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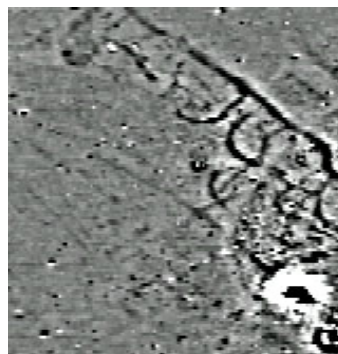
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GEOPHYSICAL SURVEY REPORT 2006/45

STILTON, Cambridgeshire



Client:



SITE SUMMARY SHEET

2006/45 Stilton, Cambridgeshire

NGR: TL 1740 9030 (Area 1); TL 1690 8984 (Area 2)

Location, topography and geology

The site is located between 1km and 1.5 km east of the town of Stilton, Cambridgeshire. The areas of interest occupied two gently undulating arable fields. The site soils are of the Hanslope association (411d), comprising slowly permeable calcareous clayey soils overlying chalky till (SSEW 1983).

Archaeology

Previous archaeological work indicates the presence of a Roman settlement at Stilton. In one of the fields (Area 1), distinct circular areas of industrial debris are visible which suggest the presence of kilns, while possible building remains can be seen in drainage ditches surrounding the second field (Area 2).

Aims of Survey

The aims of the geophysical survey were to identify and accurately locate the possible kiln structures and provide additional evidence for settlement and associated activity in the vicinity. The work was carried out for **Channel 4** as part of a **Time Team** investigation of the site.

Summary of Results *

In Area 1 gradiometry has identified several possible kilns and revealed a wealth of ditch and pit-type anomalies indicating settlement and peripheral features. The results suggest at least two phases/periods of activity at the site. Limited GPR survey failed to identify the kilns and the poor results are attributed to geological factors together with the extremely dry conditions prevailing at the time of survey.

A small corner of the second field (Area 2) was investigated with gradiometry; the results show two possible ditch type anomalies, but the limited size of the survey area precludes a more complete interpretation.

* It is essential that this summary is read in conjunction with the detailed results of the survey.

SURVEY RESULTS**2006/45 Stilton, Cambridgeshire****1. Survey Area**

- 1.1 Detailed gradiometer survey was carried out using Bartington Grad 601-2 instruments, at two locations of interest identified by Time Team. The main survey block (Area 1) was positioned to investigate potential kiln sites (suggested by surface material) in the southwestern corner of an arable field containing a sugar beet crop. Survey in this field was expanded to 'follow' anomalies of potential interest. The second area of interest (Area 2) was located in a field corner at the junction of two small waterways. The field was under a mature wheat crop which was unsuitable for survey, but a small area was cleared to enable data collection.
- 1.2 GPR data were collected over two of the potential kiln anomalies identified by the gradiometer survey in Area 1. A small number of exploratory radargrams were collected within the trench that was dug in Area 2.
- 1.3 The survey grid was set out by **GSB Prospection** using points established and tied in by **Dr Henry Chapman** using a Trimble differential GPS system. The location of the survey areas is shown in Figure 1 at a scale of 1:5000.

2. Data Processing and Display

- 2.1 The magnetic data have been pre-processed by removing baseline shifts due to zig-zag data collection. Where appropriate traverses have been corrected for minor misalignments; these are due to variations in walking speed, which are usually a result of ground conditions or topography. No filtering has been undertaken on the gradiometer datasets. For display as greyscales, the data have been interpolated to improve the visual quality of the images.
- 2.2 The GPR data traverses (*radargrams*) have been reconstructed to form a 3-dimensional block of data which has been 'sliced' horizontally to produce plan maps (*time-slices*) of responses at increasing depths. Selected time-slices annotated with interpretations have been plotted in Figure 5 with a small selection of example radargrams included in Figure 6. In general, processing of the GPR data is kept to a minimum unless the outcome of applying some form of filtering is deemed to be specifically effective in refining the data plots.
- 2.3 Figures 2 to 4 present summary greyscales and interpretations of the gradiometer data, superimposed on the mapping, at a scale of 1:1000. The GPR data are presented as selected time-slices and radargrams, at varying scales in Figures 5 and 6.
- 2.4 An archive CD included with the report contains XY trace plots, greyscale images and interpretations of the gradiometer data presented at 1:500 (Figures A1 to A13). For display at this scale Area 1 has been subdivided.
- 2.5 The display formats and the interpretation categories used are discussed in the *Technical Information* section at the end of the text.

3. General Considerations - Complicating factors

- 3.1 Conditions for survey were good, the land being gently undulating and free from obstructions. Although low sugar beet stalks were present in Area 1, these did not significantly hinder data collection with either technique.
- 3.2 Depths have been indicated on the GPR diagrams, but these have to be viewed with caution. The conversion from time to depth depends on the velocity of the electromagnetic signal through the ground. This velocity may vary markedly over relatively small distances (both laterally and vertically) and, as a result, any depth conversion *is only an approximation*. An average velocity of 0.08m/ns has been used for the time to depth conversions following velocity analysis using graphical methods, which involve the fitting of curves to point source reflections.
- 3.3 Where there is a strong electromagnetic contrast, the GPR signal can be inter-reflected or reverberated, producing a delay in the reflection of the signal. This is termed 'ringing'. This happens, to some extent, with all reflections and results in a greater apparent depth than actually exists. As a result, it is often not possible to detect the base of features; only the tops of buried deposits/features are detected with certainty (Annan 1996).

4. Results of Gradiometer Survey

Area 1

- 4.1 Anomaly (1) is a single discrete response, whose shape suggests an intact kiln, possibly with the flue or flues surviving. Although there are hints that it might lie at the corner of a broadly rectangular enclosure, anomalies (2) and (3), this interpretation is tentative due to two factors. The feature represented by (1) has produced a strong magnetic shadow, roughly 20m in diameter which has obscured any weaker responses that might be present and hampered definition of the western arm of (2). Additionally the responses (3) are ill-defined and may not be part of a coherent linear feature. Excavation of (1) initially revealed only an area of intense burning which is unlikely to account solely for the magnetic response. Continued investigations uncovered parts of an intact kiln of tile/brick construction, of Roman date.
- 4.2 A second possible kiln type response is located at (4) and as with (1) noted above, it has a magnetic shadow masking weaker responses in the immediate vicinity. In this instance, however several stronger responses can be identified which may reflect associated activity. A rectilinear ditch type anomaly is visible at (5); the magnitude of this response indicates a ditch filled with highly enhanced material, such as would be expected from a kiln site. There is an apparent break in the western arm of (5), but because of its position close to the grid/field edge, its significance remains uncertain. The northern arm of (5) becomes increasingly weaker and indistinct; anomaly (6) might indicate an eastern arm of the feature, forming part of a rectangular enclosure, but this interpretation is tentative. A trench placed over (4) revealed human skeletal remains overlying a kiln (the bodies will have produced no magnetic signal) while anomaly (5) was confirmed to be a ditch.
- 4.3 South of (5), part of a second possible enclosure ditch (7) can be seen, although the responses are slightly less coherent. It is on a different alignment to (5)/(6) and may cross the latter, although at this point the anomalies are on the grid edge, making it difficult to assess any relationship between the two. Within (7) there is a general increase in the levels of background magnetic response and a number of truncated ditch and pit type anomalies have been highlighted which are probably archaeological (given the wider context), but whose precise function remains unclear.

