ISAP NEWS

The newsletter of the International Society for Archaeological Prospection

Issue 48
September 2016

Conductivity and susceptibility in Colonial Acadia, Canada

Multi-method survey at Old Sarum, UK

Welcome to the 48th issue of ISAP News! As usual, thanks very much to those who sent contributions for this issue. We look forward to hearing from all those of you who are quietly getting on with archaeological prospection work and haven't yet got in touch to let us know what you're up to... you know who you are! All contributions are greatfully received. Please send any articles (around 700 words, with a couple of images), notifications or cover images for the next issue (ISAP News 49) to the email address below by 31st December 2016. (You don't have to hang on until the deadline to send things!)

In the meantime, read on for an update on a programme of survey of the French colonial settlement of Grand-Pré, one of the principal settlements of the Acadians, the French colonial people of Canada's Maritime Provinces. And for details of a multi-method, multi-period survey around the hillfort/motte and bailey/cathedral of Old Sarum, Salisbury, UK. Enjoy!

Hannah Brown & Paul Johnson

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The Cover Photograph shows preparations for survey undertaken by Magnitude Surveys as part of Big Heritage's Sefton Coastal Archaeology Project (**http://bigheritage.co.uk/sefton-coastal-archaeology-project/**).

Multi-method magnetic and EM survey was conducted over the earliest lifeboat station in the world, at Formby Beach (near Liverpool, UK). The FM instrument was used to do high-density (0.25 m line spacing) magnetic survey over the extant remains of the lifeboat station, to get a more detailed picture of the results and possibly locate burnt clay.

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Viewing Conductivity and Susceptibility in Stereo: A Geophysical Survey in Colonial Acadia

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Figure 1 *Students from Saint Mary's University conducting a survey with the Geonics EM38B at Grand-Pré National Historic Site in May 2015. Photo: Theta Lubliner.*

For the past sixteen years, a programme of geophysical surveys and test excavations has been revealing the vanished French colonial settlement of Grand-Pré. Established in the early 1680s alongside a vast tidal marsh, which the inhabitants subsequently dammed and drained for agriculture, Grand-Pré was one of the principal settlements of the French colonial people of Canada's Maritime Provinces, the Acadians. Living on the fault line separating the French and British empires in North America was a frequent source of trouble for Grand-Pré's residents, but they prospered, until, on the eve of the Seven Years' War, Anglo-American troops destroyed their communities and made them refugees. That was 1755. By 1760, boatloads of immigrants from Connecticut arrived to take up vacant land and establish Horton Township on the ruins of Acadian Grand-Pré. The New Englanders retained and expanded the French agricultural program on the dyked marsh, but they remodelled the adjacent uplands so thoroughly that hardly a trace remains of the French settlement. It is a case tailor made for archaeological geophysics.

Not that this is particularly easy. Like most North American settlers of the colonial era, Grand-Pré's builders turned to the forests when it came time to construct their homes, barns, mills, and churches. Stone buildings were rare, and the earth-fast remains of Acadian timber architecture consequently present only ephemeral geophysical targets. The antiquity of their sites further reduces archaeological visibility, for they predate the truly explosive industrial productivity that spread white earthenwares around later settlements like ceramic confetti.

Stone was periodically employed to line cellars, wells, or occasionally provide a footing for wooden buildings, but Grand-Pré's relatively soft sandstone bedrock, which generally fractures into fist-sized rocks by the time it sprouts up at the surface, performed these jobs poorly. When they could be found, the inhabitants seem to have preferred basaltic boulders that had originated in ancient lava flows capping the low range of hills several kilometers to the north. The southbound glaciers that scraped across this

