting doubt on the potentially genuine cupmark. For now, the stone has been placed atop the fieldwall, and has been recorded as a possible cupmarked stone. Careful analysis of the fieldwalls might result in the discovery of further examples, which, if present, would suggest a possible connection with the henge.

Possible cupmark (left) and reverse side of possible cupmarked stone (photos: P Frodsham)

6. Conclusions and recommendations

6.1 Geophysical surveys have been undertaken over a possible henge monument at Low Broadwood Hall, Allendale Town, Northumberland, as part of the *Belief in the North-East* community archaeology project. Magnetometer, electrical resistance and ground-penetrating radar surveys were undertaken. The works facilitated community engagement in heritage research.

6.2 One of the objectives of the surveys was to establish the nature and extent of any sub-surface anomalies which might be associated with the surviving earthwork. The magnetometer and resistance surveys have confirmed the presence of a substantial ditch on the inside edge of the upstanding bank in the north-west quadrant of the site. There is also limited evidence for a ditch in the upper part of the GPR data from the north of the site.

6.3 The resistance survey has also detected a probable continuation of the northern part of the ditch eastward into the adjacent field. The ground there appears to have been truncated by ploughing and the construction of two lynchets, and the resistance anomaly appears to reflect the narrower, lower, surviving fills of the ditch there. Based on the geophysical surveys, the monument appears to have been broadly circular with a radius of approximately 55m to the centre of the ditch. Earlier analytical field survey indicated that the enclosure could be elliptical or egg-shaped.

6.4 A probable causewayed entrance is present at the westernmost part of the enclosure, where there is no upstanding bank and no geophysical evidence for a ditch in either the magnetometer or resistance surveys.

6.5 The surveys confirm the henge-like nature of the enclosure, with an external bank, internal ditch and one surviving probable causewayed entrance.

6.6 The surveys have not shed any further light on the nature of a circular earthwork feature within the enclosure, other than to determine that the feature retains more moisture than the surrounding soils. Whilst further anomalies are present within the enclosure, no additional probable archaeological features have been identified.

6.7 Traces of former ploughing have been detected in the two western fields.

6.8 The scant remains of two post-medieval tracks may have been detected.

6.9 Some additional anomalies almost certainly reflect field drains and a utility.

Recommendations

6.10 The results of the geophysical survey suggest that if the site ever was a complete circle, or an ellipse, then its earthworks to the south and east, and presumably also much of original internal surface, have been completely lost. Perhaps the only way to establish the nature of the earthworks that survive, and whether any associated features survive within this arc of the circle, is through a programme of excavation. This need not be extensive; just a small-scale evaluation exercise could be designed to establish the nature of the earthworks and obtain samples for analysis and possible dating, while also establishing whether the earthworks to the east are part of the enclosure as suggested in the survey by Ainsworth *et al*. (2021), or relate entirely to subsequent agricultural activity. Such work could also be designed to establish the nature of the 'internal' circular feature, and also to investigate the wider area through test-pitting. Subject to landowner consent, this could potentially be a partnership project for the Altogether Archaeology and Belief in the North East groups, with an appropriate level of professional support.

6.11 Detailed comparison with other henges throughout northern England, and elsewhere, in terms of architectural form and landscape setting, might prove rewarding.

6.12 Locally, work to clarify the nature of lithic assemblages from around Allendale might help to establish their character and chronology, potentially providing something of a local context for the creation of a henge here at some point during the 3rd millennium BC.

7. Sources

Ainsworth, S, 2016 *Shedding Light on the North Pennines: the Allen Valleys and Hexhamshire Lidar Landscape Survey*. Unpublished Altogether Archaeology Project Report

Ainsworth, S, McOmish, D, Oswald, A, & Payne, A, 2021 Two newly-identified possible 'hengiform' monuments in the North Pennines, in G Hey & P Frodsham (eds) *New Light on the Neolithic of Northern England*, 211-222. Oxford & Philadelphia

Archaeological Practice 2023 *Land on the North-East Side of Low Coniscliffe, Darlington. Archaeological Mitigation*. Unpublished interim report. Newcastle upon Tyne

Archaeological Services 2016 *Dry Burn enclosure, near Garrigill, Cumbria: post-excavation full analysis*. Report **4042**, Archaeological Services Durham University

CIfA 2020 *Standard and Guidance for archaeological geophysical survey*. Chartered Institute for Archaeologists

Frodsham, P, 2017 *Lidar Landscapes: Surveys of Weardale, Upper Teesdale and the Upper Derwent Valley*. Unpublished report for the North Pennines AONB Partnership

Frodsham, P, 2021 'A most noble work', at the heart of Neolithic Britain. Some thoughts on the Long Meg complex in the light of recent fieldwork. In G Hey & P Frodsham (eds) *New Light on the Neolithic of Northern England*. Oxford: Oxbow, p147-175.

Hale, D, Platell, A, & Millard, A, 2009 A late Neolithic palisaded enclosure at Marne Barracks, Catterick, North Yorkshire. *Proceedings of the Prehistoric Society* vol **75**, p.265-304

Harding, J, 2003 *Henge Monuments of the British Isles*. Stroud: Tempus

Harding, J, 2013 Cult, Religion and Pilgrimage. Archaeological Investigations at the Neolithic and Bronze Age Monument Complex of Thornborough, North Yorkshire. *CBA Research Report* **174**. York, Council for British Archaeology

Howchin, W, 1880 Notes on a Find of Pre-historic Implements in Allendale, with Notices of similar Finds in the surrounding District. *Natural History Transactions of Northumberland, Durham and Newcastle-on-Tyne*, vol **VII**, p210-222

NERRF 2.0 *North-East Regional Research Framework for the Historic Environment.* https://researchframeworks.org/nerf/ (accessed 07-12-2023)

Passmore, D, & Waddington, C, 2012 *Archaeology and Environment in Northumberland: Till-Tweed Studies Volume* **2**. Oxford: Oxbow

Payne, A, 2011 *Rotherhope, Alston, Cumbria. Report on Geophysical Survey, November 2010*. Unpublished English Heritage Research Department Report Series, **40**, 2011. Portsmouth, English Heritage

Roberts, I, & Prudhoe, J, 2005 *Ferrybridge Henge: the Ritual Landscape; Archaeological Investigations at the Site of the Holmfield Interchange of the A1 Motorway*. Leeds: Archaeological Services WYAS.