- 4.4 Anomaly (8) has a form and magnitude suggesting an industrial feature such as a kiln, and as with (4) above, it is located adjacent to a strong rectilinear anomaly (9), suggesting a ditch filled with industrial waste. Anomalies (10) continue the rectilinear pattern and may represent the same feature, possibly part of a large rectangular enclosure.
- 4.5 The responses at (11), although strong, are not typical of an industrial feature - they are several orders of magnitude weaker than those recorded at (1), (4) and (8). However, the shape of the responses - a circle approximately 10m in diameter with a central "pit" - clearly indicates an archaeological feature and warranted further investigation. Excavation revealed a kiln constructed of burnt stone rather than brick/tile and this accounts for the comparatively reduced magnetic response.
- 4.6 Linear ditch type anomaly (12) extends roughly east-west across the entire survey area. The magnitude of the response varies along its length; the further from the core of industrial activity, the weaker the magnetic response, indicating a difference in the ditch fill. A number of anomalies extend from (12) to the south, forming a pattern of rectilinear and curving enclosures, that could indicate settlement plots. A modern public footpath follows the line of (12) and it is possible that this Right of Way has its origins in antiquity.
- 4.7 The area to the northwest of (12) is magnetically quiet with few clear archaeological type anomalies detected. The faint anomalies at (13) and (14) may be of interest as they are on the same alignment as (12) and could represent associated (albeit peripheral) features. Several parallel trends have been highlighted but these are likely to reflect modern cultivation. The data to the southwest of (12) and its associated enclosures are also magnetically quiet. Although a few pit type anomalies and trends have been highlighted, they are difficult to define and interpret with any degree of certainty. Many of the trends could be the product of more recent agricultural activity.
- 4.8 Evidence of another phase of occupation at the site is provided by responses (15) and (16). The former is a short ditch type anomaly whose strength is attributed to the fact that it crosses the possible industrial feature (8) noted above and therefore has a magnetically enhanced fill. Anomalies (16) comprise narrow bands of magnetically "quiet" (or possibly even slightly negative) responses. Together these form a roughly oval or egg shaped enclosure with axes measuring 100m and 80m. Most of the area within the oval is dominated by the strong industrial and ditch type anomalies discussed above; however in the northwestern quadrant, the level of magnetic response is reduced and a number of weak trends and pit type anomalies can be seen which might indicate features associated with the oval enclosure. Excavations confirmed the presence of a ditch and suggested an Anglo-Saxon date for this feature, in which case some of the aforementioned weaker anomalies could be evidence for Anglo-Saxon settlement.
- 4.9 Two roughly parallel truncated linear anomalies (17) and (18) extend northwards from (15). Again, the strength of the response is attributed to their relative proximity to industrial features. They could reflect ditches appended to the oval enclosure; however, there are hints that the responses extend across this feature. Anomaly 17 may continue as faint trends (?17) possibly forming part of a large enclosure to the north. The possible continuation of (18) is less clear; it may be represented by a short linear (?18a) or a barely discernible trend (?18b). The highly indistinct nature of these responses makes this interpretation tentative.
- 4.10 Several small scale ferrous anomalies or "iron spikes" are scattered throughout the area. These are typical of small pieces of iron or other strongly magnetic debris buried in the topsoil and are usually assigned a modern origin. Given the wider archaeological context, in this case it is possible that some of these anomalies reflect pieces of unstratified iron, brick or other fired material of greater antiquity.

Area 2

- 4.11 Two broad parallel linear anomalies have been detected extending across this area. They could be archaeological ditches, although the form of the response seems more suggestive of natural features. There are hints of further possible ditch or pit type responses extending from the western putative ditch. Unfortunately the limited size of the survey precludes any firm interpretation.

5. Results of GPR Survey

Area 1 - West

- 5.1 Little is shown in the time-slices (Figure 5) below a depth of 0.5m. The lack of deep responses is illustrated quite obviously in the radargrams (a typical example of which is included in Figure 6), as is the lack of any obvious structural features. An area of increased response has been noted and lies in the approximate position of the kiln structure, but it is nothing more than a spread of increased reflectivity. The most apparent features are those induced by agricultural intervention.
- 5.2 After excavation, a small number of radargrams were collected immediately north of a sondage dug into the heart of the kiln structure. One of these is included in Figure 6 and it can be seen that even with the overburden removed the response from the kiln is not very strong or well defined.

Area 1 - East

- 5.3 As with the western survey block, there is little to show in the time-slices of the kiln structures buried beneath. Again, ploughing striations are apparent and a relatively strong linear response is coincident with the magnetic ditch-type anomaly (5), discussed previously.

Area 2

- 5.4 Within this area, GPR survey was limited to a small number of exploratory traverses in the bottom of the trench. The intention was to look for any structural remains. As can be seen from the example radargram in Figure 6, the radargrams showed nothing.

6. Conclusions

- 6.1 In Area 1, the gradiometer survey has detected a wealth of archaeological anomalies suggesting industrial activity, settlement and more peripheral features, with at least two periods of occupation indicated. Evidence for both Roman and Anglo-Saxon activity at the site was subsequently confirmed by excavation. The size of Area 2 was limited due to a mature crop and, although anomalies of possible interest were identified, very little can be said about their precise nature.
- 6.2 The results of the GPR survey were somewhat disappointing; it appears that the clayey soil conditions have severely limited penetration. The hot weather at the time of survey had baked the topsoil which seemingly resulted in an insufficient contrast between the kiln structures and the surrounding material for them to show distinctly.

Project Co-ordinator: C Stephens
Project Assistants: J Adcock, J Gater & G Taylor

Date of Survey: 6th - 8th June 2006
Date of Report: 11th September 2006

References:

- Annan A. P. 1996 *Ground Penetrating Radar Workshop Notes*, Sensors & Software Inc., Canada.
- SSEW 1983. *Soils of England and Wales. Sheet 4, Eastern England.*
Soil Survey of England and Wales.

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PROJECT: 2006/45 STILTON
TITLE: Location Diagram
Based on digital mapping provided by Time Team



■ Gradimeter Survey
▨ GPR Survey

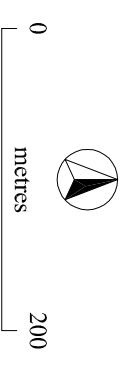


Figure 1

GSB PROSPECTION Ltd.

