Placing geophysical survey at the centre of archaeological and heritage services

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The first stage of archaeological evaluation often involves non-intrusive techniques such as geophysical survey. In this case study, the team from CIfA Registered Organisation Wessex Archaeology outline recent advances in archaeological geophysics and how using the right technique can support positive outcomes for clients and developers.

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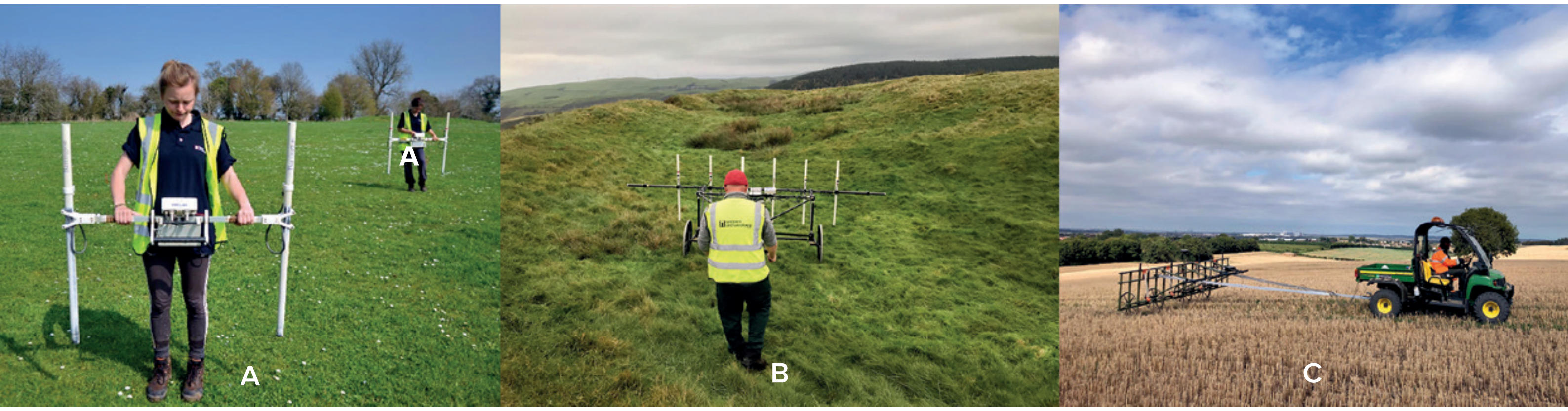
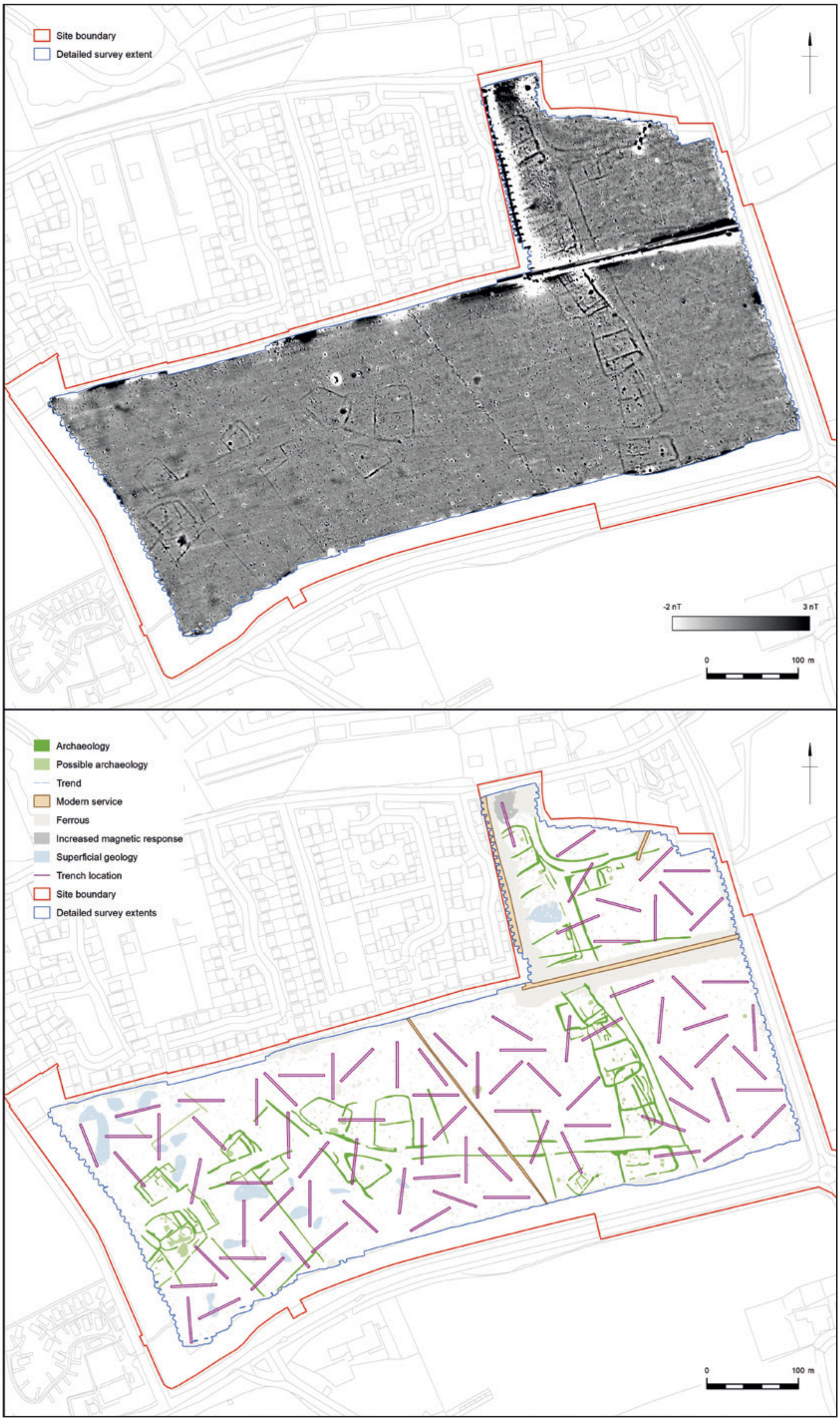