Schmidt, A, 2013 *Geophysical Data in Archaeology: A Guide to Good Practice*. Archaeology Data Service & Digital Antiquity, Oxbow

Schmidt, A, Linford, P, Linford, 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**, Namur

Topping, P, 1992 The Penrith henges: a survey by the Royal Commission on the Historical Monuments of England. *Proceedings of the Prehistoric Society* vol **58**, p. 249-264

Vyner, B, 2007 A Great North Route in Neolithic and Bronze Age Yorkshire: The Evidence of Landscape and Monuments. *Landscapes* vol **8** issue 1, p69-84

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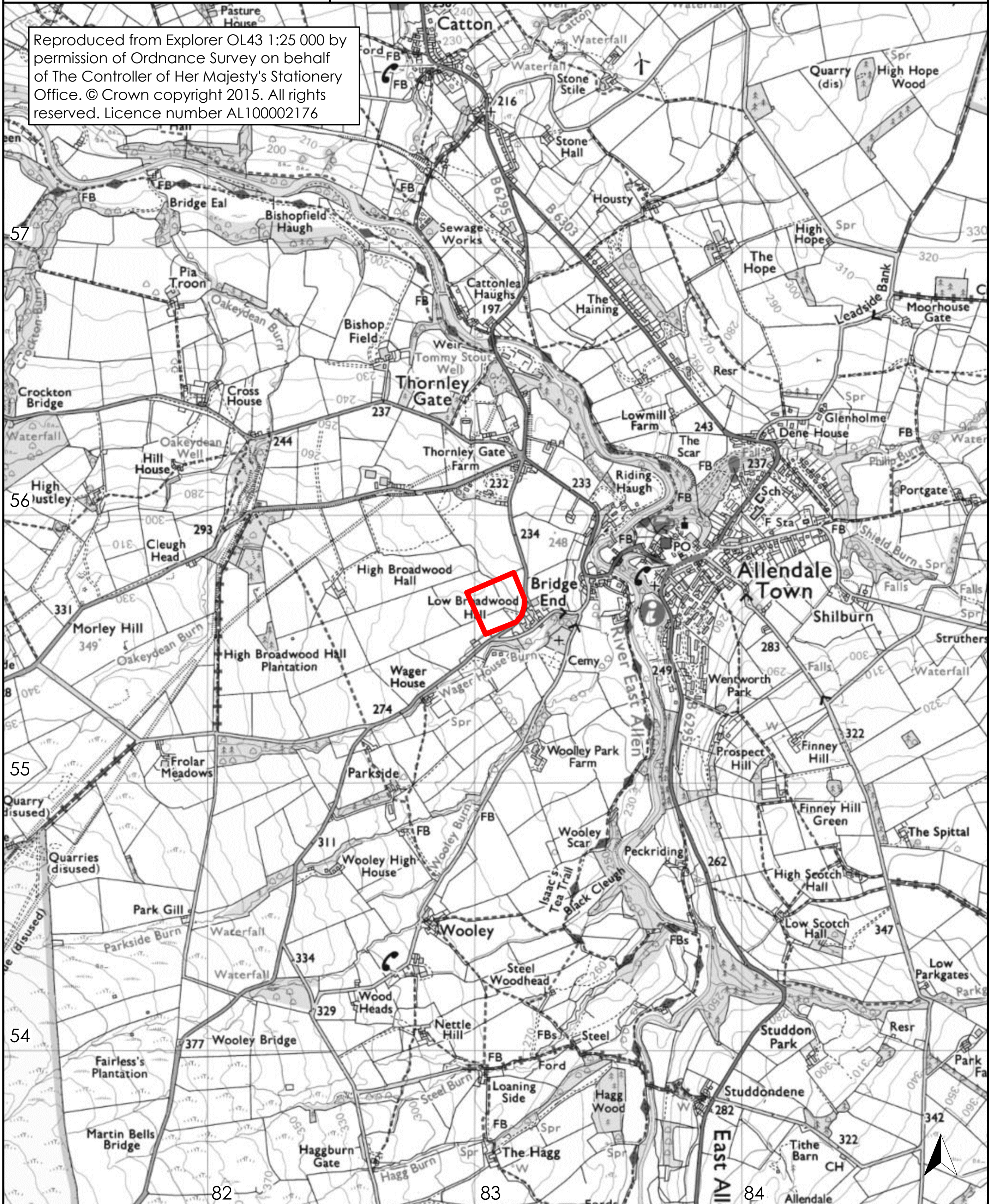
Figure 1: Site location