PROJECT: 2006/45 STILTON

TITLE: Gradimeter Survey - Area 1:
Summary Greyscale

Based on digital mapping provided by Time Team

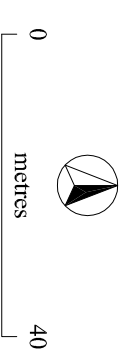
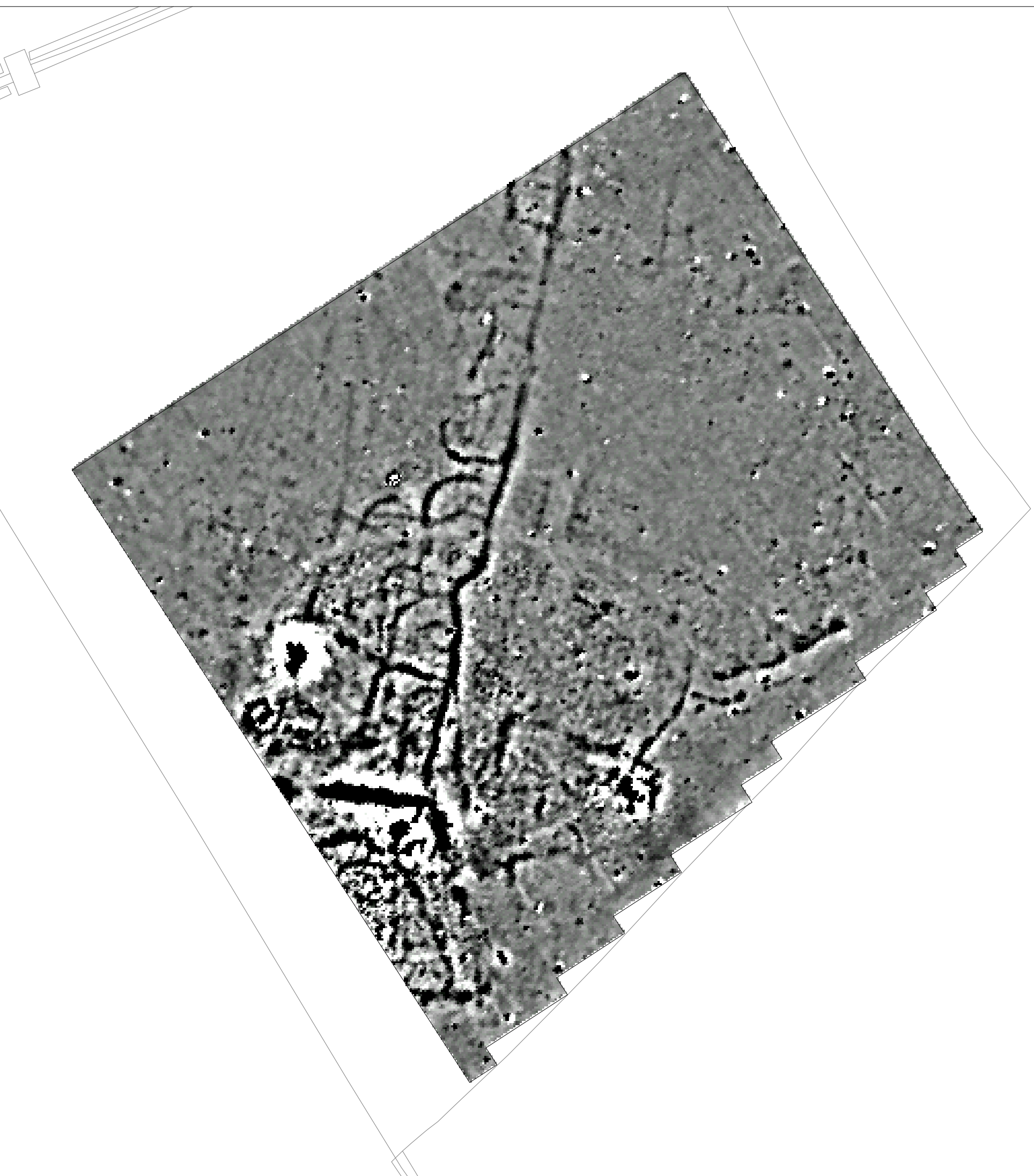


Figure 2

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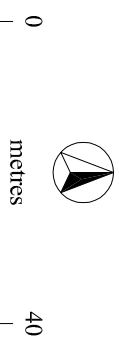
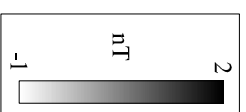
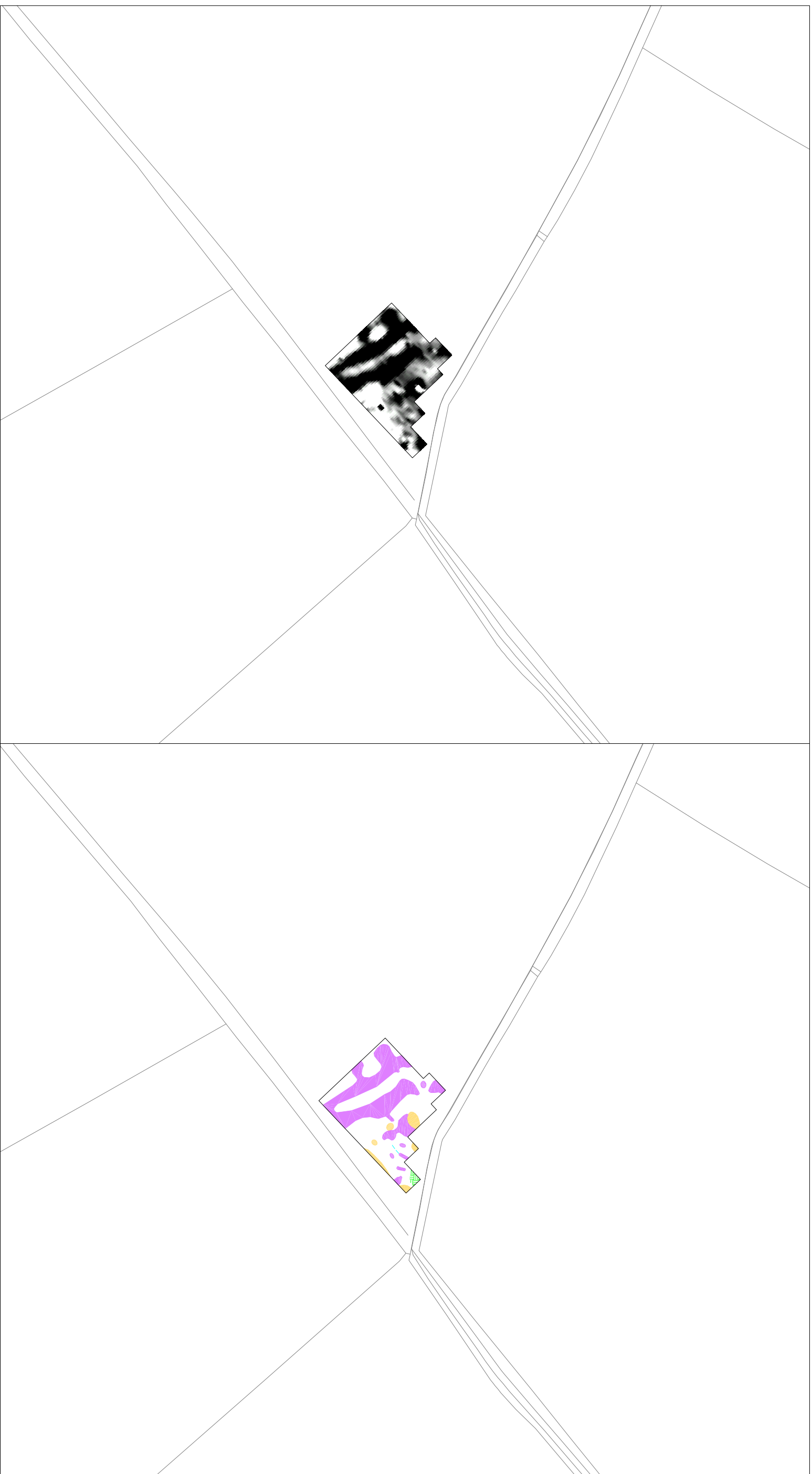
PROJECT: 2006/45 STILTON

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Based on digital mapping provided by Time Team