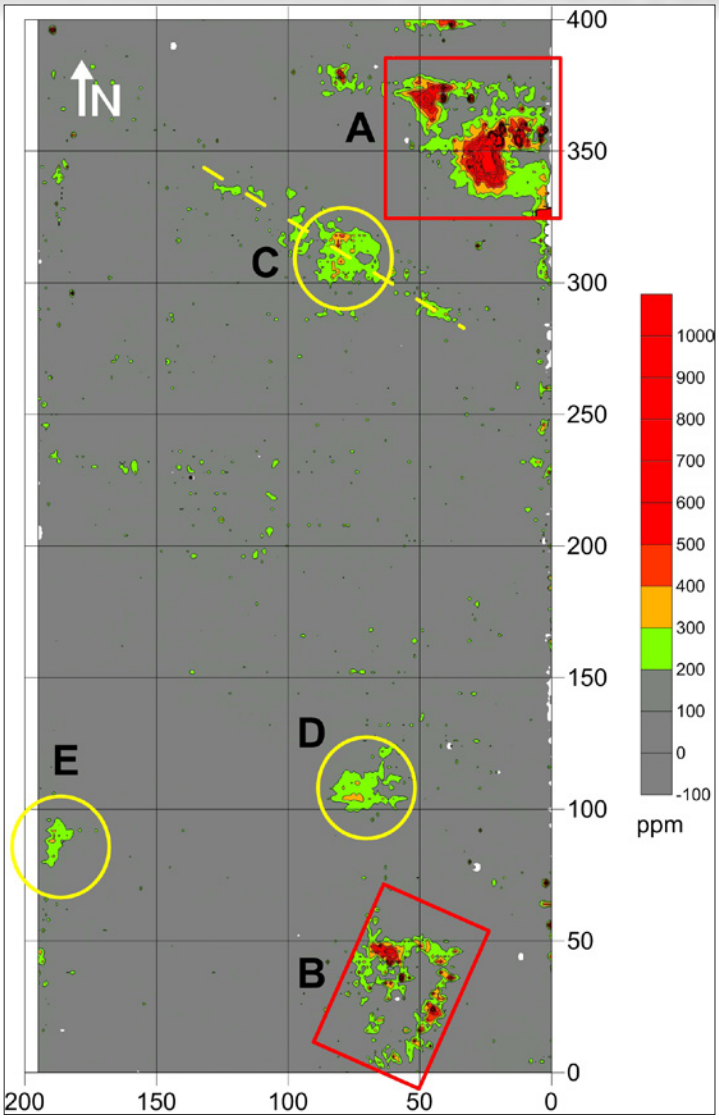

Figure 2 *In-phase results ('magnetic susceptibility') revealing two intensely anomalous areas (A and B), as well as three other areas of interest (C, D, and E). Anomaly C may be anthropogenic, but it may also have a geological origin (dotted line).*

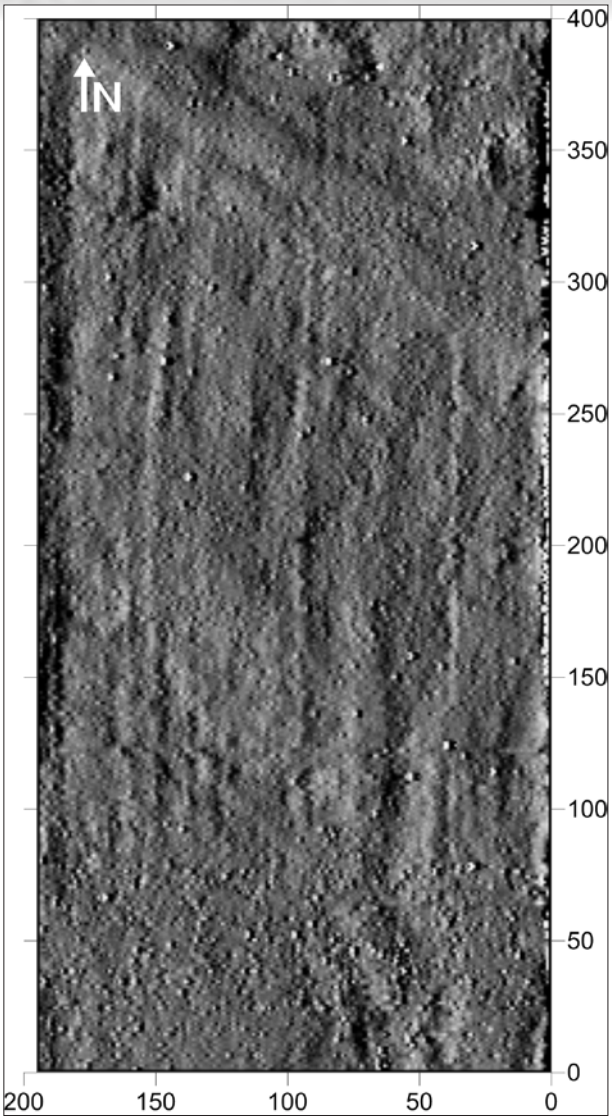

Figure 3 *Conductivity data plotted as a shaded relief map. Several linear field boundaries, which do not find expression in the susceptibility data, are readily apparent.*

terrain millennia ago, deposited a fine selection of basalts on the very hills where the Acadians would later build their homes. Hard as iron and often naturally fractured in convenient, prismatic shapes, they were an ideal building stone, and the fact that they are highly magnetic gives us some assurance when heading into the field to conduct surveys.

Recently, for example, we surveyed a large (approx. 8ha) upland field at Grand-Pré National Historic Site with a group of undergraduate students from Saint Mary's University (**Fig. 1, previous page**). We deployed the Geonics EM38B in vertical dipole mode at 2m transect intervals, collecting 10 readings per second along alternating transects. The survey took three days for the novice crew to complete, and data were subsequently processed with DAT38BW and Surfer 12 software to produce plots of the in-phase and quadrature signals (broadly representing apparent magnetic susceptibility and conductivity, respectively).