site location

0 1km
scale 1:20 000 for A4 plot

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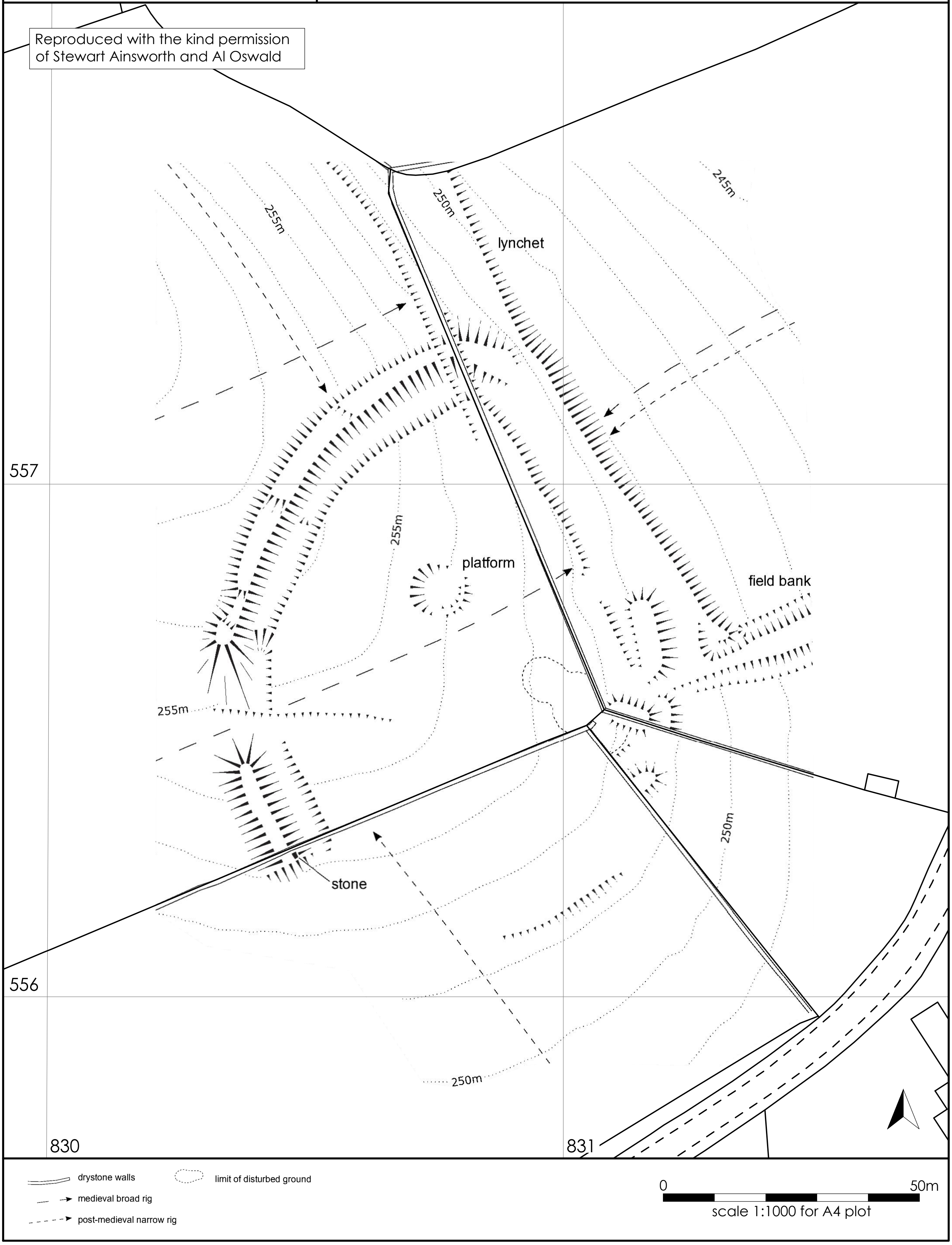
Figure 2: Analytical field survey, from Ainsworth et al. 2021