Figure 3





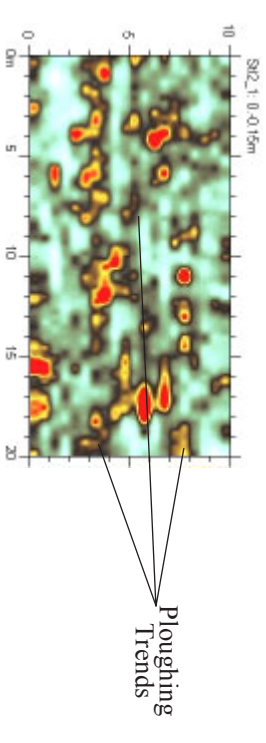
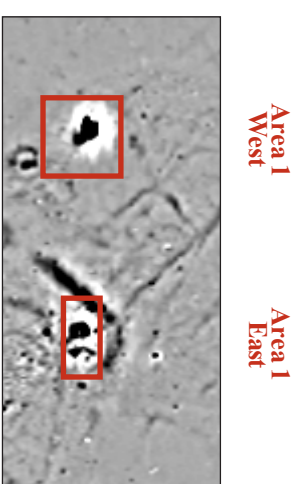
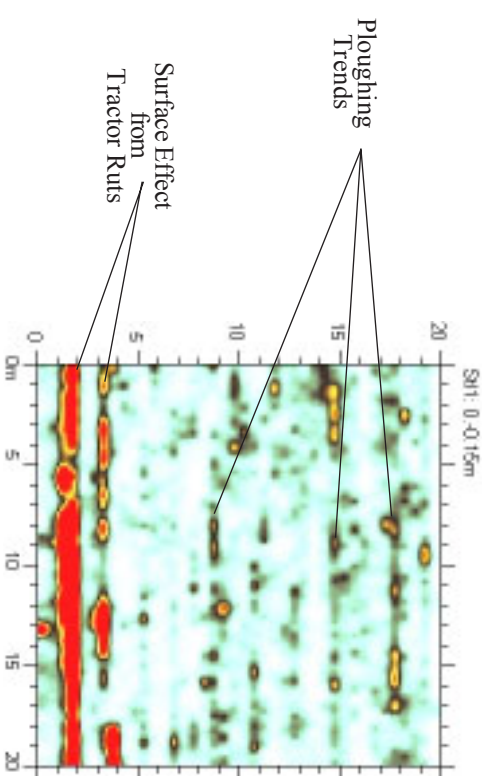
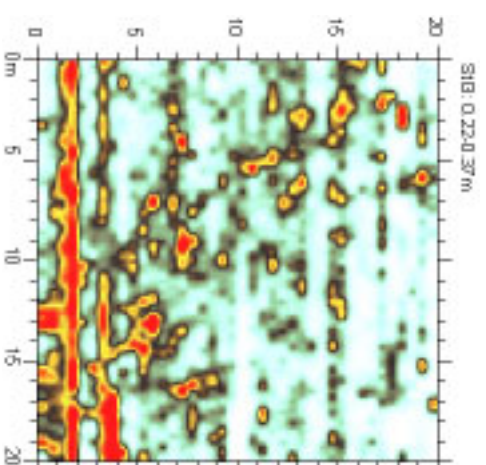
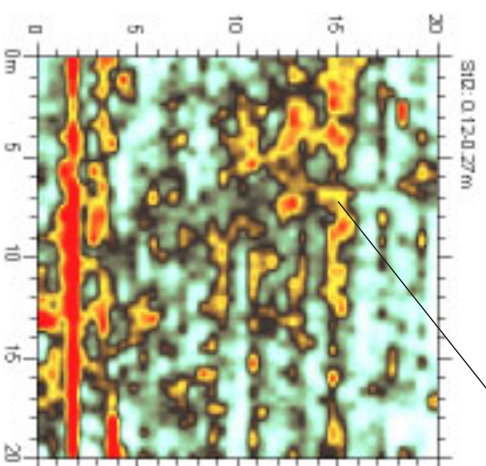
-  ?Archaeology
-  ?Natural
-  Ferrous
-  Trend

Figure 4

STILTON GPR Survey - Selected Time-slices

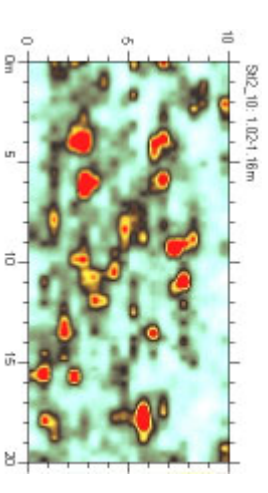
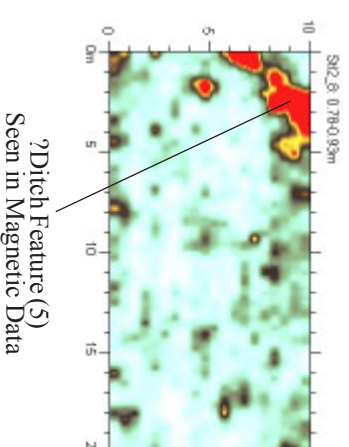
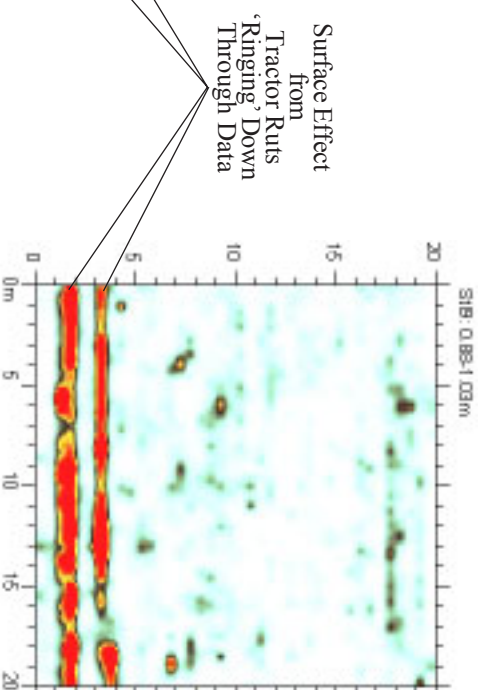
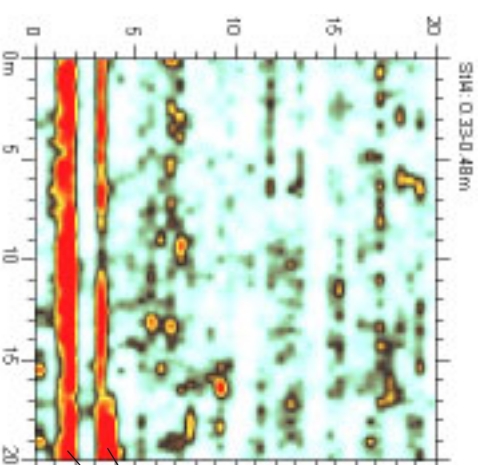
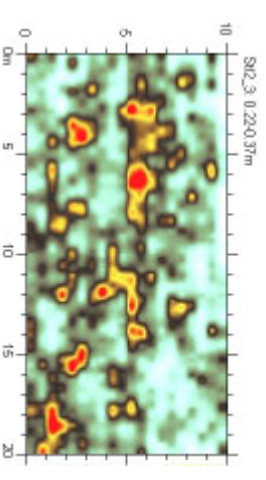
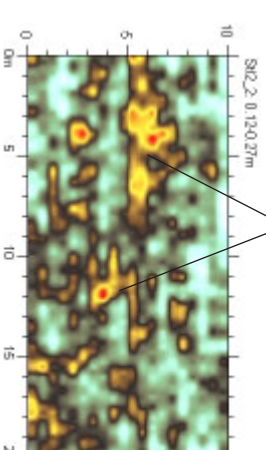


