

NON-INTRUSIVE APPROACHES:

the value of combining geophysical, airborne laser scanning, six-band multispectral imaging and geochemical surveys for comprehensive landscape prospection

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There are numerous non-intrusive specialist techniques at an archaeologist's fingertips. Rather than defaulting to a generic geophysical magnetometer survey followed by blanket trenching, complementary non-intrusive techniques can be utilised to identify and clarify the nature of anomalies, benefiting both the client and the environment. In 2024 Archaeological Research Services Ltd won the prestigious King's Award for Enterprise for innovative work in applying geochemical analysis with other methods of landscape prospection to characterise archaeological remains using rapid, non-invasive techniques. This combination enables any required follow-up trenching to be better targeted, while also reducing the amount of carbon released into the atmosphere. This article outlines the benefits of combining techniques in bespoke survey programmes for archaeological prospection.

What is prospection and why do we do it?

Archaeological prospection refers to the assessment of a landscape parcel using one or more techniques to identify the presence, extent and type of any surviving heritage assets. Prospection may take place for several reasons, such as in advance of proposed development, as part of academic study, for resource quantification or landscape characterisation by a regulatory body, or to inform landscape management. With significant infrastructure development underway across the UK and beyond, the need for well thought out and effective archaeological prospection has never been greater, particularly considering the

short lead-in times often associated with large infrastructure projects.

Bespoke combinations?

As highlighted in Clark's (1996) seminal *Seeing Beneath the Soil*, there is no 'silver bullet' of prospection techniques. Instead, methods should be seen as complementary, offering distinct contributions to our understanding of a site.

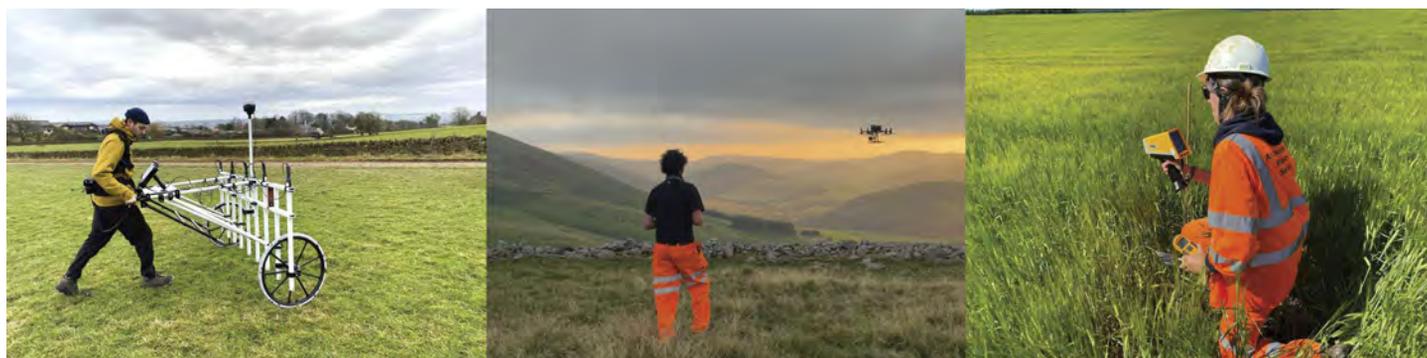
By combining prospection techniques like high-resolution airborne laser scanning (ALS/LiDAR), six-band multispectral Imaging and magnetometry, a comprehensive understanding of a site's upstanding and buried archaeological remains can be built

through visualisation of both above- and below-ground anomalies.

To break this down, high-resolution ALS can enable identification of extant features, such as raised earthworks, cut features and structural remains, through the analysis of detailed and spatially accurate visualisations. Through visualisation of crop and vegetation health and long-wave infrared (thermal) data, six-band multispectral imaging can indicate buried remains and identify buried features where standard aerial photography or satellite imagery cannot. Magnetometry, and/or other geophysical techniques, can then bolster this through mapping more subtle buried features based on magnetic response. Combining techniques like this gives the best possible chance to identify and record archaeology on a range of sites and environments.

But which techniques?