Given the nature of the archaeological remains, the in-phase data ('magnetic susceptibility') appear to have most effectively pinpointed areas of archaeological interest (**Fig. 2**). Two intensely anomalous areas (A and B) almost certainly contain architectural features and, measuring between 300 and 2000 parts per million (ppm), stand in sharp relief against background values of between 0-100 ppm. The former (A) appears to be a ploughed out domestic compound, likely Acadian, while the latter (B) may be the remains of a later barn that met its end by a lightening strike in the late 19th century. Both demand follow-up surveys and test excavation.

The EM38B's ability to simultaneously collect two datasets is a significant asset, even if the quadrature channel ('conductivity') is often more useful in characterizing soil type and hydrology than pinpointing archaeological targets. In this case, a shaded relief map of the quadrature data reveals a series of linear features that do not express themselves significantly in the in-phase channel (**Fig. 3**). Viewing a portion of the line data (**Fig. 4, overleaf**) demonstrates how these anomalies appear primarily as quadrature anomalies. They are almost certainly

field boundaries, likely a broad ditch (A), with higher conductivity, and two ploughed out stone clearance features (B) and (C), with lower conductivity, the latter probably composed largely of sandstone cobbles rather than the mafic boulders and burned material typically associated with domestic sites. Interestingly, none of the boundaries we detected corresponds very well with the property boundaries of early Horton Township, which could raise doubts about the skill of colonial mapmakers, point to earlier or later construction events, or some combination of these. One thing is certain, though: detecting such large and ephemeral features would have been impossible if we had relied on fieldwalking or test excavation, both of which remain staple methodologies of Cultural Resource Management archaeology in Canada.

Depopulated and wrecked by war, colonial Acadia holds important insights for archaeologists and archaeological geophysicists. Our examination of the ruined landscape continues.