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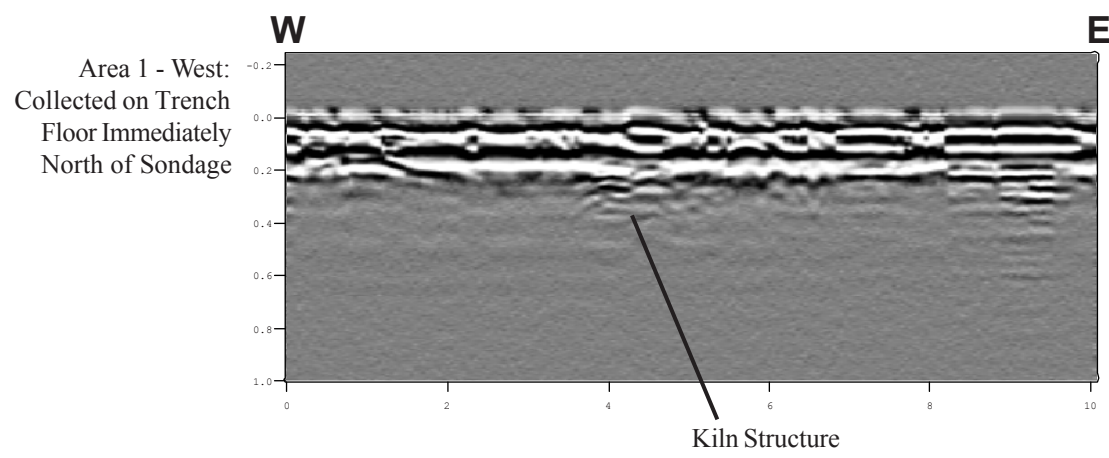
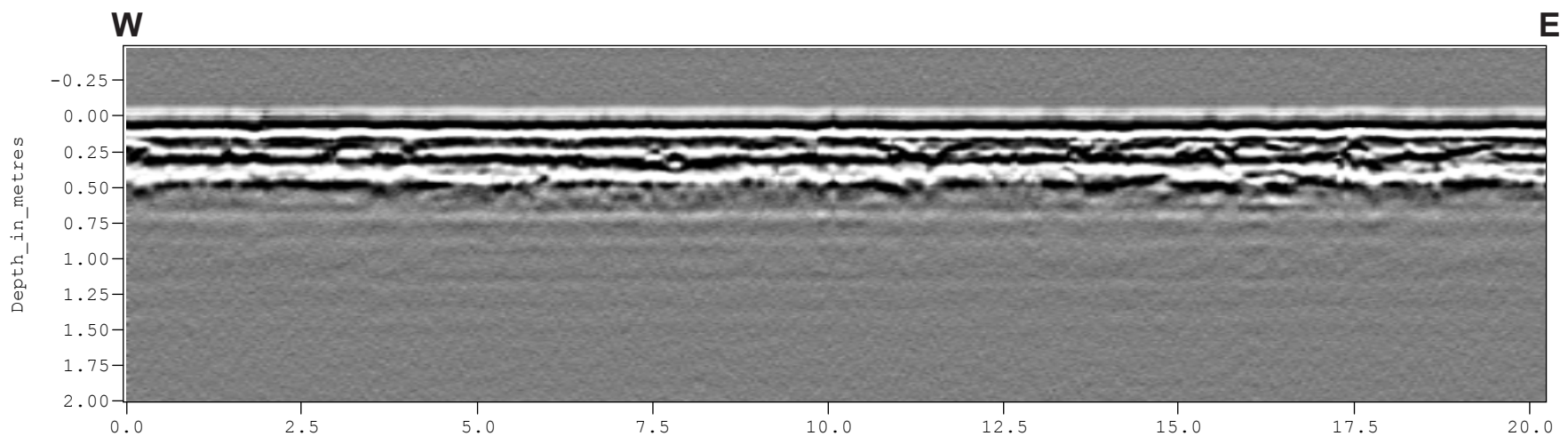
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Plot Axes

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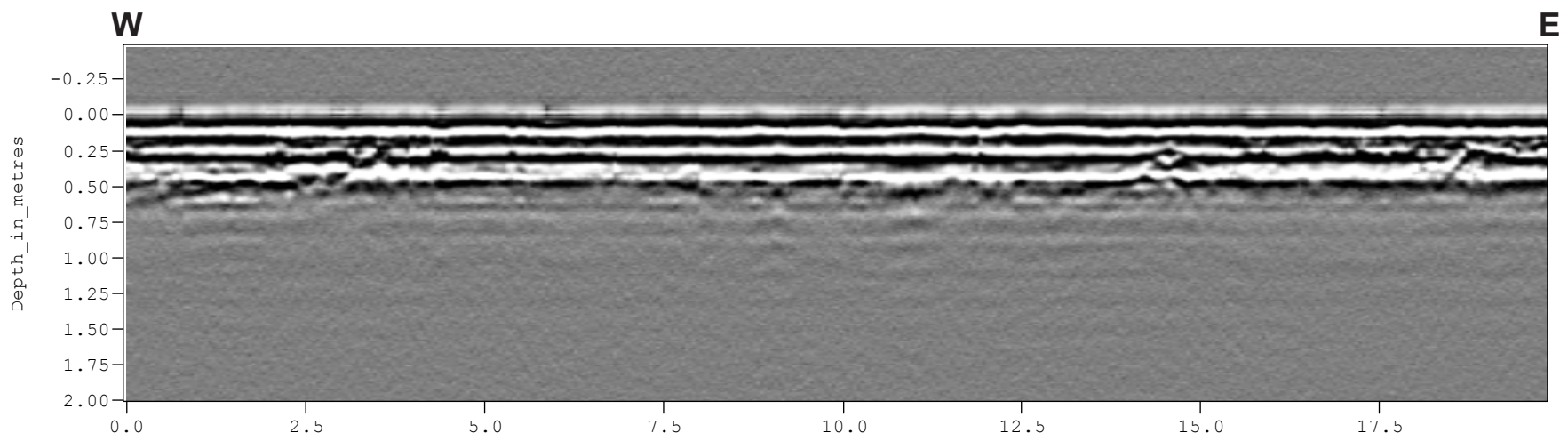


