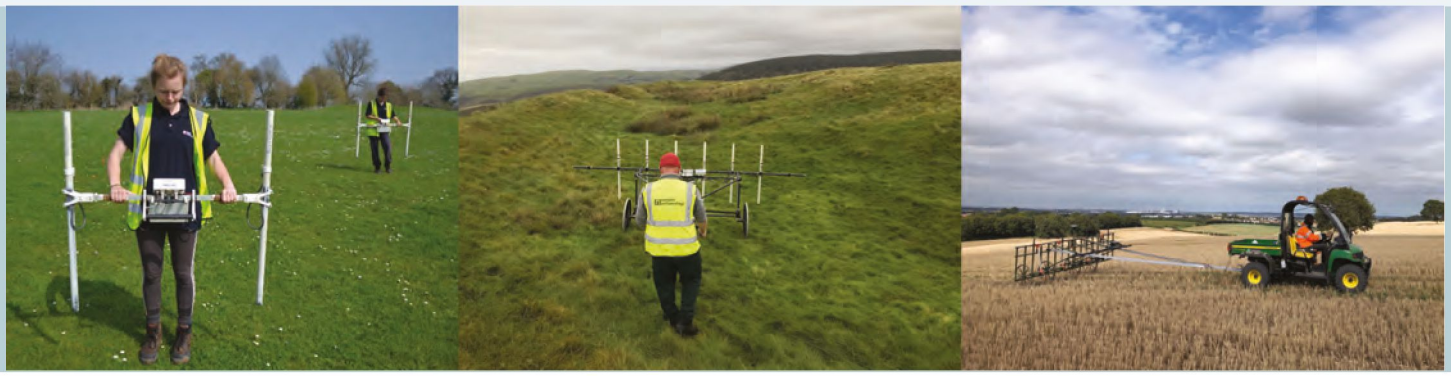
Placing geophysical survey at the centre of archaeological and heritage services

Rok Plesnicar, Geophysicist; Nicholas Crabb ACIfA (8829), Senior Geophysicist; and Tom Richardson ACIfA (6261), Terrestrial Geophysics Manager, Wessex Archaeology

The advent of contemporary digital technologies such as GIS, remote sensing and geophysical survey has had a tremendous impact on archaeological practice. These tools have become commonplace, and they enable us to investigate beyond the 'site' to consider what is happening within the wider landscape. Geophysical survey, in particular, has made significant technological advances over the last 30 years, with new instruments and sampling strategies making fieldwork faster, more sophisticated, and more cost-effective.



Typical gradiometer setups used in terrestrial geophysics. L–R: Handheld Bartington Grad601 dual sensor system; Non-magnetic cart mounted Bartington Grad-13 sensors; All-terrain vehicle towed array with SenSys FGM650/3 sensors. In optimal conditions handheld systems allow for approximately 2ha of survey data to be collected in a single day, whereas cart-based system and vehicle-towed systems can facilitate more than 5ha and 10ha respectively. Credit: Wessex Archaeology

Terrestrial geophysical survey incorporates a variety of non-destructive methods used to identify subsurface variations through the measurement of physical properties of the ground. Each technique has specific advantages and limitations, and when deployed in appropriate conditions, they can be extremely effective. More recently, the towing of these instruments on vehicle-mounted arrays, and integration of GPS/GNSS data, enables rapid data collection at very high resolution, allowing for entire archaeological sites and landscapes to be mapped at unprecedented levels of detail. As such, it is fair to say that the evolution of geophysical prospection has been one of the most important methodological advances of field archaeology in recent times.

