



**GEOPHYSICAL SURVEY REPORT
2009/44**

Northern Green, Westminster Abbey



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Specialising in Shallow and Archaeological Geophysics

GSB Survey No. 2009/44

Northern Green, Westminster Abbey

NGR	TQ 2998 7946
Location	Westminster Abbey, London
County	Greater London Authority
District	City of Westminster
Topography	Flat
Current land-use	Grass
Soils	Unclassified 'Urban' soil (<i>Soils of England and Wales. Sheet 6, South East England. Soil Survey of England and Wales. 1983</i>)
Geology	Alluvium
Archaeology	Westminster Abbey is a World Heritage Site and, in addition to the current abbey buildings, a number of earlier ecclesiastical structures have been built on the site. A Saxon monastery was recorded in the vicinity until fire destroyed it in the 9 th Century. Benedictine monks set up a centre around 960AD and Edward the Confessor established an abbey church on the site and a palace nearby between 1045 and 1050. The abbey was rebuilt in 1245 by Henry III and added to again in 1503 by Henry VII. Finally two towers were added between 1722 and 1745 and the whole church was extensively restored between 1849-78 (Mower and Rodwell 2009, <i>Proposed Archaeological Excavation Northern Green, Westminster Abbey, London. Unpublished research design.</i>)
Survey Methods	Ground Penetrating Radar

Aims

To locate and characterise any anomalies of possible archaeological interest within the application area. The work forms part of a wider archaeological assessment being carried out by **Time Team** for **Channel 4**.

Summary of Results*

The footprint of the original 13th century Sacristy has been recorded along with some associated detail within and adjacent to the structure, including a cross-wall and possible burials. Responses born of a medieval sunken chamber, post-medieval structures and 19th century investigations have also been found. Broad zones of reflections seem most likely to be evidence of the post-Sacristy row of buildings which ran along the north side of the Nave from the 17th century whilst, further north, a number of potential stone casket burials have been identified. The hexagonal Watch House, depicted in an 18th century plan has not been found. The definition of many of the archaeological elements has been denuded slightly by subsequent phases of utility installation.

Project Information

Project Co-ordinator: J Adcock
Project Assistants: Dr. J Gater & E Wood
Date of Fieldwork: 15th – 17th September 2009
Date of Report: 22nd January 2010

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

Survey Specifications

Method

The survey grid was set out using tapes and tied in to the Ordnance Survey (OS) grid using a Trimble RTK GPS system by **Dr Henry Chapman**.

Technique	Traverse Separation	Reading Interval	Instrument	Survey Size
Magnetometer - Scanning (Appendix 1)	-	-	-	-
Magnetometer – Detailed (Appendix 1)	-	-	-	-
Resistance – Twin Probe (Appendix 1)	-	-	-	-
Ground Penetrating Radar (GPR) (Appendix 1)	0.25m (Areas 1&2) 0.50m (Area 3)	0.05m	Sensors & Software Noggin SmartCart ^{plus} 250MHz	~0.2ha

Data Processing

	Magnetic	Resistance	GPR
Zero Mean Traverse	-	-	N
Step Correction	-	-	N
Interpolate	-	-	Y
Filter	-	-	As Indicated

Presentation of Results

Report Figures (Printed & Archive CD): Location, data plots and interpretation diagram on base map (Figures 1-3). Reference plots (Figures 4-8)

Plot Formats: See Appendix 1: Technical Information, at end of report.

General Considerations

Conditions for survey were generally good, though sporadic heavy rain during the three days on site caused the electrical nature of the soils to change. This produced some variation within the survey areas resulting from data collected at different times.

Any depths referred to in the interpretation of GPR data *are only ever an approximation*. The conversion from delay time to depth depends upon the propagation velocity of radar waves through the ground; this can vary significantly both laterally and vertically on sites such as this. An average velocity of 0.07m/ns has been used after an iterative process of fitting hyperbolic curves to point-source reflections. 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 and happens to some extent with all reflections, resulting 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 are detected with any kind of certainty (Annan 1996).

Results of Survey

1. GPR Survey

All references to plans, drawings and the history of the site are taken from Mower & Rodwell, 2009 (see Site Summary Sheet, for further details).

Area 1

- 1.1 The shallow slices starkly demonstrate the difficulties presented by this site – primarily the sheer number of services that cross the survey area. The majority are relatively shallow, but the responses can mask, or at least diffuse, the reflections from surrounding and deeper archaeological deposits.
- 1.2 The prime complication is the cable route that unfortunately follows the line of the Sacristy inner wall; therefore the linear anomaly (1) is a result of the cable and trench in the shallower slices, and the wall footings in the deeper slices. The outer wall (2) is relatively well defined as is the internal cross wall (3) – although the latter response is somewhat complicated by the remains of a medieval sunken chamber (4) as well as the adjacent floodlight housing. Other post-medieval structures and responses pertaining to the 19th century excavation of the site are likely to have caused the majority of responses around and to the east of (4), where further structural remains and a buried surface were uncovered between the services.
- 1.3 Some amorphous reflectors (5), which are within the Sacristy footprint, are difficult to interpret but it seems likely that these are of archaeological origin. The question that remains, however, is whether they relate to something contemporary with the Sacristy (i.e. burials or other former subterranean feature) or they are a result of the 17th century prebendal buildings that stood on the site after the Sacristy was demolished. There is a similar question about responses (6), north of the Sacristy, and (7) within the cloistered area – there are known to have been burials across this area, but the aforementioned buildings may well have had footings running through here. The possibility exists that a more mundane interpretation is applicable for (7), such as a drain, soak-away or similar.
- 1.4 The zones of increased response (8) are interesting as they appear to be on a similar orientation to the graves excavated by George Gilbert Scott near this location in the 19th century. This may be an indication of this disturbance, or a coincidental variation in the subsoil brought about through one or more of the multiple phases of activity.
- 1.5 Some of the more isolated anomalies have produced very strong, flat reflectors in the radargrams. These have been tentatively identified as potential casket (most likely stone) burials - this interpretation remains tentative as they could be isolated structural elements, but given the other sarcophagi found, the former interpretation must be considered.
- 1.6 Although a drainage pipe flanks the edge of the Abbey buttresses, it seems likely that the responses seen at depth, between and around them, are an effect of the original stepped foundations.