STILTON GPR Survey - Selected Radargrams

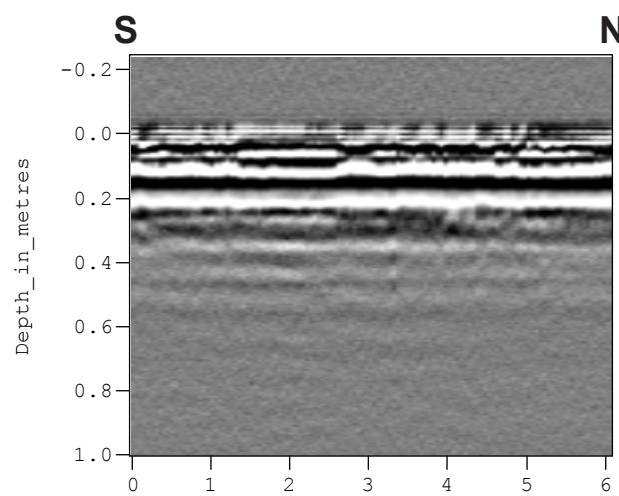
Area 1 - West



Area 1 - East



Area 2



For Scale
See Individual
Plot Axes

STILTON
Gradiometer Survey - Area 1A

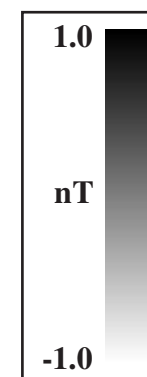
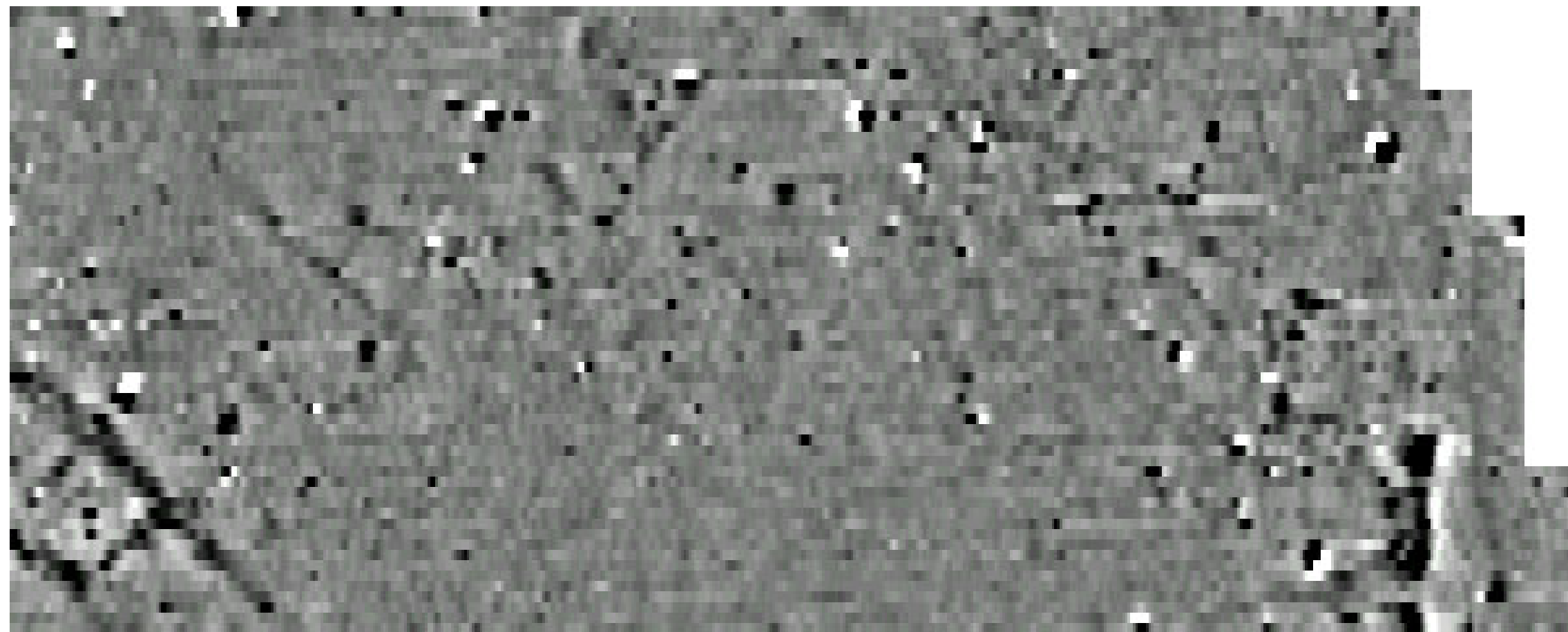


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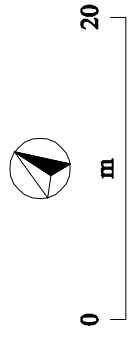
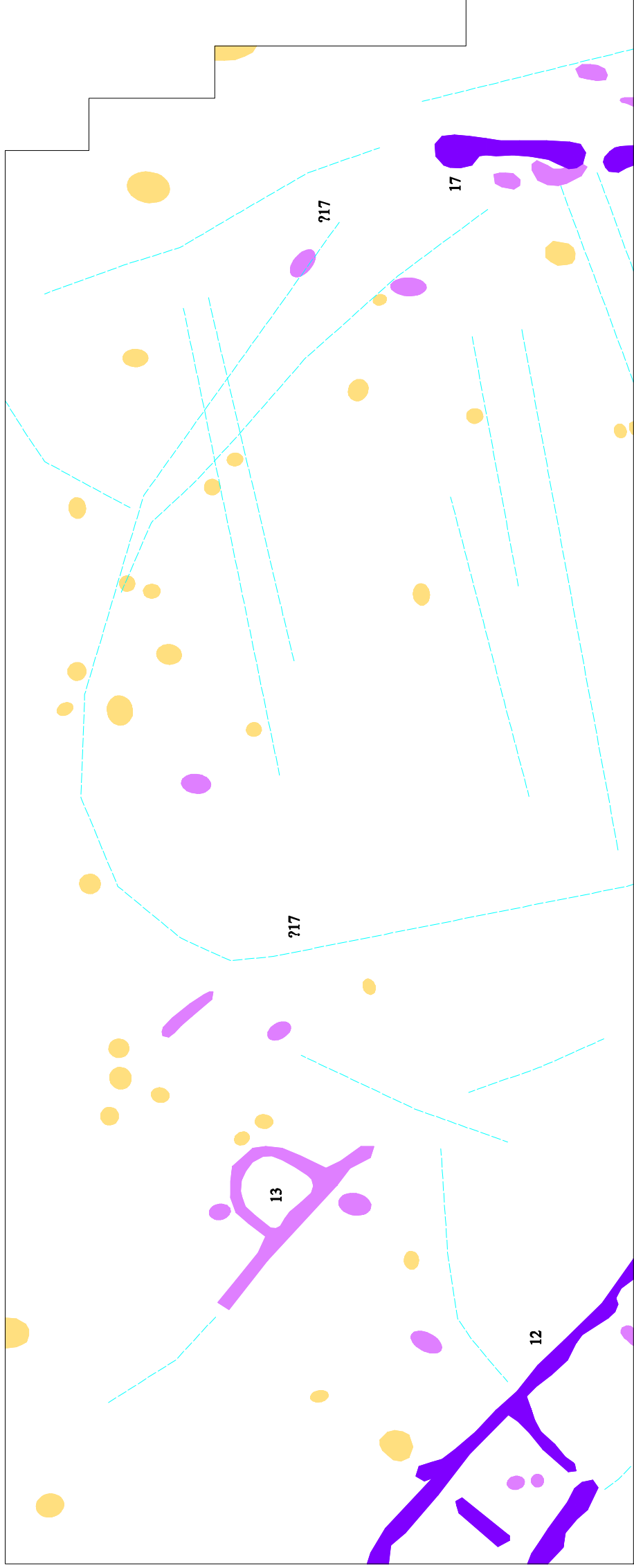


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Gradiometer Survey - Area 1A



STILTON Gradiometer Survey - Area 1A



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Gradiometer Survey - Area 1B



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Gradiometer Survey - Area 1B