Typical gradiometer setups used in terrestrial geophysics: A) a handheld Bartington Grad601 dual sensor system; B) a non-magnetic cart mounted Bartington Grad-13 sensors; C) an all-terrain vehicle towed array with SenSys FGM650/3 sensors. In optimal conditions, handheld systems allow for approximately 2 ha of survey data to be collected in a single day, whereas cart-based systems and vehicle-towed systems can facilitate more than 5 ha and 10 ha respectively. ©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.

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. This allows 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 geophysics 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.



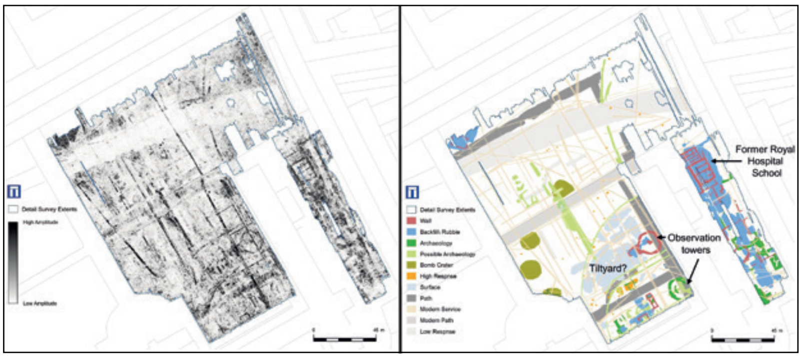
Greyscale plot of magnetic gradiometer survey, illustrating a wide range of archaeological features that can be detected through this technique. Digital data reproduced from Ordnance Survey data.

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 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, 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 a magnetic gradiometer survey (see greyscale image on page 34), an extensive and complex array of enclosures were discovered, with those in the east of the site forming a ladder settlement. These were 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.

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. Although results can be poor on some geologies and where there are extensive superficial deposits (for example alluvium), deeper geophysical methods, such as lower-frequency ground-penetrating radar (GPR), electrical resistivity tomography (ERT) and electromagnetic induction (EMI) can delineate landforms and subsurface variation, which in turn can be related to archaeological potential. 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.

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 450 MHz. 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.