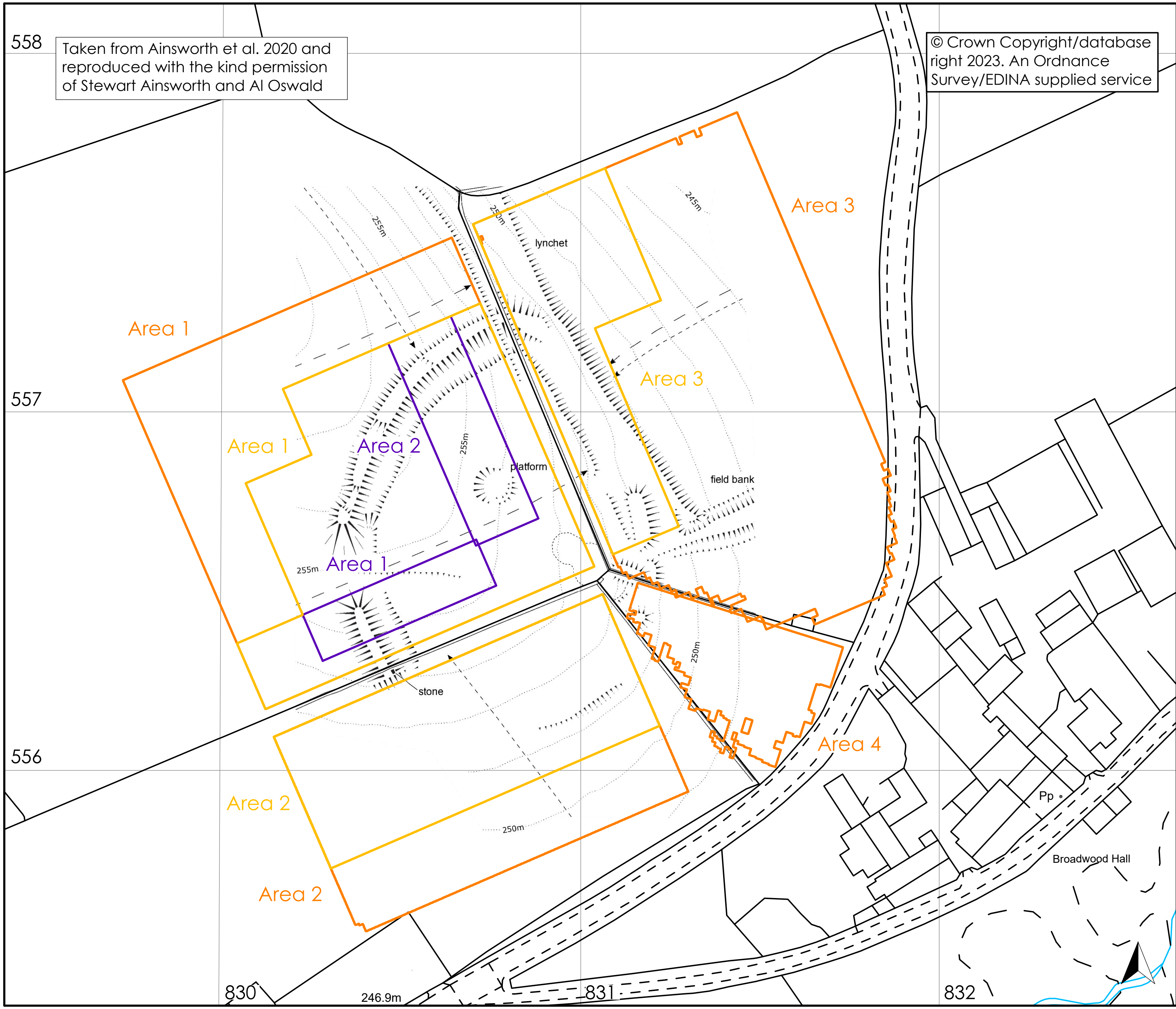


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Figure 3: Location of geophysical surveys

0 75m
scale 1:1500 for A4 plot

magnetometer survey
resistance survey
GPR survey

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Figure 4: Magnetometer survey

0 50m
scale 1:1000 for A3 plot

magnetometer survey

Area 1
-3 nT 4

Areas 2-4
-4 nT 6

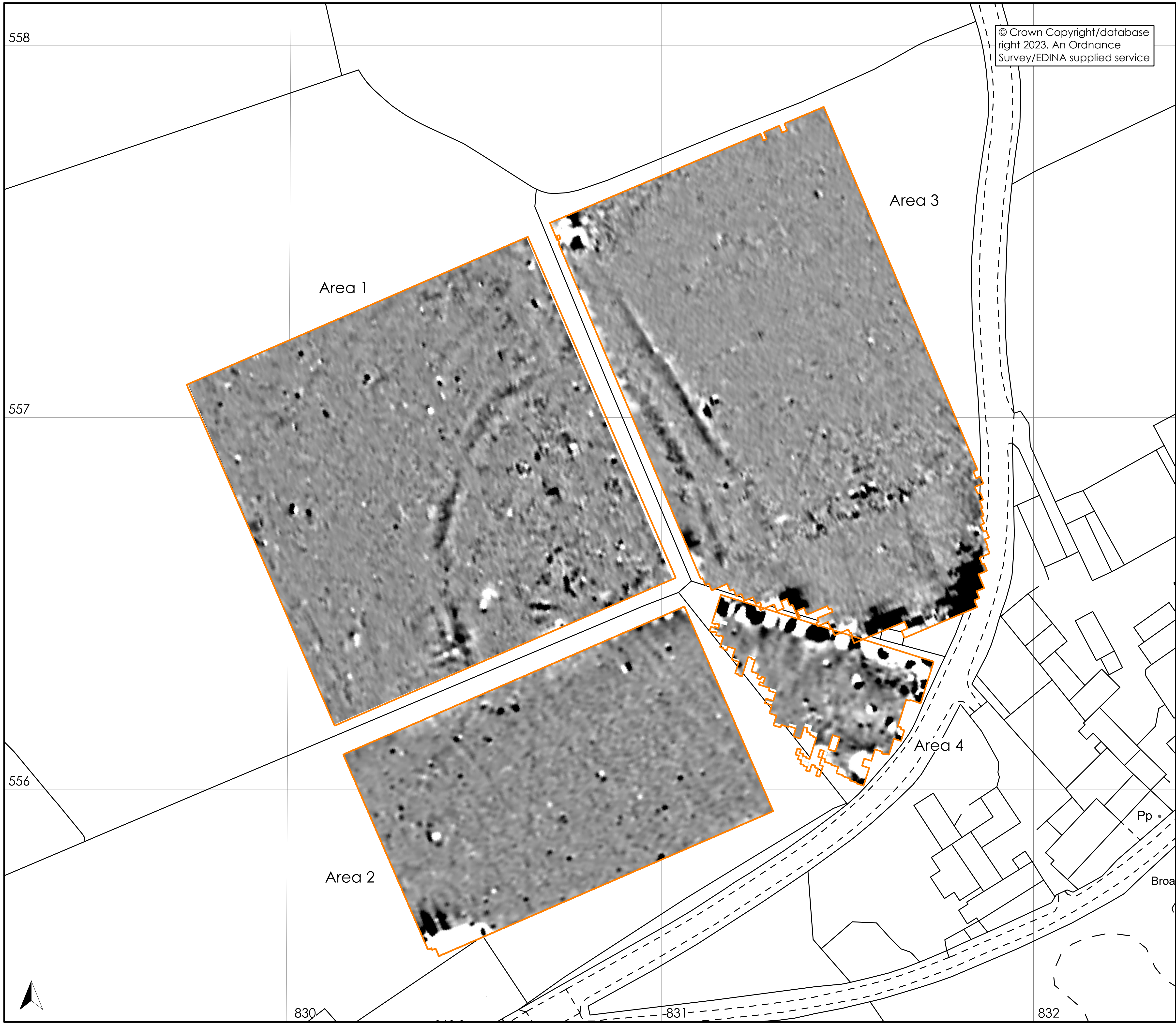

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Figure 5: Magnetometer survey (filtered data)