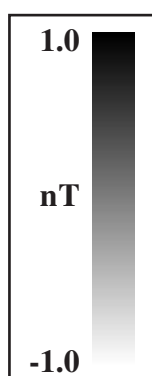
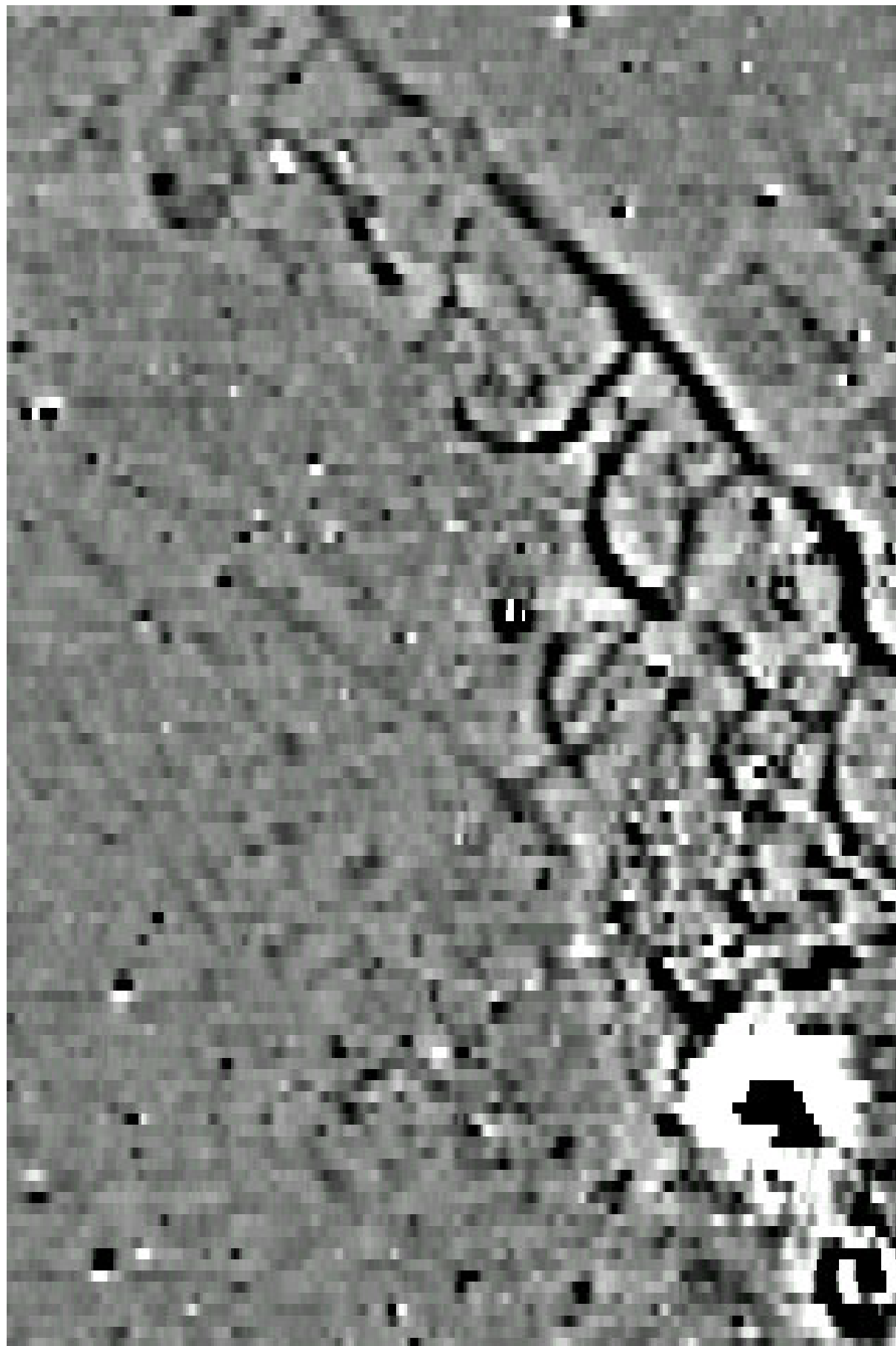


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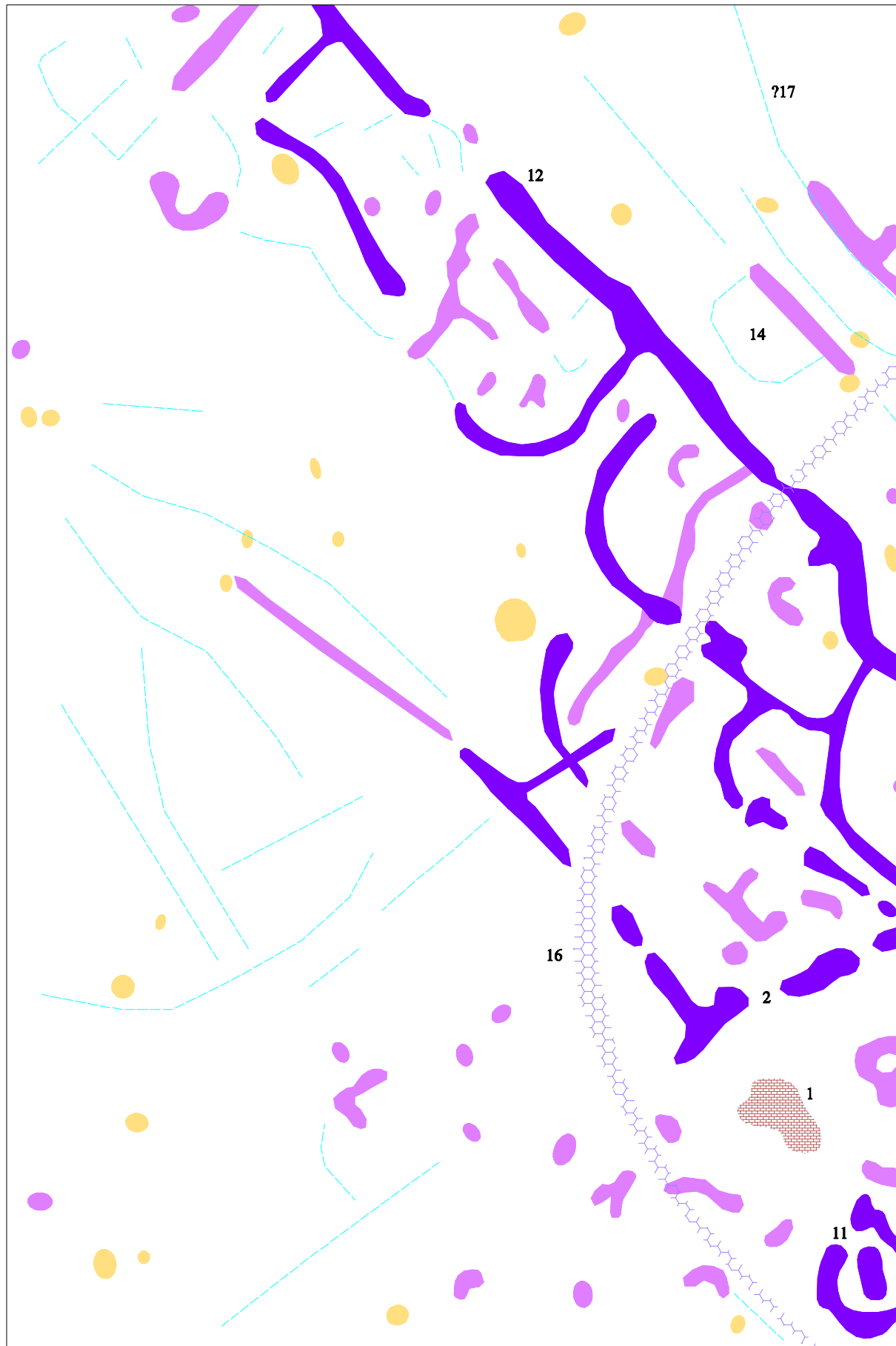
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




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Gradiometer Survey - Area 1B