Area 2

- 1.7 As with the previous area, the shallow slices are dominated by the effects of services, such as drains, cables and pipes which have again complicated interpretation. The western end of the Sacristy is likely to have run down the right-hand side of this survey area towards the buttress immediately west of the north door into the nave, but only a short section of this is visible and, even then, the interpretation is somewhat tentative.

- 1.8 There is a broad zone of increased response and more discrete, yet still somewhat amorphous, higher amplitude anomalies running through the centre of the survey area. Given that the Sacristy is assumed to have stopped before this point, it seems likely that these reflectors relate to the aforementioned buildings which ran along this side of the Abbey. There are certain hints of rectilinearity within the distribution, but defining individual wall lines, exact footprints or layout of these properties has not been feasible. It remains a possibility that some of the high amplitude anomalies are not structural elements but, in fact, a result of burial structures, perhaps partially collapsed - thus accounting for the less obvious responses in the radargrams.
- 1.9 The deepest slices show a diagonal band of increased response (9) of uncertain origin - this is right on the limits of penetration and the reliability of weak features identified by time-sliced data alone is somewhat questionable. The zone of reflections abutting (9) to the north is coincident with, and is likely to be a continuation of, features seen in the shallower slices; these may simply be 'ringing' effects rather than a bona-fide indication of the depth extent of those features.

Area 3

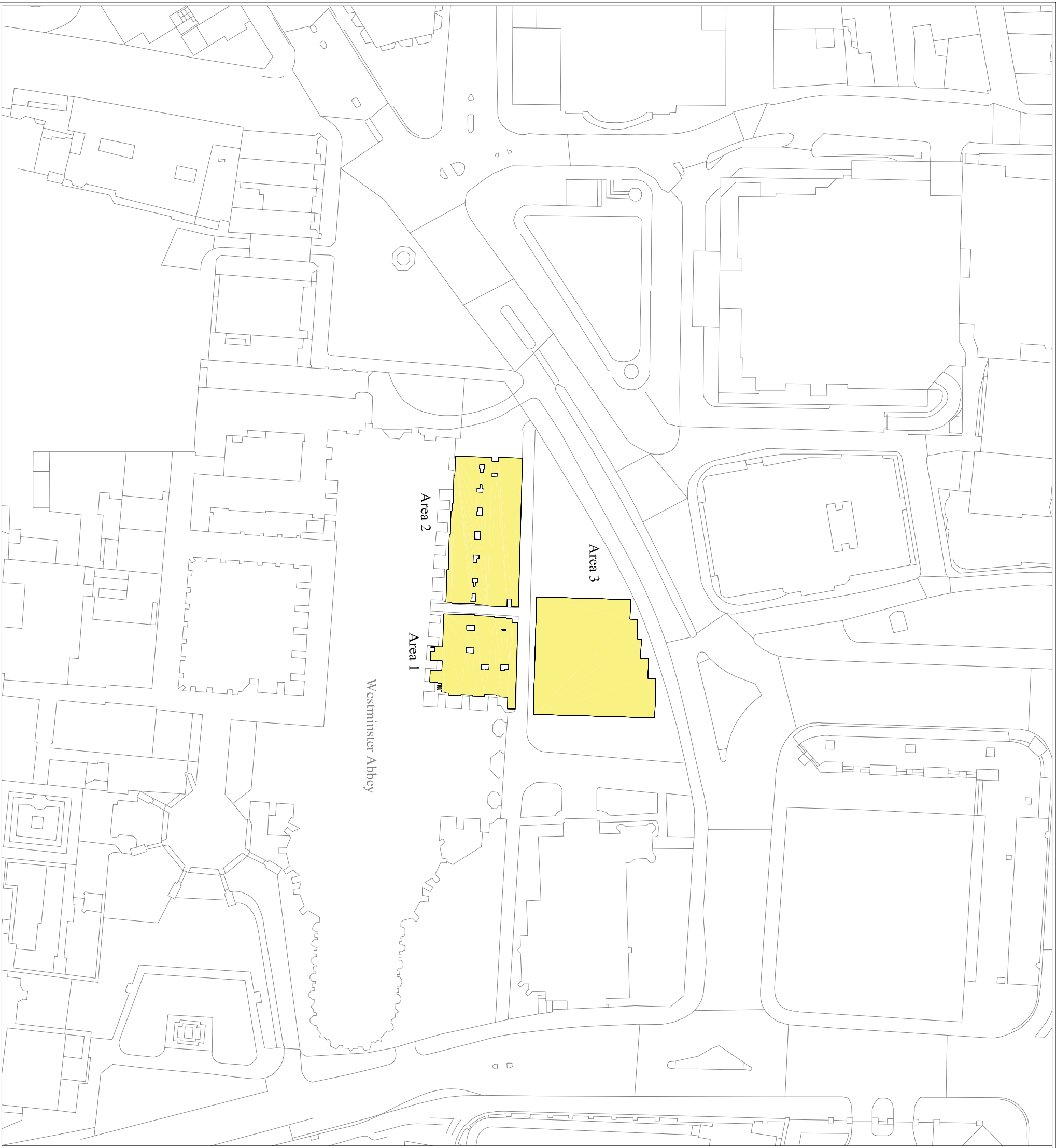
- 1.10 This survey area was a speculative attempt to find the Watch House, a hexagonal gothic building recorded on a plan of the site from the 18th century. Whilst it was not possible to identify this feature, a number of isolated but very strong reflectors were recorded. This area was recorded as being the "Church Yard" in the 1761 plan and, as such, burials are to be expected. Only the strongest, most likely intact, examples have been recorded. Some of the other smaller reflectors may be fragmentary responses from collapsed caskets. It may be the case that the hexagonal structure still lies just beyond the survey area, either immediately north or west. There is a lot of shallow disturbance shown in the radargrams adjacent to the northern site boundary; it is unclear as to what this may be but the likelihood of a modern origin seems high.
- 1.11 The deepest slices show a linear trend of increased response (10) flanking the current road which broadens out in a couple of locations. The origins of this are not entirely clear, although it can be seen in some radargrams that over-ground reflections have been at least partially responsible.
- 1.12 A sinuous group of reflections (11) trends through the area on a similar alignment to those noted in Area 2 (9); the significance of this and reliability of the recorded responses remains unclear.