0 50m
scale 1:1000 for A3 plot

magnetometer survey

Area 1, 2 & 4
-3 nT 4

Area 3
-4 nT 6

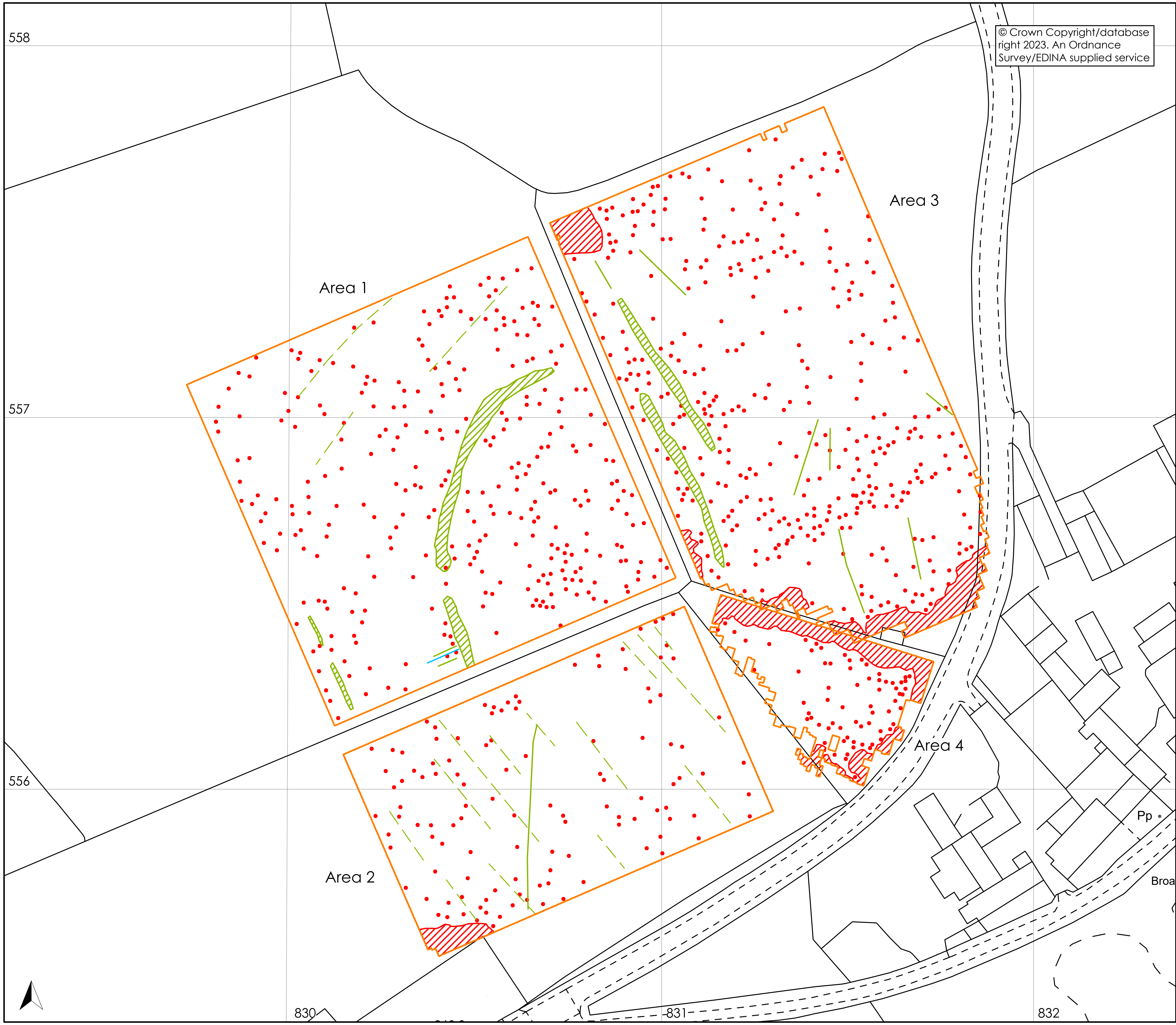

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Figure 6: Geophysical interpretation of magnetometer data

0 50m
scale 1:1000 for A3 plot

- magnetometer survey
- dipolar magnetic anomaly
- positive magnetic anomaly
- negative magnetic anomaly

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Figure 7: Resistance survey

0 50m
scale 1:1000 for A3 plot

resistance survey

20 ohm 55

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Figure 8: Resistance survey (filtered data)