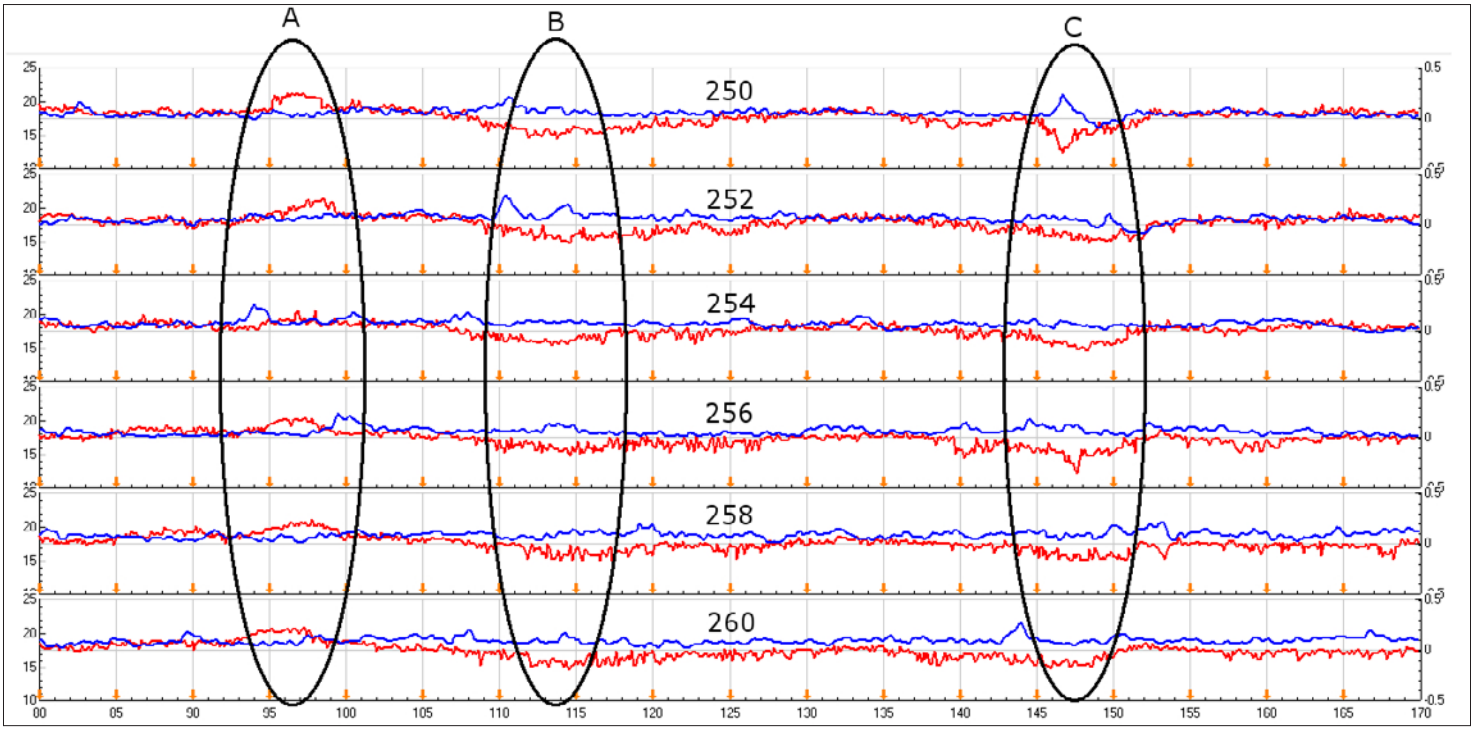

Figure 4 *Portions of lines 250-260 as displayed in DAT38BW software, with magnetic susceptibility indicated in blue (ppt) and conductivity in red (mS/m). The scale at the bottom depicts meter marks along the survey grid. Anomalies with interline correlation depict a likely ditch (A) and two ploughed out stone field boundaries (B and C).*

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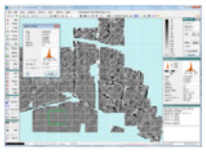

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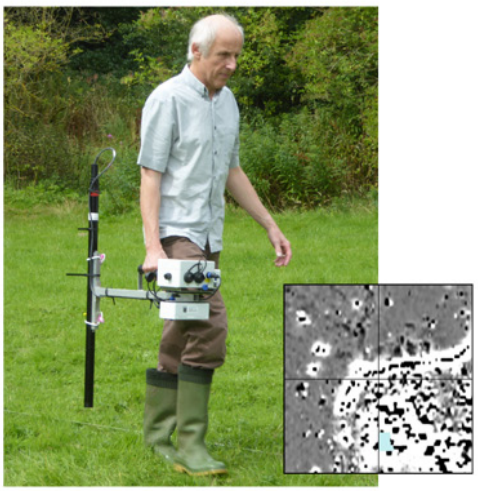

Geophysical surveys at Old Sarum and Stratford Sub-Castle

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For the past three years a multi-method geophysical survey has been conducted at Old Sarum, near Salisbury, in Wiltshire, UK. The survey was undertaken by staff and students from the University of Southampton together with Alex Langlands and members of the Department of History at the University of Swansea. Survey was conducted in April of 2014, 2015 and 2016, with the involvement of undergraduate and postgraduate students, together with a short season in June 2016. While the objective of the survey project was initially to provide an opportunity for training of archaeology students, the project was established with a research agenda for the investigation of this famous Iron Age, Romano-British and medieval site and its environs, starting with non-intrusive techniques of evaluation. To this end the fieldwork has comprised topographic survey and incorporation of existing LiDAR data, magnetometer survey, earth resistance survey and GPR survey. In 2014 and 2015 fieldwork focused on the inner and outer bailey of the monument. However, in 2016 more work was conducted at the site in the fields surrounding the curtilage of the ancient monument.

The site of Old Sarum includes a univallate Iron Age hillfort with evidence of Romano-British occupation and documentary evidence of a Saxon burh and mint. The site was rebuilt as a royal motte and bailey castle, including a cathedral and bishop's palace and extra-mural settlement. The hillfort is roughly oval in shape, enclosing an area of c.12ha, with entrances at the east and west ends. Excavations within the hillfort have produced evidence of early Iron Age settlement and of later Iron Age and Romano-British occupation from the 1st to the 3rd centuries AD. The site is the focus for a number of major Roman roads and the Roman town of Sorviodunum has been suggested as lying within and around the hillfort. There is, however, a lack of any substantial evidence for Romano-British occupation within the hillfort and current understanding does not allow this suggested location to be confirmed. Documentary sources attest to the establishment of a Saxon burh at the site. After the Norman Conquest in 1066 a royal motte and bailey castle was built within the hillfort. The defences of the hillfort were adapted to become those of the outer bailey while a mound was constructed in the centre of the hillfort. The first cathedral was built in 1078, and consisted of a nave separated from two side aisles by eight great arches on each side. This building was completed in 1092, but was struck by lightning and partly destroyed. Rebuilding in the Norman style commenced in 1130 under Bishop Roger and involved the large scale levelling of this part of the hillfort interior. Outside the western limits of the defences aerial photographs and excavation show traces of what may be a contemporaneous suburb of Old Sarum.

Excavation has been conducted at the site in the 20th century, including St John Hope and Hawley's work in the earlier part of the century, excavation by Rahtz and Musty, and a number of trial excavations and archaeological mitigations prior to development in the area.

The potential for extensive evidence of Romano-British and medieval settlement, and the nature of excavated remains at the site, meant that an approach drawing on different geophysical survey methods was ideal, giving an unparalleled opportunity to map the extent and form of buried remains within and surrounding Old Sarum.