2. Conclusions

- 2.1 Whilst it has been possible to define the complete circuit of the Sacristy inner wall in Area 1, only the northern section of the outer wall has been detected. The western end has only been partially imaged at the very eastern edge of the second survey area. Some internal detail has been recorded between the two sets of walls as well as reflections from potential features within the enclosed ground. It is also possible that some of these relate to burials rather than purely former structural elements of the Abbey. It is possible that some of the reflectors are shadows of the range of buildings that ran along the Northern Green, post-dating the Sacristy. There are also many responses relating to not only the medieval sunken chamber but also much later phases of activity (i.e. previous investigations and services).
- 2.2 Area 2 is also crossed by numerous services, and the remainder of responses are less clearly defined than in Area 1. It seems likely that the reflections are from the aforementioned range of buildings, but the lack of definition has made the identification of footprint shape or individual wall-lines difficult. Many of the reflectors here could originate from burials but, given the known presence of buildings, it is difficult to differentiate between what are isolated structural remains and individual burials.
- 2.3 Survey in Area 3 has failed to identify the hexagonal building (Watch House) shown on plans of the site, but a number of potential stone casket burials have been located.

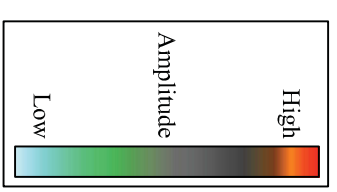
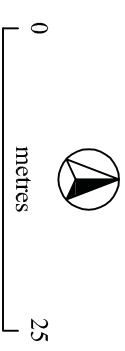
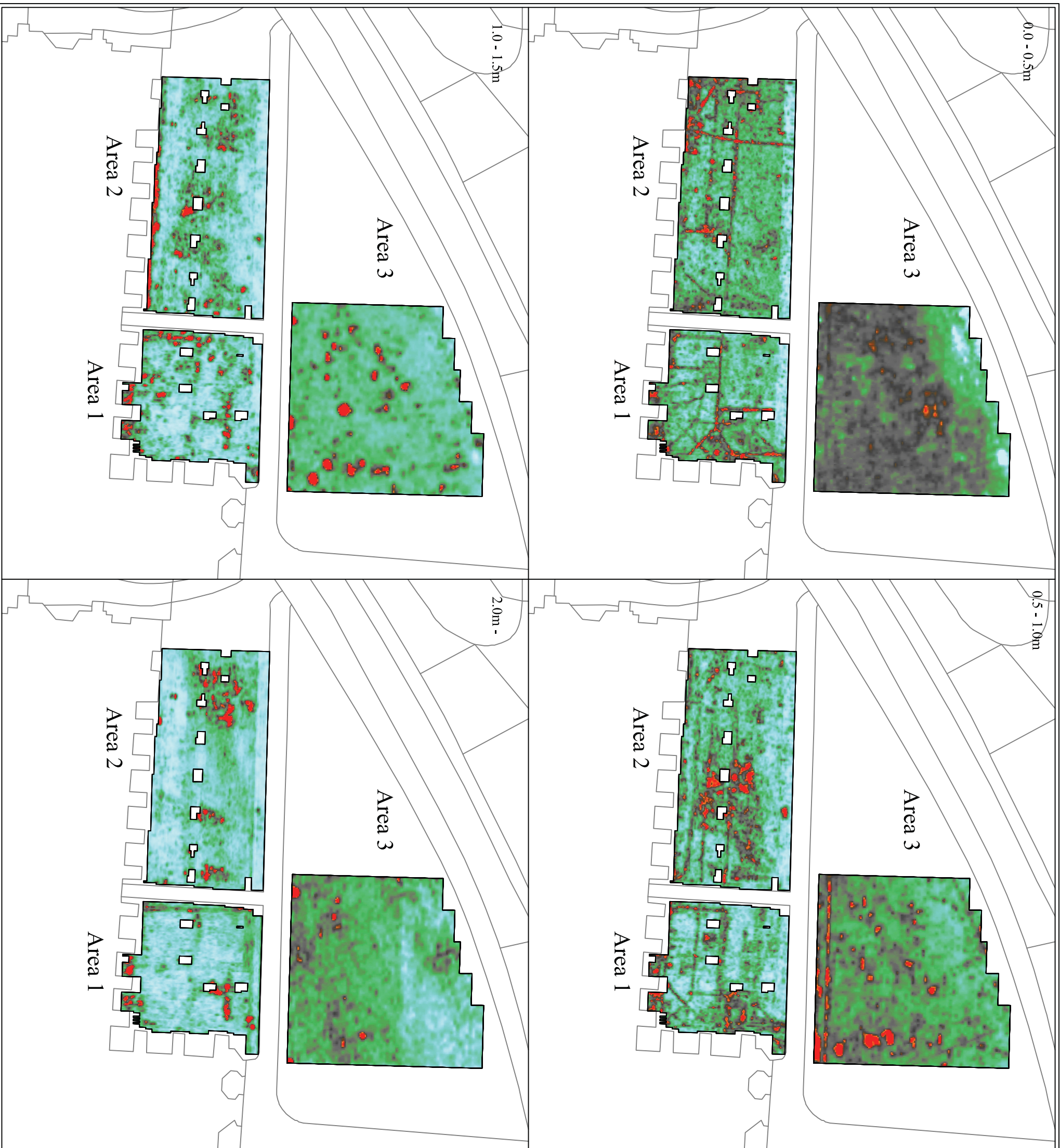
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Figure 5	GPR data Area 2	nts
Figure 6	GPR data Area 2 (cont)	nts
Figure 7	GPR data Area 3	nts
Figure 8	GPR data Area 3 (cont)	nts



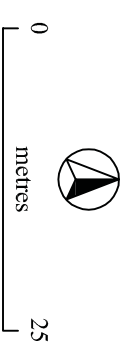
 GPR Survey

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Location of Survey Areas
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Figure 1



Due to the complex nature of deposits, it is advisable to refer to the full time-slice datasets in addition to the summary plots.