0 50m
scale 1:1000 for A3 plot

resistance survey

20 ohm 55

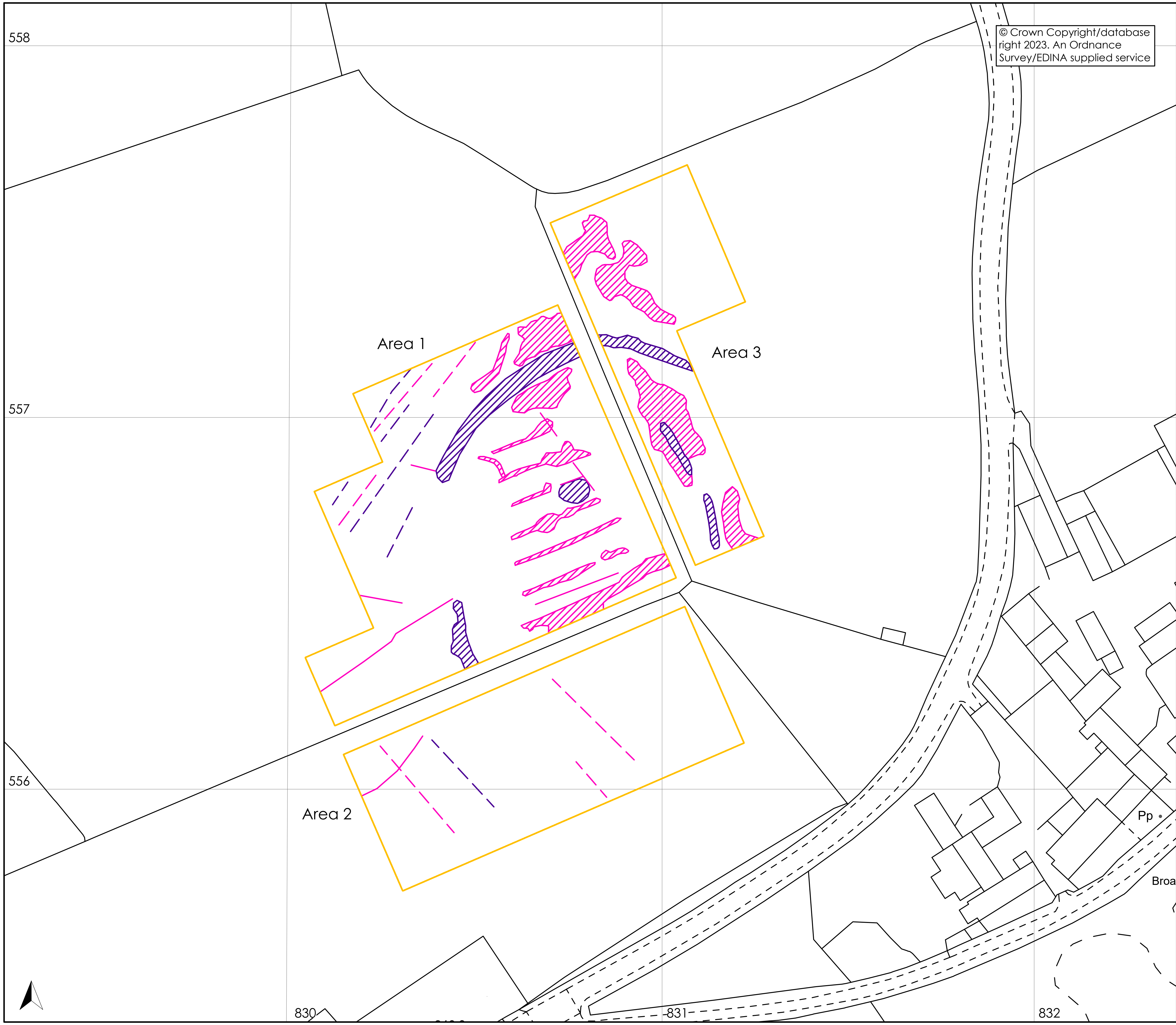

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Figure 9: Geophysical interpretation of resistance data