This question is not always simple and the answer will be determined by a range of variables, including the nature of possible archaeology expected to be encountered, environmental variables such as geomorphic unit, soil type, bedrock geology, vegetation type, crop coverage and cycle, drainage, land access, surface morphology/terrain and time/resources available. A project may be time sensitive



A range of landscape prospection techniques – geophysical survey, high-resolution data capture with a UAV, and geochemical survey alongside magnetic susceptibility survey. Credit: Archaeological Research Services Ltd



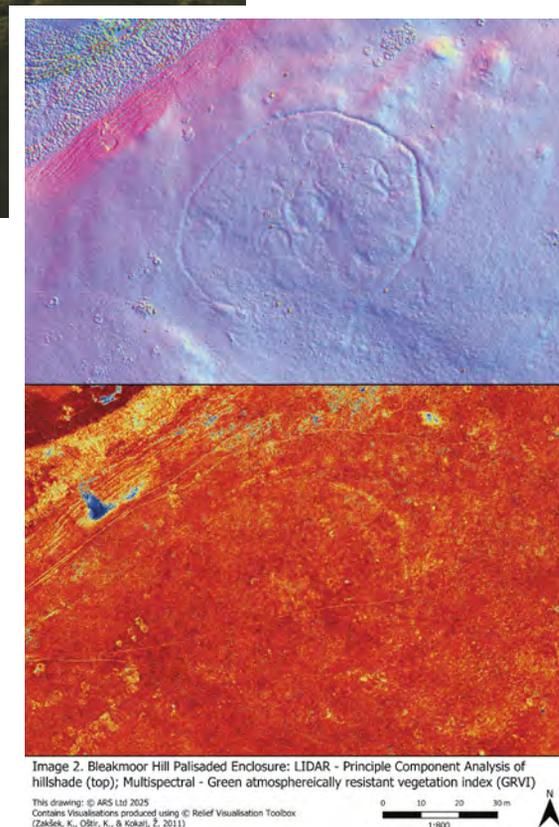
*Bleakmoor Hill
palisaded settlement,
looking south towards
the Simonside Hills.
Credit: Archaeological
Research Services Ltd*

and cannot wait until after harvest for an on-ground survey, or perhaps the geology is not suited to some geophysical techniques, or an area may be mantled with alluvium or colluvium that accumulated during the mid- or later Holocene, meaning that buried land surfaces containing archaeological remains could survive beyond the reach of geophysics. Instead, through application of aerial survey techniques, geochemical survey and/or the use of geoarchaeological survey, an assessment of the potential archaeological resource is still possible.

A case study of Bleakmoor Hill, Northumberland, is outlined below. When the site was first considered for development, there was only one principal heritage asset known – a Scheduled palisaded settlement (Historic England List no. 1008562) that following evaluation was found to be of Early Iron Age date. The approach taken adopted a carefully considered, wide range of non-invasive surveys, together with targeted trial trenching, followed by further detailed survey and ultimately targeted excavation. The igneous bedrock was not conducive to geophysical survey. A bespoke suite of non-intrusive surveys was carried out, including targeted geochemical survey utilising a portable X-ray fluorescence reader, magnetic susceptibility survey, and high-resolution ALS (LiDAR) and six-band multispectral imaging survey, supported by sediment coring and environmental analysis and

mapping from satellite imagery, aerial photographs and historic maps. The surveys identified a previously unknown Bronze Age landscape of less obvious features that included platform settlements, burial cairns, field boundaries and clearance cairns, in addition to Late Iron Age cord rigg cultivation, later boundary features, trackways, ridge and furrow agriculture and post-medieval quarrying. These surveys provided a high-quality evidence base to inform the application proposals, determine a suitable and proportionate scheme of mitigation.

Finding bespoke solutions to landscape prospection, investigation and mitigation that draw on the latest archaeological science and methods is now a common feature of our daily workflow. Combining the appropriate suite of techniques with key relevant research questions provides a sound basis for defining high-quality, rapid, cost-effective and practical solutions in advance of large-scale developments. Careful selection of non-invasive techniques can decrease the amount of trenching required, which not only reduces unnecessary impacts on buried archaeology but also lessens carbon emissions, all while ensuring an archaeologically focused outcome.



*Bleakmoor Hill Palisaded Enclosure: LiDAR –
Principal Component Analysis of hillshade (top);
Multispectral – Green Atmospherically Resistant
Vegetation Index (GRVI) (bottom). Credit:
Archaeological Research Services Ltd*

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