Figure 1 *GPS survey being carried out by students from the University of Southampton.*

For the survey a grid system was established using a Leica Viva Real Time Kinetic (RTK) GPS (**Fig. 1**) utilising the Ordnance Survey coordinate system OSGB36. Survey markers were set out at 30m by 30m intervals, and the grids for all areas were georeferenced, together with the other landscape features and breaks of slope recorded during the topographic survey of the site. The Leica GPS was also used to conduct a topographic survey of the different survey areas, with readings taken along traverses spaced c. 5m apart, at 1m intervals or where changes in elevation above 0.2m occurred within a 1m distance. Further detailed survey was carried out using a Leica TCR703XR and a TCR805 Power Total Stations, with data downloaded using LISCAD software.

The magnetometer survey was conducted using a Bartington Instruments Grad 601 dual sensor fluxgate gradiometer (**Fig. 2, overleaf**). Measurements were taken at 0.25m intervals on 0.5m traverses, with data collected in zig-zag fashion. Earth resistivity (**Fig. 3, overleaf**) was carried out using a Geoscan Research RM15 resistance meter, with measurements taken at 0.5m intervals along traverses spaced 0.5m apart. The survey data were processed using Geoplot 3.0 software. The GPR survey (**Fig. 4, overleaf**) was conducted using a Sensors and Software

Figure 2 (top left) *Magnetometer survey using a Bartington Instruments Grad 601-2 fluxgate gradiometer in the outer bailey of Old Sarum.*
Figure 3 (left) *Earth resistance survey being undertaken in the outer bailey, while Dominic Barker has a cup of tea.*
Figure 4 (lower left) *GPR survey being carried out in the outer bailey.*
Figure 5 (bottom left) *Magnetometer survey from afar in the outer bailey, close to the ruins of the cathedral.*

Noggin Plus system with 500Mhz antenna and Smartcart in the outer bailey. Data were collected along traverses spaced 0.5m apart. Data were processed using GPR Slice software.

The geophysical survey at Old Sarum has provided evidence of the development of the site and the nature of settlement at the site with, unsurprisingly, an emphasis on the medieval city in the data. All of the outer bailey was covered using magnetometry (**Fig. 5**) and earth resistance survey, with an ERT profile conducted across the northern part of the outer bailey. In addition the trial GPR survey of the outer bailey provided some evidence for the medieval plan of the area.

Data from the outer bailey presents a plan of the medieval city of Old Sarum, demonstrating that the area, now an undulating area of pasture, was once a thriving settlement (**Fig. 6, overleaf**). The outer wall of the outer bailey is visible in some sections of the data making its course around the bailey perimeter. A series of massive structures are ranged along the southern part of the bailey abutting the outer wall. An area to the north of these structures, certainly in the south-east quadrant, seems to have been kept open, whether for mustering of people or resources, or purely as part of a circular route through the city is unclear.

In the south-west quadrant the large structures alongside the defensive wall seem to continue (**Fig. 7, overleaf**), and a narrow road seems to make its way through the quadrant. The remaining results seem to suggest a residential area of buildings radiating out from the edge of the inner bailey ditch. In addition to the walls and deposits, some other responses in the magnetometry may indicate the possibility of industrial features, such a kilns or furnaces, in this sector with large dipolar anomalies, some measuring 2-3m across. Indeed the strong positive response from some of the anomalies suggests deposits heavily affected by anthropogenic activity, suggesting dumps of ceramic, ash and other materials. The pattern of settlement, seemingly representing residential occupation, continues around to the western side of the outer bailey. It is just to the south of the western entrance to the bailey that the nature of the features changes, suggesting a completely different series of structures associated with the cathedral. Principally, a number of structures are presented in the results that align with the known pattern of structures in this quadrant of