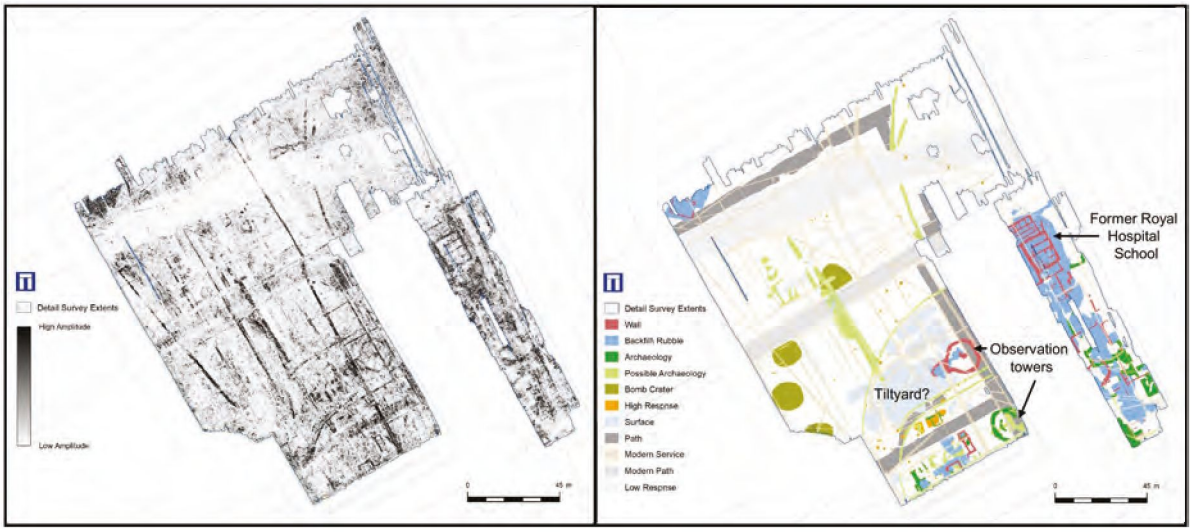
At Wessex Archaeology, geophysics is utilised alongside a range of archaeological and heritage services. This enables us to draw upon a breadth of experience and leads to a cohesive approach, where different disciplines meet throughout the lifecycle of a project. As these techniques are often deployed at the outset of a project, this can be critical in helping clients achieve successful planning outcomes, engage communities and stakeholders, and enhance the value of national historical assets.

The value of geophysics in the planning process

Today, geophysical survey plays a major role in developer-funded archaeology. It is now regularly deployed over vast areas, with preliminary results normally available shortly after completion. This allows for an initial assessment of the potential archaeological impact of a development scheme and facilitates a proactive planning approach that can maximise available resources and time. Surveys can be undertaken pre-planning or ahead of land purchases to inform development design, and potentially reroute schemes if significant remains are encountered. Effective interpretation of these datasets helps to focus resources in subsequent phases of investigation,

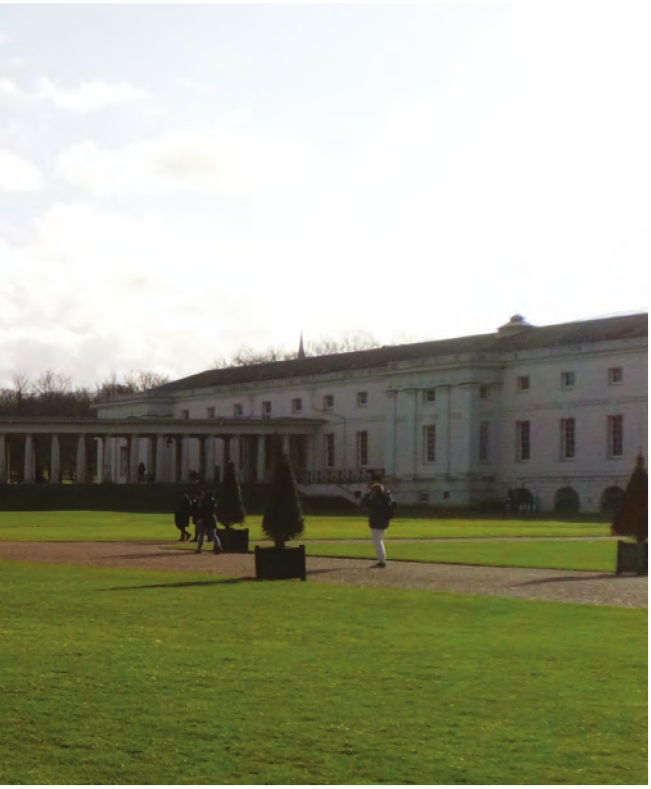
... it is fair to say that the evolution of geophysical prospection has been one of the most important methodological advances of field archaeology in recent times.