0 50m
scale 1:1000 for A3 plot

resistance survey
high resistance anomaly
low resistance anomaly

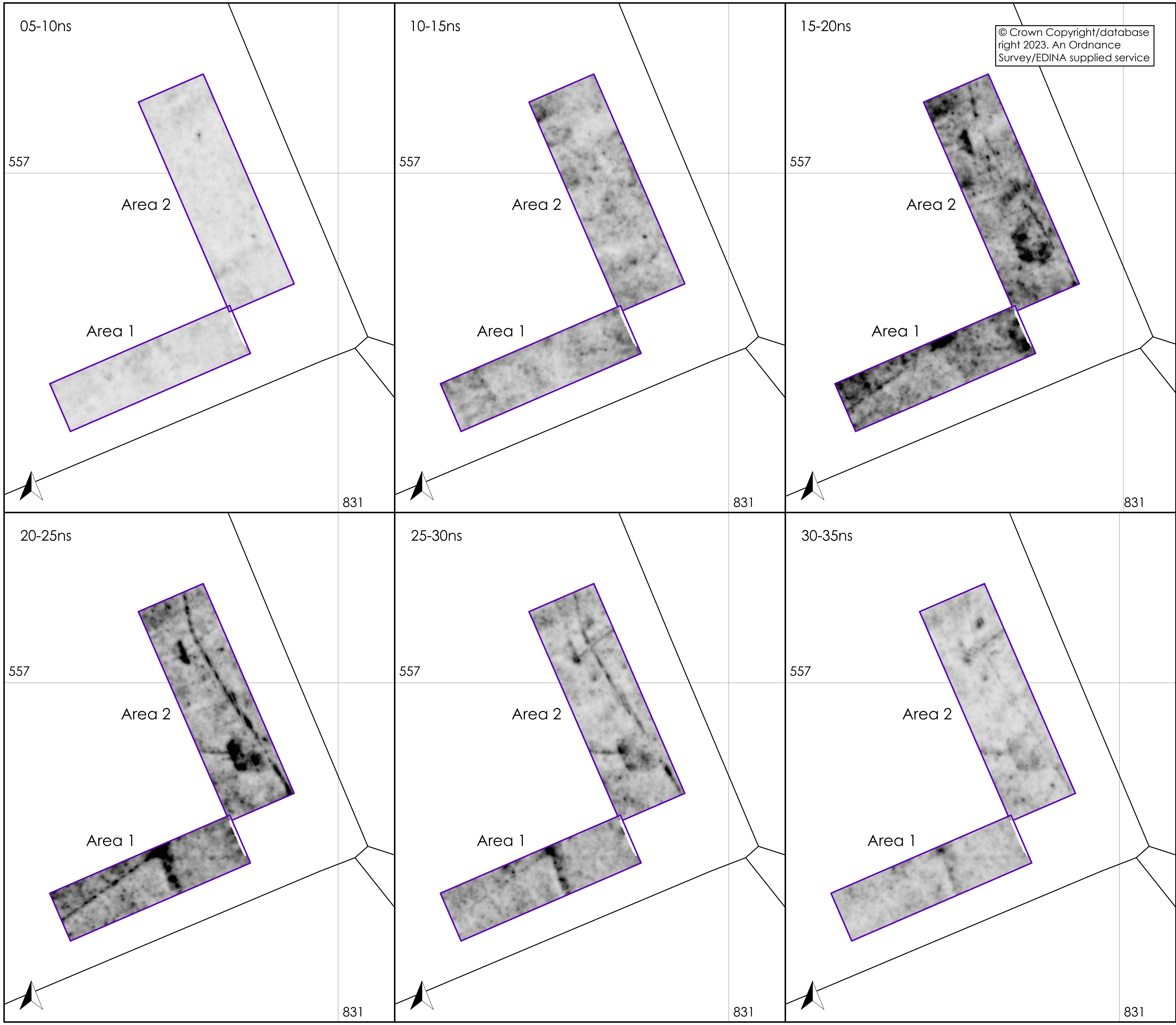

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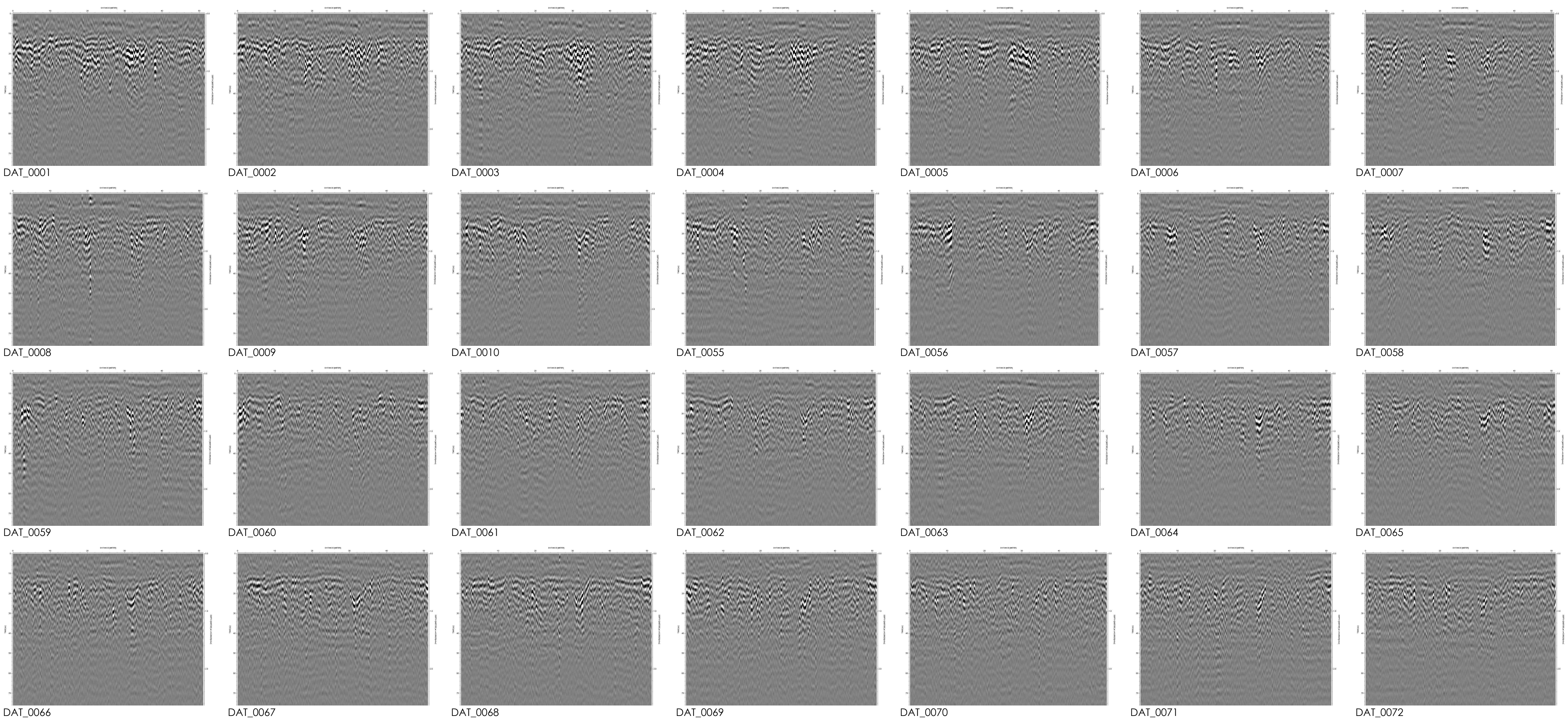
Figure 10: GPR time-slices