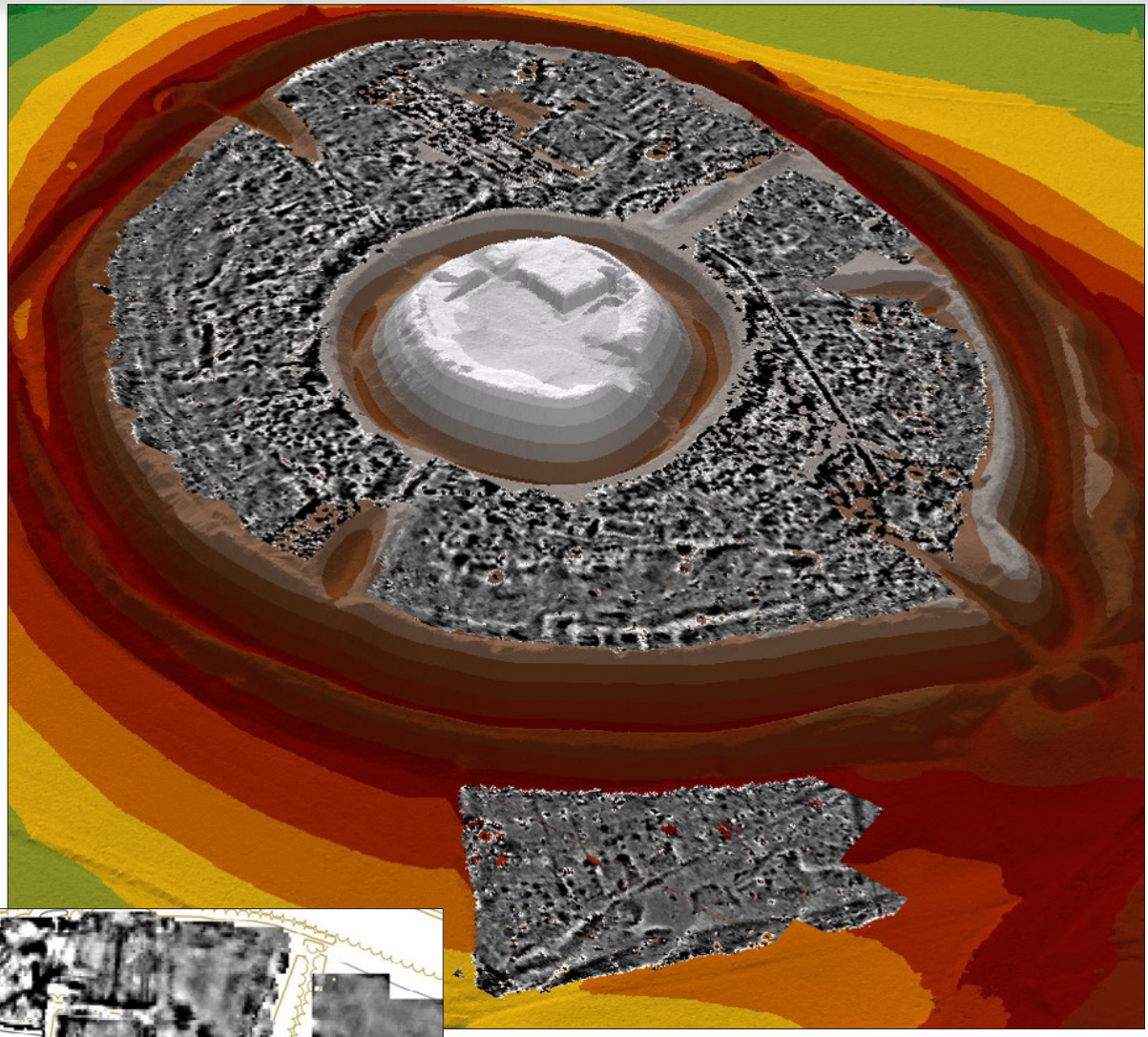


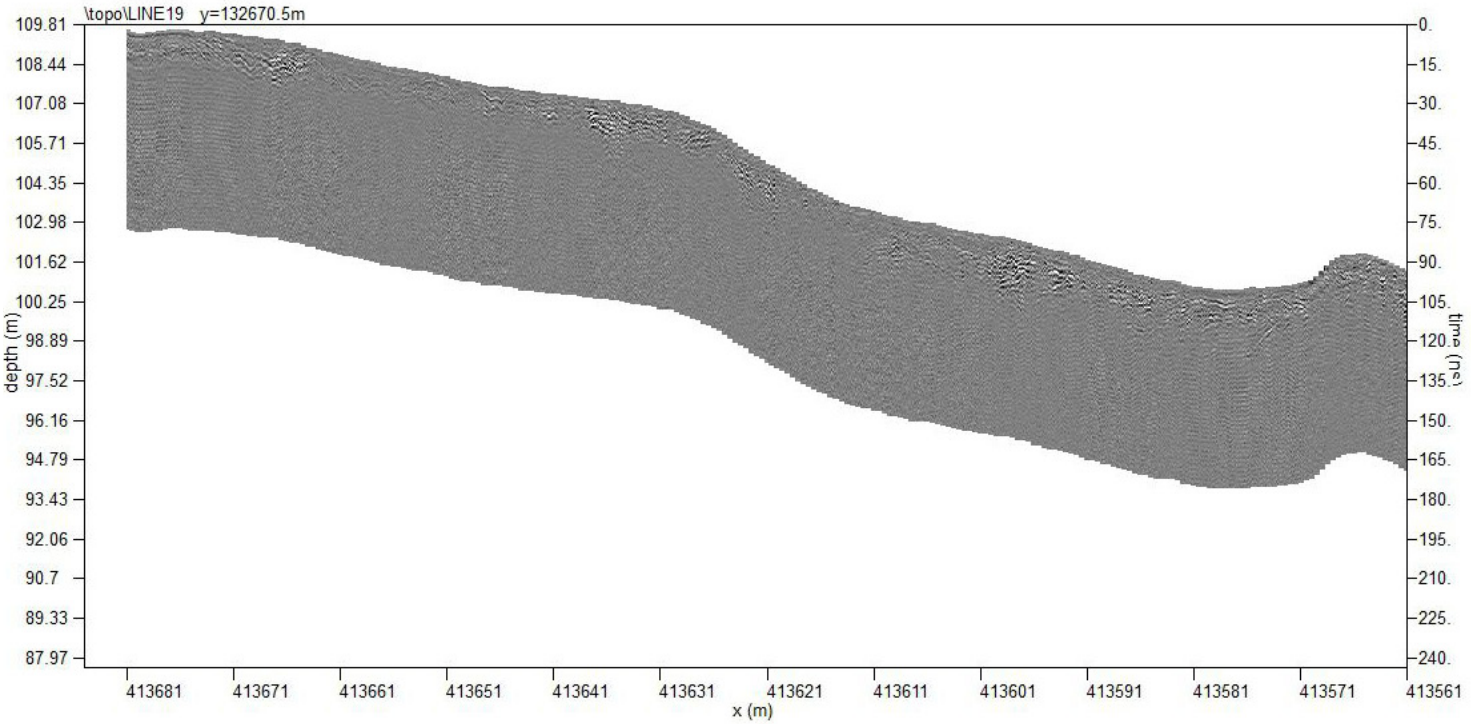
Figure 6 (right) *Results of the magnetometer survey overlaid onto LiDAR data for Old Sarum. LiDAR data source © Environment Agency copyright and/or database right 2014*