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Summary GPR Time-slices
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Figure 2

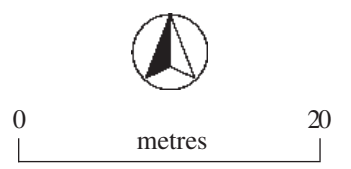
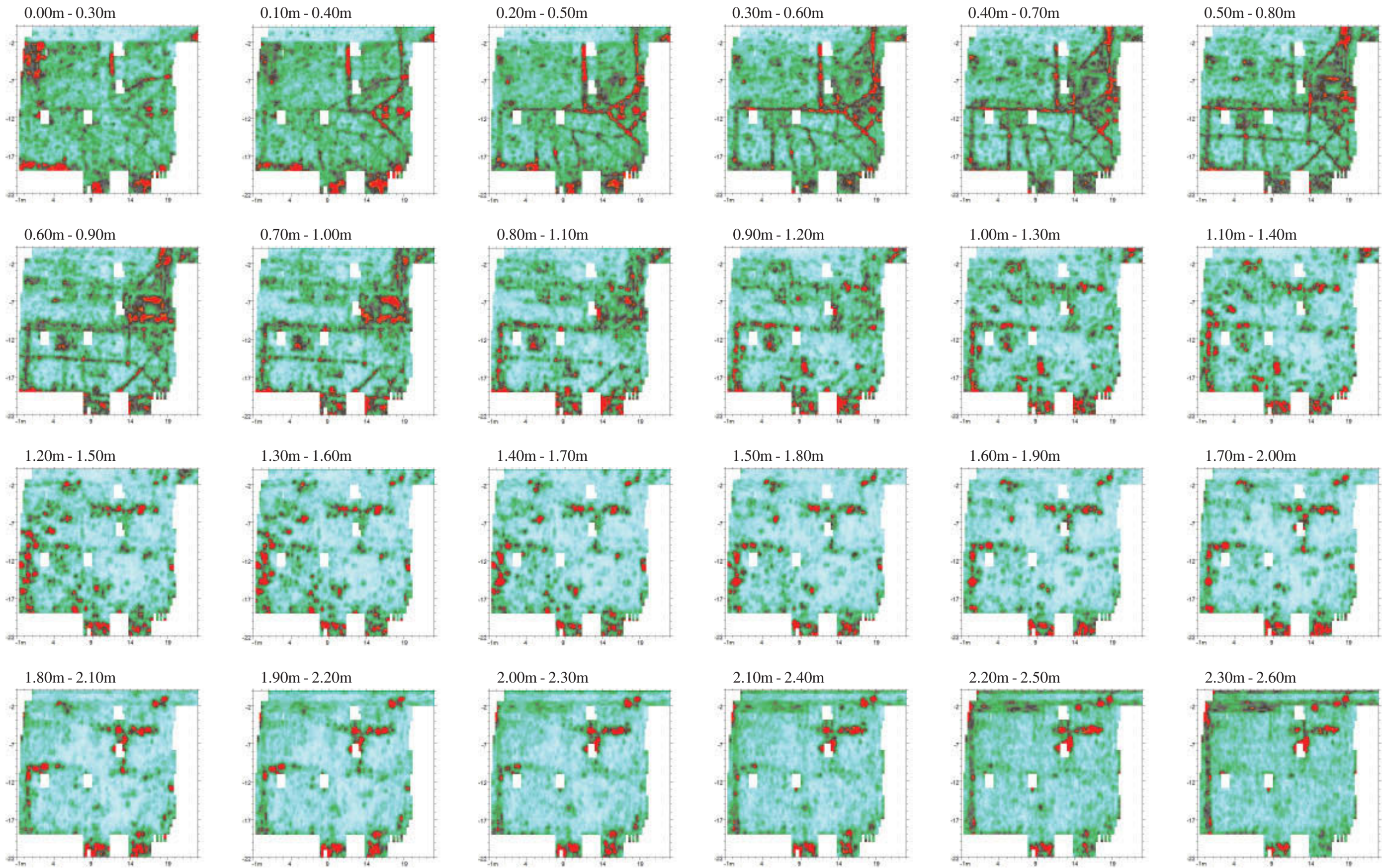


- High Amplitude - ?Sacristy
- High Amplitude - ?Grave
- High Amplitude - Archaeology
- High Amplitude - Archaeology
- High Amplitude - Uncertain
- Increased Response - Uncertain
- High Amplitude - Modern
- Trends - Modern
- Trends

Due to the complex nature of deposits, it is advisable to refer to the full time-slice datasets in addition to the summary plots.

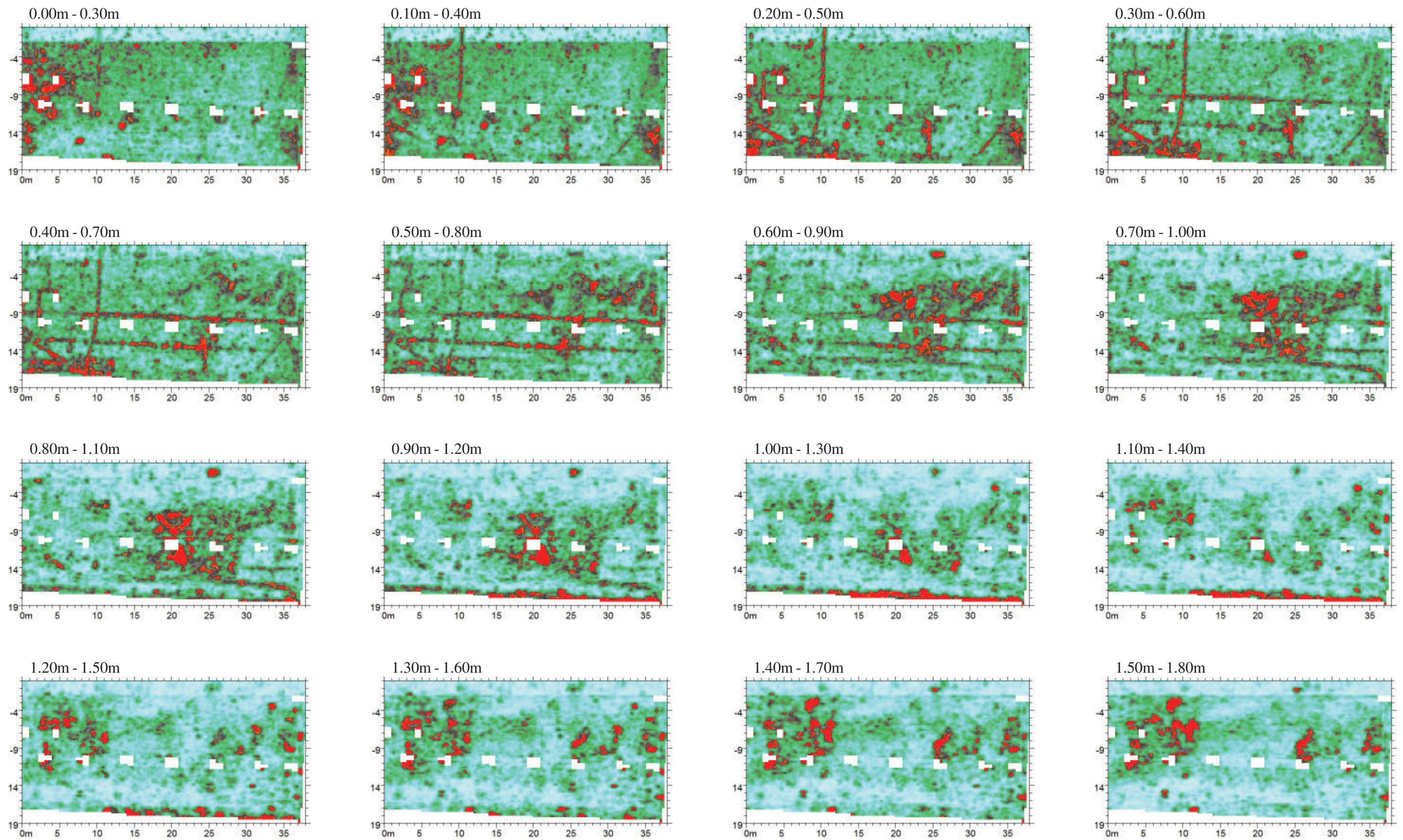
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Summary GPR Interpretations
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Figure 3