Multi-channel GPR survey in progress at Queen Anne's house in Greenwich, London (NHLE 1002060). The survey was undertaken using an Impulse Radar Raptor array, which contains eight transmitter and receiver antennae spaced 8cm apart, with a central frequency of 450MHz. Credit: Wessex Archaeology



Greyscale plot and interpretation of multi-channel GPR survey from Queen Anne's house in Greenwich, illustrating the location of the observation towers of King Henry's tiltyard. Digital data reproduced from Ordnance Survey data. Credit: Crown Copyright (2020) All rights reserved. Reference Number: 100022432.

either through the targeted application of complementary geophysical survey methods or by informing the location of intrusive evaluation or mitigation strategies. This can reduce costs for the client and provide enhanced detail of any archaeological remains that may be preserved in situ. For example, at the development site shown in the greyscale plot of magnetic gradiometer survey, an extensive and complex array of enclosures were discovered, with those in the east of the site forming a ladder settlement, dated to the Iron Age and Romano-British periods in subsequent evaluation trenching. The clarity and detail provided by the survey meant that the design of the development could be adjusted, leaving the focus of the settlement outside of the impact of the scheme.



Rok Plesnicar

As a geophysicist based in the Salisbury office, Rok has helped to improve Wessex Archaeology's field practice establish more effective and efficient methods, both in the field and the office. He is particularly interested in the application of GPR and cart and vehicle-based systems.

Nicholas Crabb

Nicholas is a senior geophysicist with experience in directing geophysical fieldwork projects varying from small investigations of Scheduled Monuments and historic properties to large infrastructure projects. He is particularly interested in the application of geophysical and remote sensing techniques to investigate complex archaeological remains or areas of geoarchaeological potential. He is currently working part-time whilst studying for a PhD at the University of Brighton.

Tom Richardson

As Terrestrial Geophysics Manager, Tom acts as lead on projects from initial discussions with clients through to delivery of the final product. He aims to produce high-quality results that meet the client's needs by providing innovative survey designs and solutions.

The most widely used geophysical method in the UK is magnetic (fluxgate) gradiometer survey. This is because it responds well to the broadest range of archaeological features, is effective in most rural environments, and can cover large areas quickly (Schmidt et al 2015). Although results can be poor on some geologies and where there are extensive superficial deposits (eg alluvium), deeper geophysical methods (such as lower-frequency GPR, ERT, EMI) can delineate landforms and subsurface variation, which, in turn, can be related to archaeological potential (Carey et al 2018). The application of appropriate methods in different landscape settings can, therefore, be a powerful tool in managing the impact of developments on the historic environment.

Adding value to community projects

In addition to aiding development, geophysical survey can provide significant value to community and research projects. Since these are usually conducted on sites of archaeological interest, the aim is generally to provide a more detailed insight or specific interpretation. At Queen's House in Greenwich, London (NHLE 1002060) a multi-channel GPR survey was carried out, which confirmed the location of observation towers associated with a tiltyard constructed for jousting events in 1514–18 by Henry VIII. It also characterised several more recent features including the foundations of the former Royal Hospital School.

References

Carey, C, Howard, A, Knight, D, Corcoran, J, and Heathcote, J (Eds), 2018 Deposit Modelling and Archaeology. University of Brighton. https://www.brighton.ac.uk/_pdf/research/set-groups/deposit-modelling-and-archaeology.pdf

Schmidt, A, Linford P, Linford N, David, A, Gaffney, C, Sarris, A, and Fassbinder, J, 2015 *EAC Guidelines for the use of Geophysics in Archaeology: Questions to Ask and Points to Consider,* EAC Guidelines 2. Namur, Belgium: Europae Archaeologia Consilium (EAC), Association Internationale sans But Lucratif (AISBL). ISBN 978-963-9911-73-4