Figure 7 (below) *Results of the earth resistance survey from the western part of the outer bailey. © Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service.*

the outer bailey. However a series of anomalies are present in the quadrant that align on a north-east to south-west orientation that suggest an earlier phase of occupation in the area.

The 2015 GPR survey in the outer bailey (**Figs 8, overleaf,** and **9, page 11**) reinforces the nature of the structures in this area. There is a pattern of buildings across the survey area, with clear structures most prominent along the top of the inner part of the outer bailey, and immediately to the east of the outer bank of the defences. In addition some possible rubble filled ditch features are visible, either associated with the prehistoric earthworks of the hillfort, or with an earlier phase of the medieval defences at the site. The results seem, however, to indicate the possible presence of three terraces in the outer bailey, with structures at the edge of the terrace, and potential access routes or roads on each separate terraced level. The GPR survey needs to be extended across the entire outer bailey to provide further evidence for the pattern of settlement.

The results of the magnetometer survey in the field to the south-east of Old Sarum (**Fig. 10, overleaf**) indicate a continuation of the settlement found within the earthworks of Old Sarum. At least three roads or trackways are visible, with a number of platforms and structures visible in the results. In addition, a number of medieval boundaries are



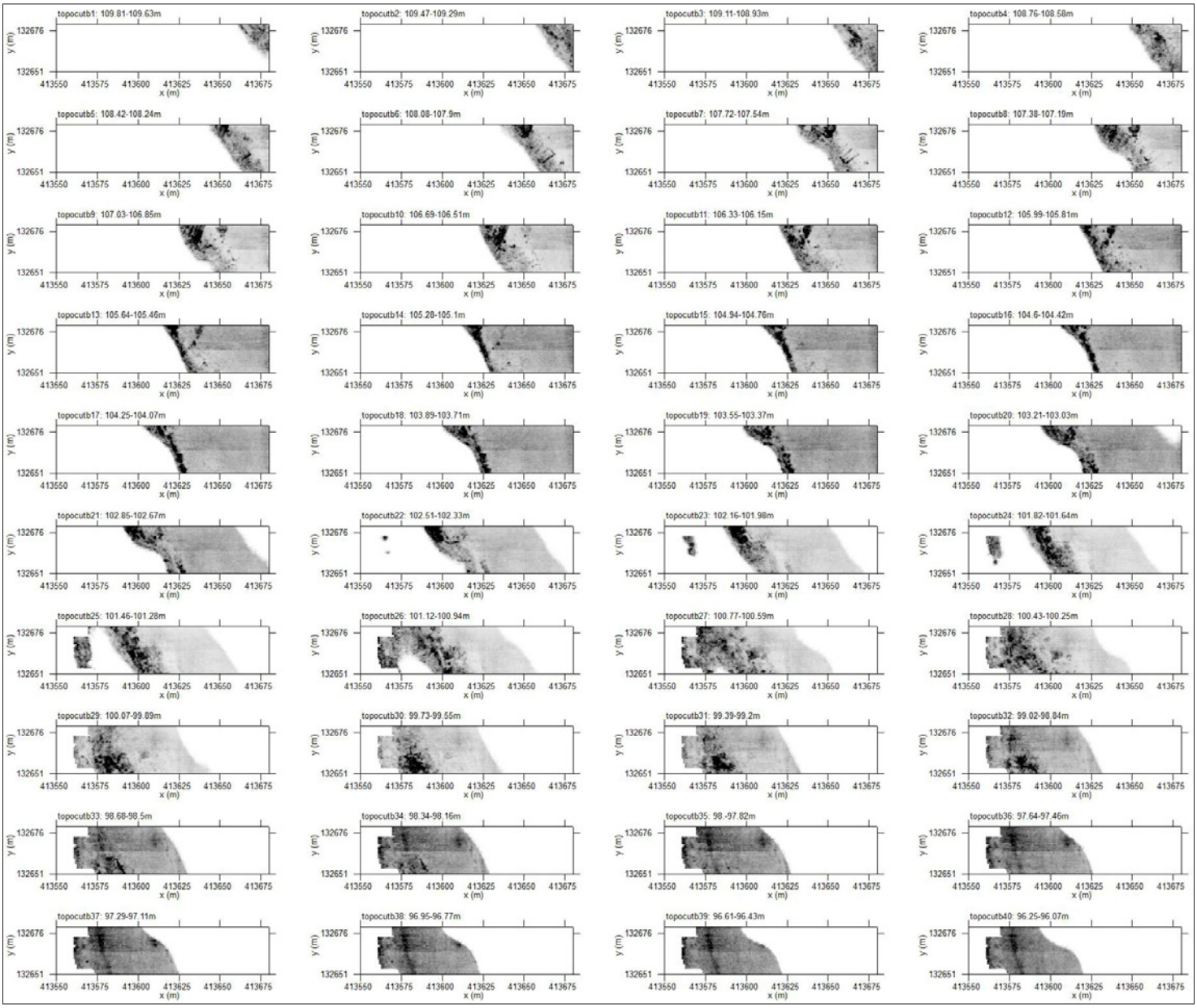
visible indicating a palimpsest of archaeology in the material.