BACKGROUND FILTERED & MIGRATED DATA

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 GPR Data: Area 1
Figure 4



0 20
metres

Low High
RELATIVE AMPLITUDE

BACKGROUND FILTERED & MIGRATED DATA

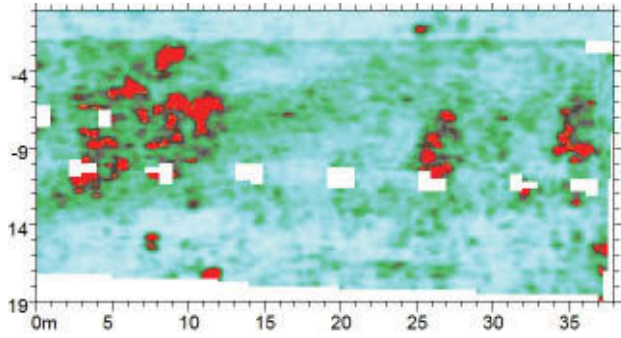
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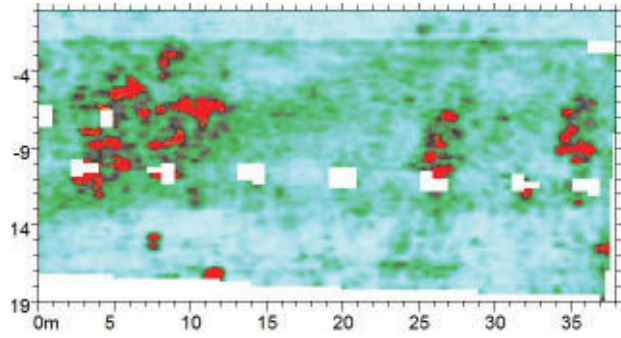
GPR Data: Area 2