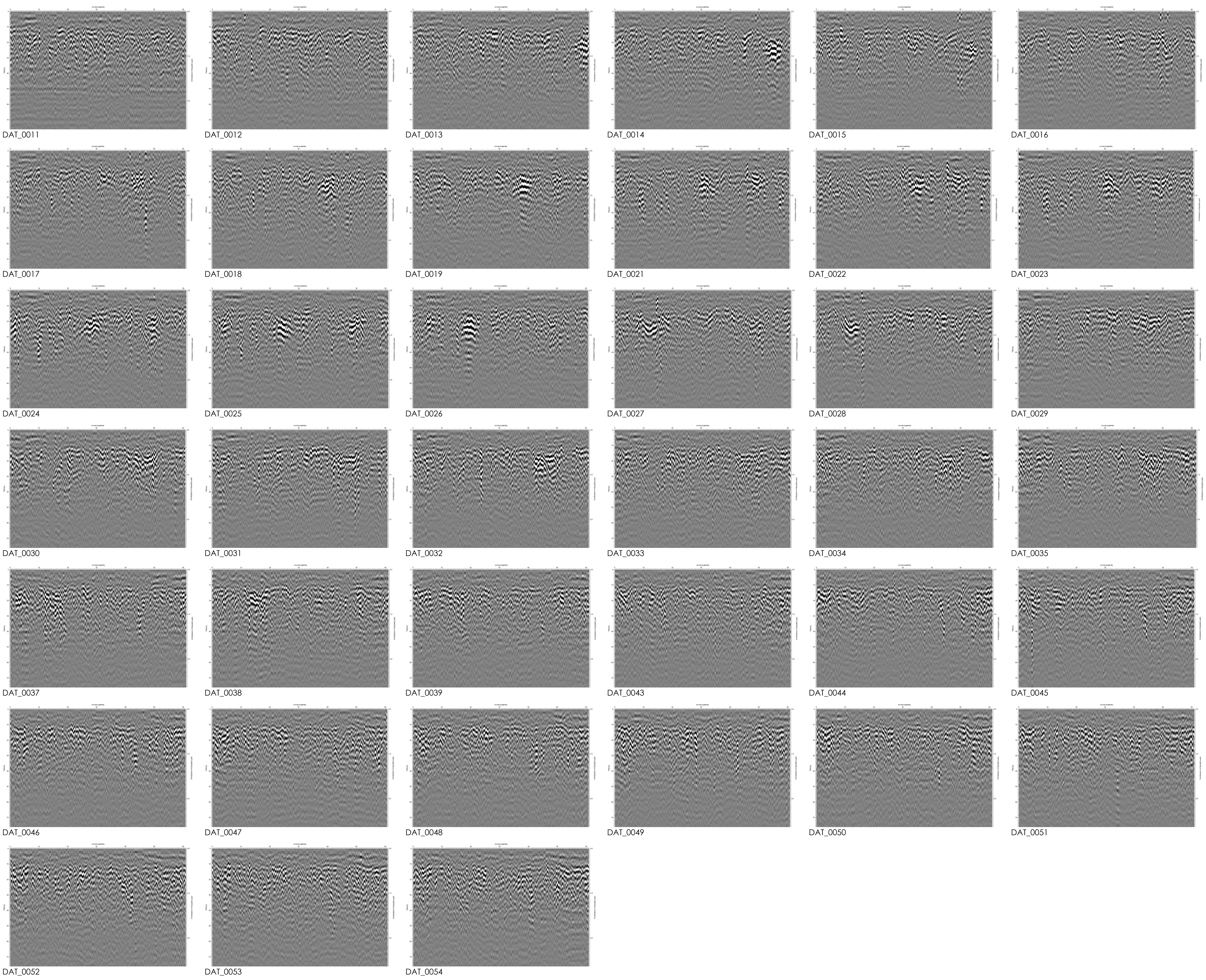
0 50m
scale 1:1000 for A3 plot

GPR outline

Area 1



Area 2



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scale 1:1250 for A2 plot

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Figure 11: GPR profiles

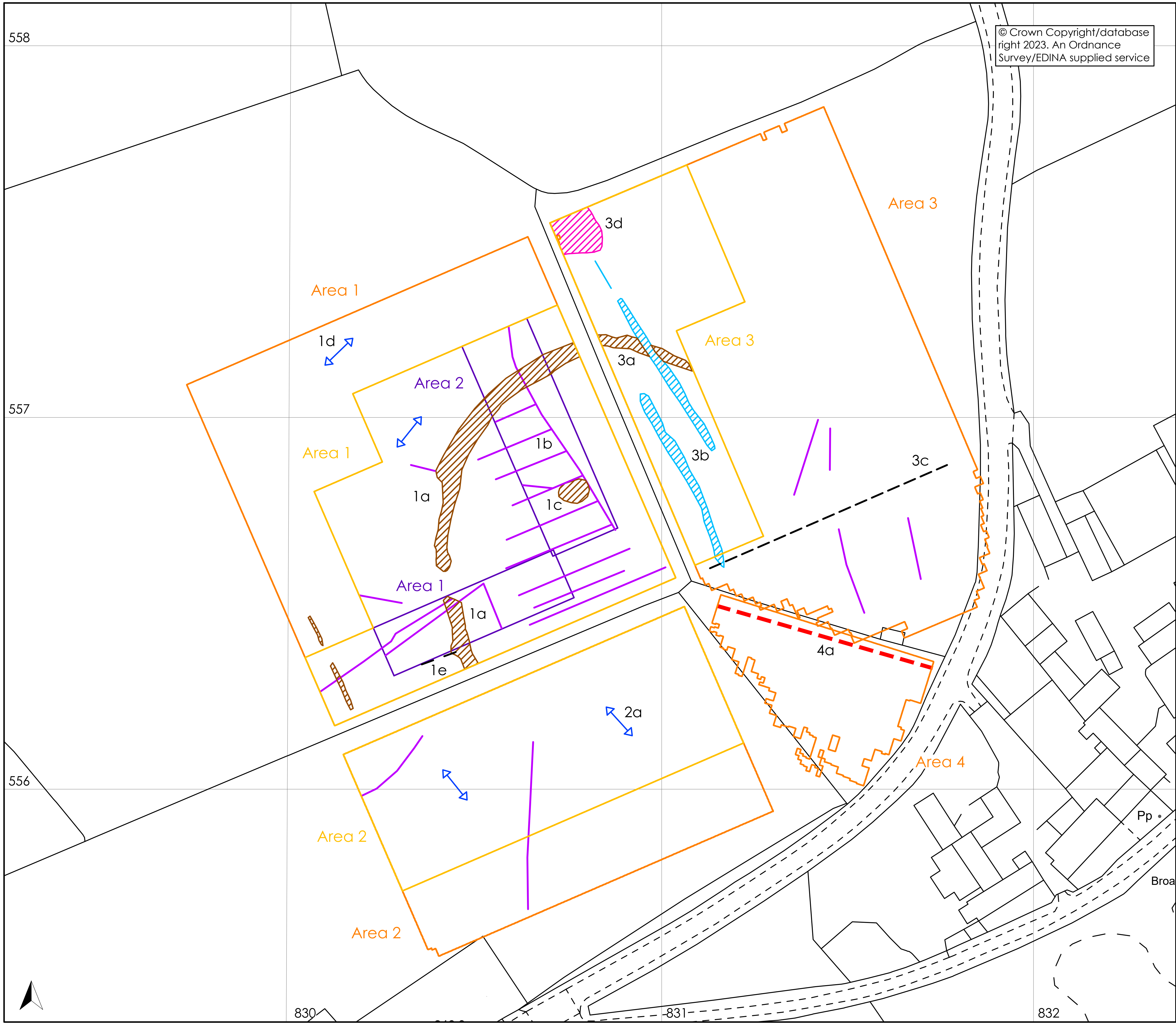

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Figure 12: Archaeological interpretation

0 50m
scale 1:1000 for A3 plot

- magnetometer survey
- resistance survey
- GPR outline
- soil-filled feature
- disturbed area
- former lynchet
- former ploughing
- former track
- utility
- land drain

not to scale

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Figure 13: Panoramic view from the possible henge