The results presented here represent the first phase in the continuing work at Old Sarum and the surrounding landscape. Future fieldwork is planned to extend the GPR survey in the outer bailey, and to extend the magnetometer and earth resistance surveys in the fields surrounding the monument, to map the full extent of the settlement between Old Sarum and the River Avon. The fieldwork will be integrated into research on the archive material for the area, including the excavation archives at Salisbury Museum, and material held at Salisbury Cathedral and English Heritage/Historic England.

Figure 8 (top) *Simple profile of the GPR data with topographic correction.*

Figure 9 (left) *The results of the magnetometer survey to the south-east of Old Sarum, indicating phases of Romano-British and medieval occupation.* *© Crown Copyright/database right 2014. An Ordnance Survey/EDINA supplied service.*

Figure 10 *Timeslices of the GPR data for the western section of the outer bailey.*



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The Near Surface Geophysics Group of the Geological Society of London (NSGG) is pleased to announce the twelfth in a succession of biennial day meetings devoted to archaeological geophysics. Near surface geophysical techniques have become firmly established in archaeological research and evaluation and are now routinely applied in archaeological investigations. This meeting offers a forum where contributors from the UK and further afield can present and debate the results of recent research and case studies. Suppliers of equipment and software also attend and the meeting represents an invaluable opportunity for both archaeological and geophysical practitioners to exchange information about recent developments.

There has been an enthusiastic response to the call for papers and we can look forwards to a full and interesting day with 15 talks and 12 posters.
Details of the programme should be available in the next two weeks.

Registration

Pre-registration is now open on the NSGG website.

Note that this time, to cut the queue to register on the day,
there is a discount for signing up before the event.
Please visit the NSGG website's meetings page for details:

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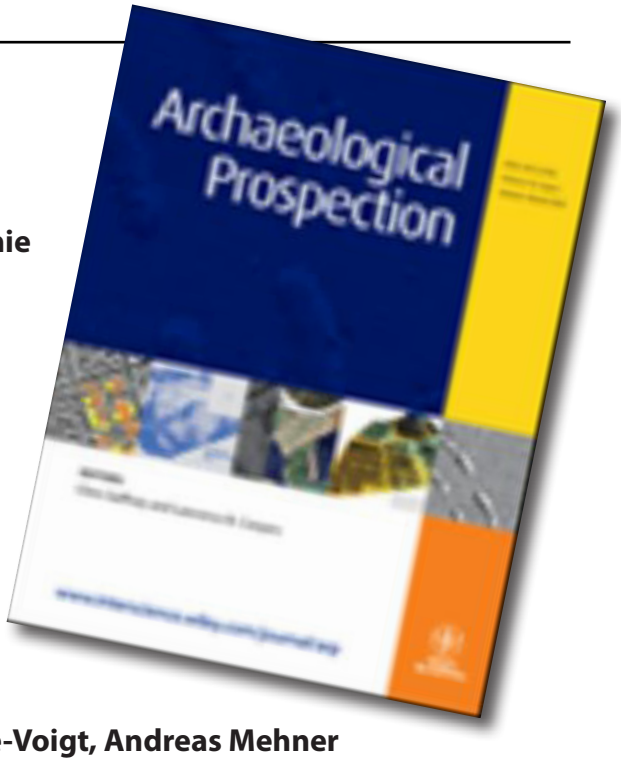

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