Figure 5

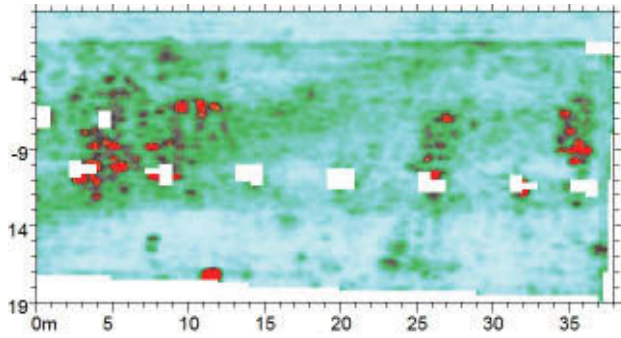
1.60m - 1.90m



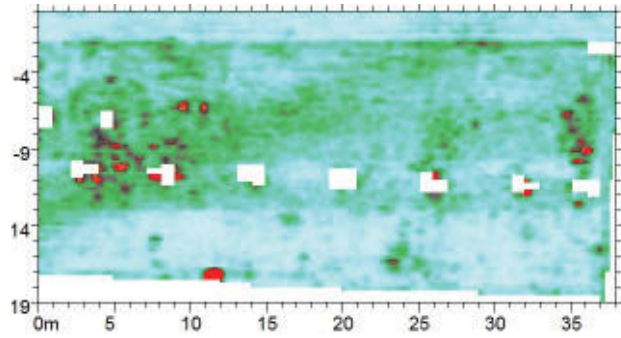
1.70m - 2.00m



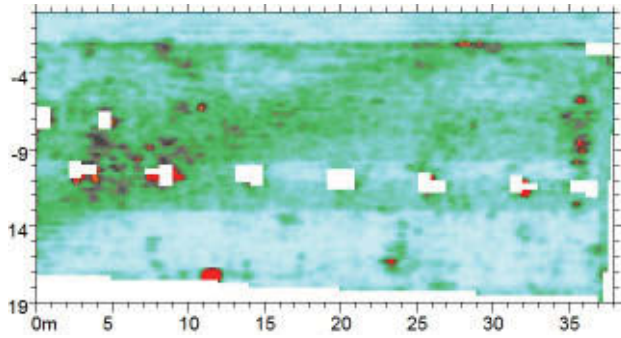
1.80m - 2.10m



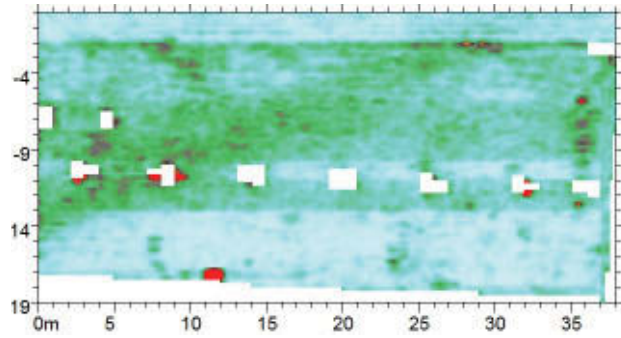
1.90m - 2.20m



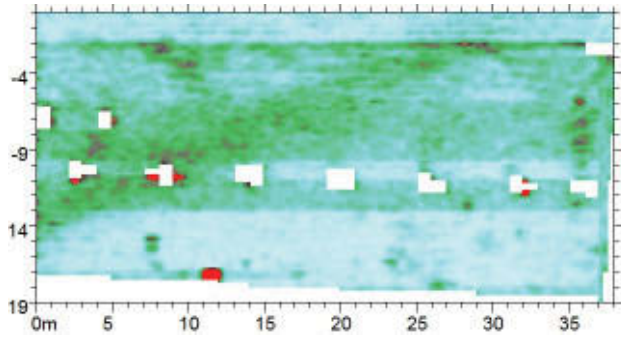
2.00m - 2.30m



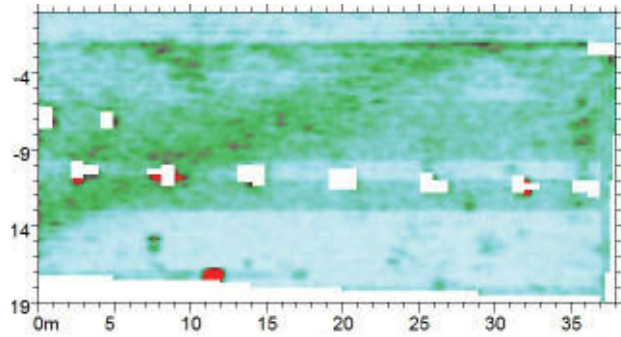
2.10m - 2.40m



2.20m - 2.50m



2.30m - 2.60m



0 metres 20

Low High

RELATIVE AMPLITUDE

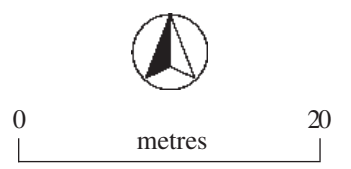
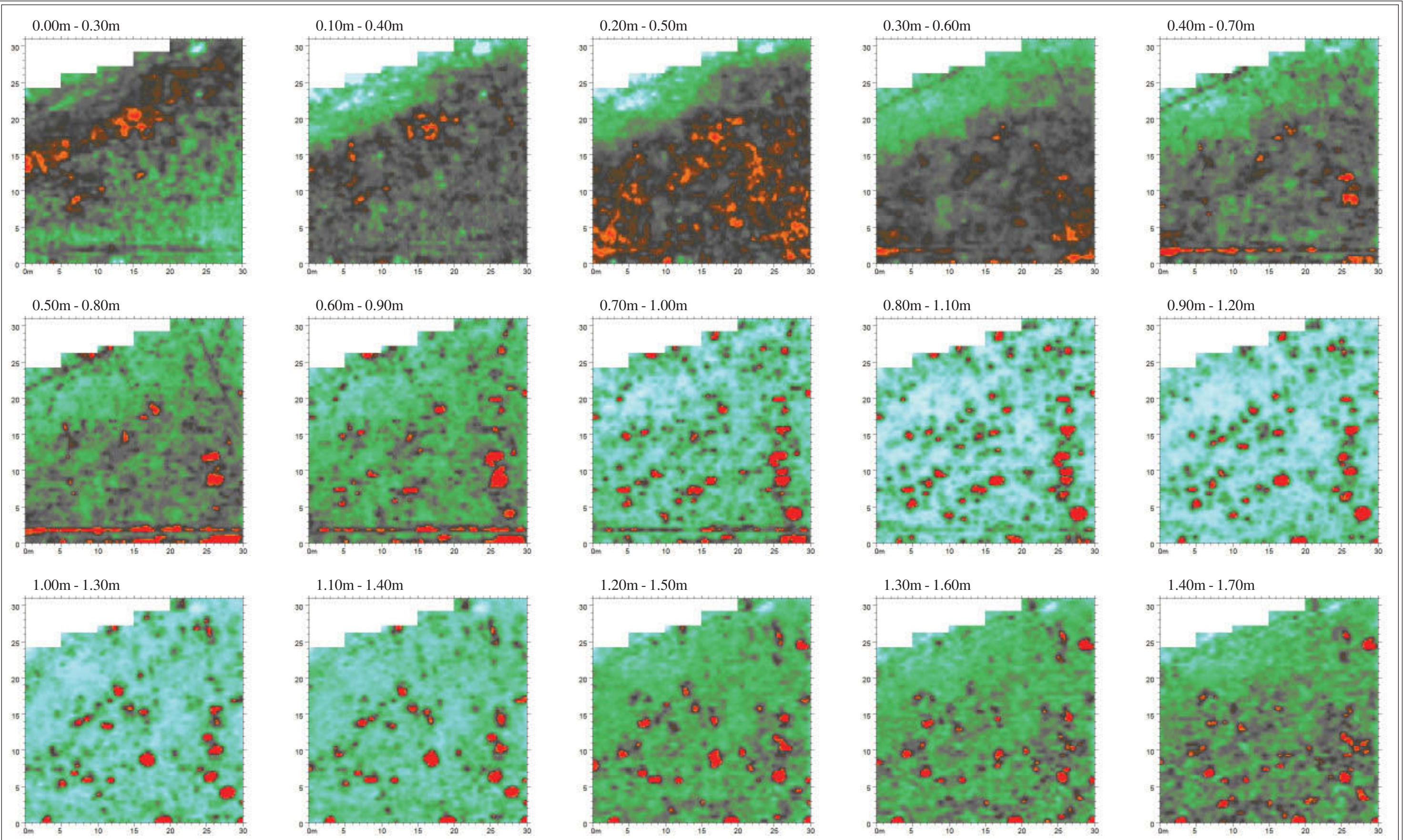
BACKGROUND FILTERED
& MIGRATED DATA