STILTON

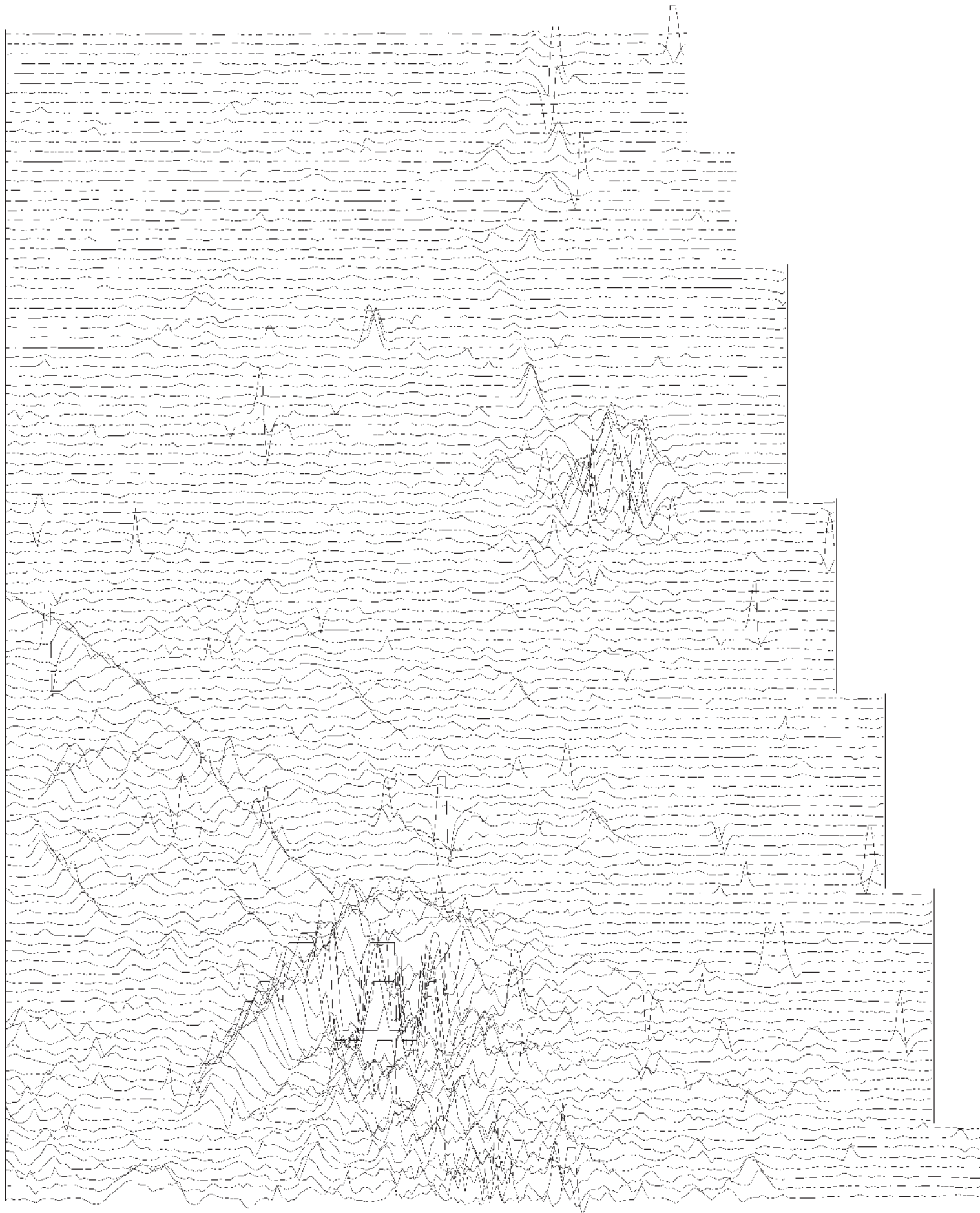
Gradiometer Survey - Area 1B



-  Archaeology
-  Industrial - Kiln
-  ?Archaeology
-  Weak Negative Anomaly - ?Archaeology
-  Trend
-  Ferrous



STILTON
Gradiometer Survey - Area 1C



15 nT



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Gradiometer Survey - Area 1C



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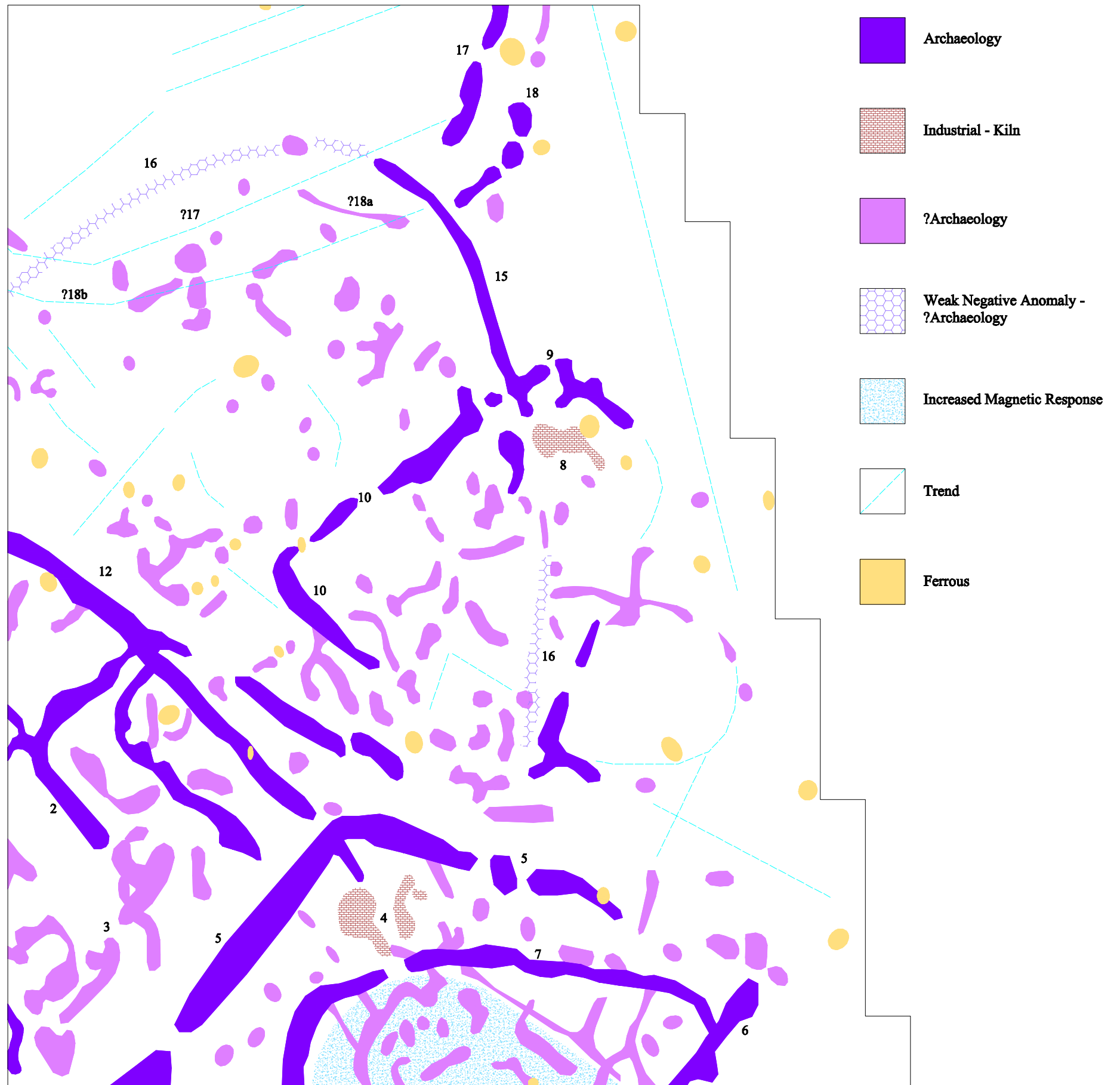


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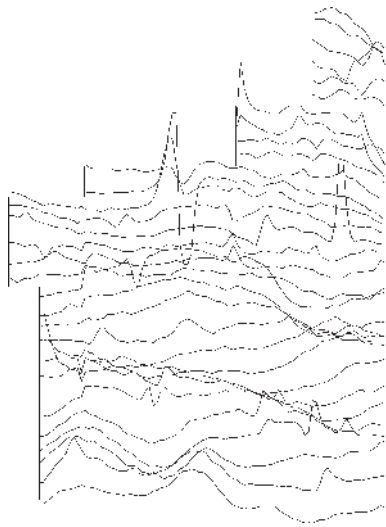


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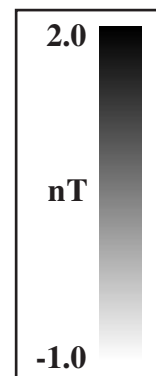


STILTON

Gradiometer Survey - Area 2



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STILTON

Gradiometer Survey - Area 2