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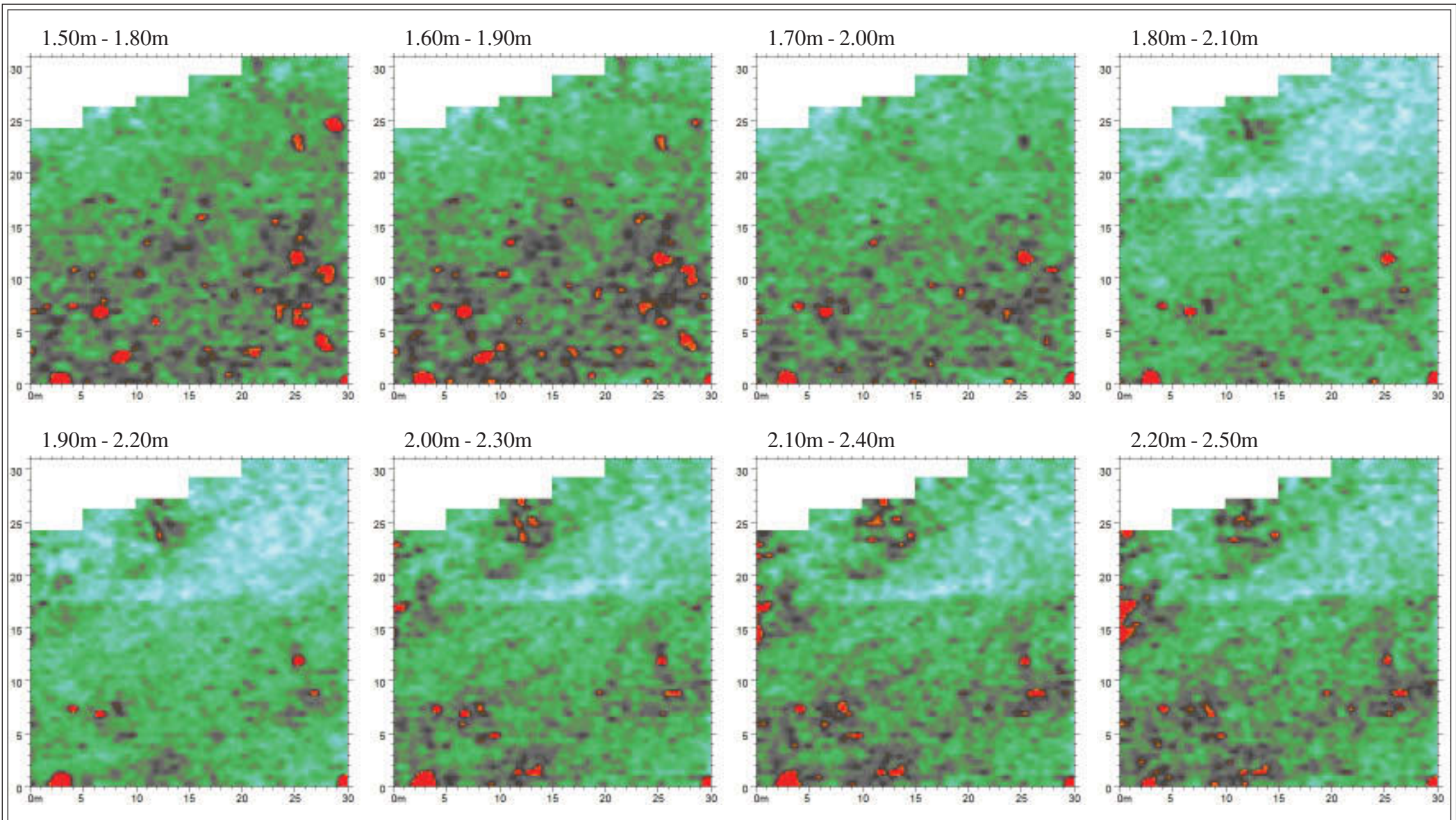
GPR Data: Area 2 (cont.)

Figure 6



MIGRATED DATA

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 GPR Data: Area 3
Figure 7



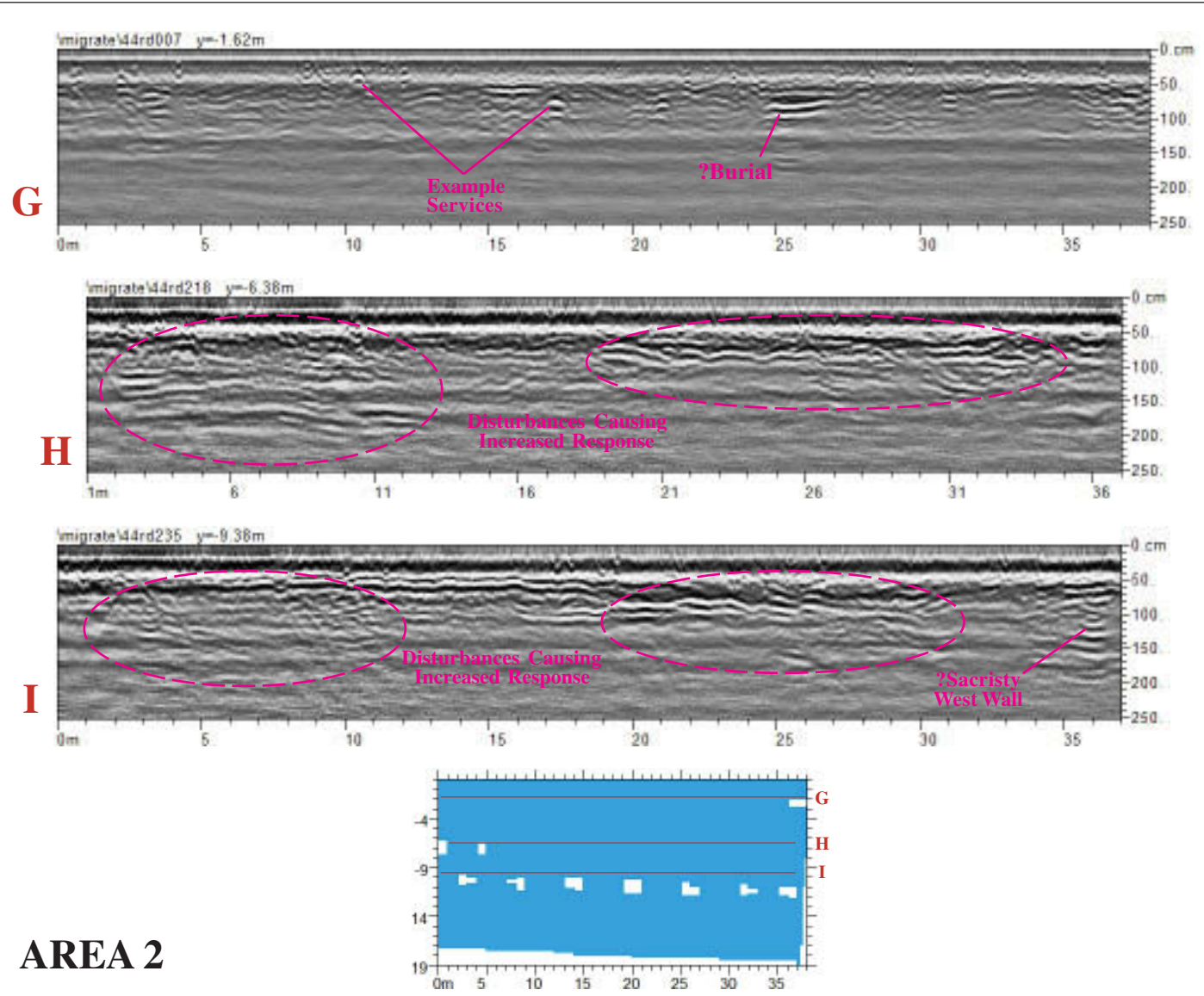
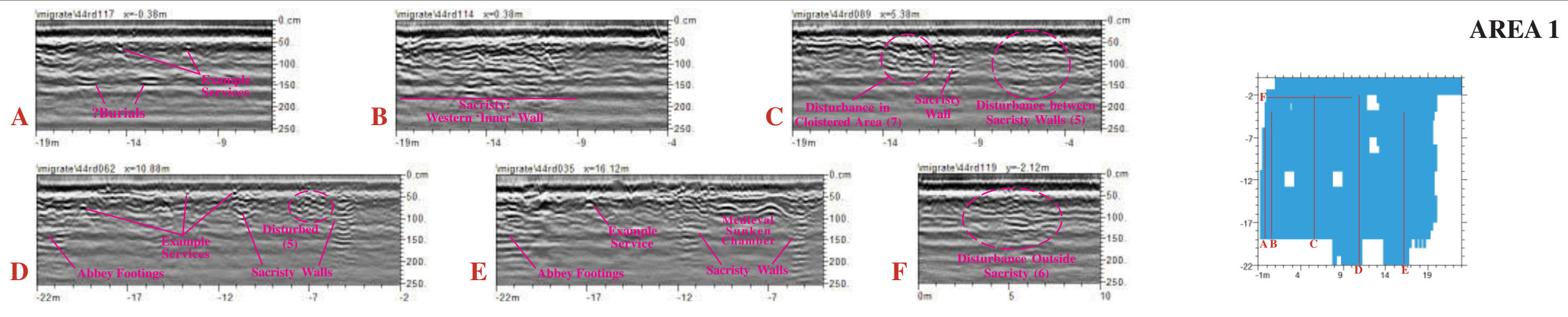
0 metres 20

Low High
RELATIVE AMPLITUDE

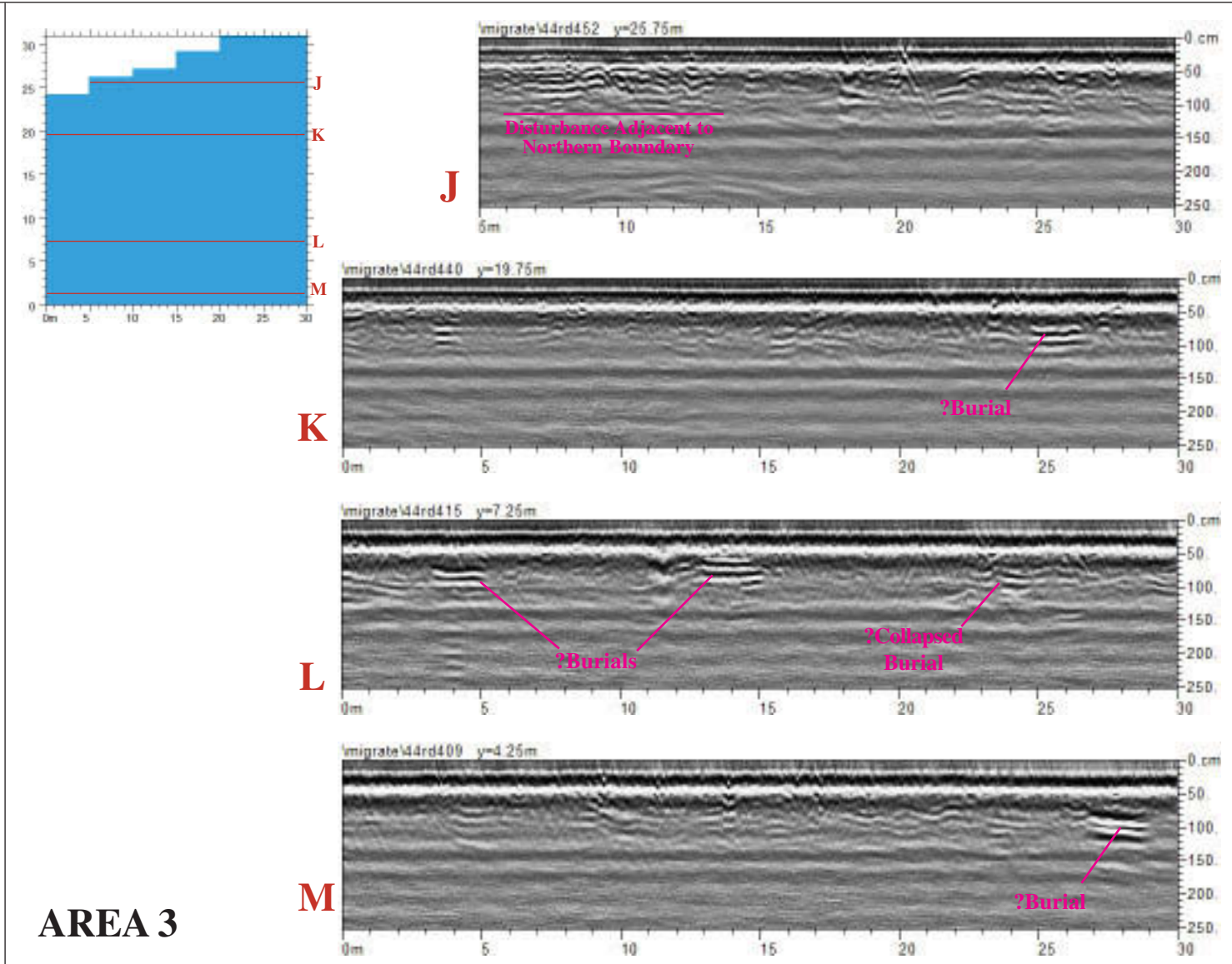
MIGRATED DATA

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GPR Data: Area 3 (cont.)
Figure 8

AREA 1



AREA 2



AREA 3

See Plot Axes
For Scale



MIGRATED DATA

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GPR Data: Selected Radargrams
Figure 9