Appendix 3.4

Organisation: Fusion Joint Venture [1], Archaeological Research Services[2]
Authors: Jay Carver, MCIfA[1]; Dr Roger Doonan[2]; Dr Clive Waddington, MCIfA[2]
Topic: Geochemical sampling as a method for archaeological evaluation and prospection

Background

A programme of evaluation trenching in a low-lying relict flood plain setting with a high water table at Ladbroke, Warwickshire, was undertaken as part of the HS2 archaeological enabling works during March 2020 following the long period of rain from October 2019 to March 2020 and immediately following the wettest February on record. The works were undertaken for Fusion JV on behalf of the HS2 Company by Archaeological Research Services Ltd on and around a complex of buried archaeological remains thought to relate to a late Iron Age–Roman transition rural settlement site with potential for multiphase activity. Although it was possible to excavate some trenches, the ground conditions in the lowest part of the site meant damage to archaeological remains was occurring during the trenching process, due to the impact of having a machine on such wet, soft ground and trying to excavate remains below the water table.

The approach

A novel solution was identified to complete the evaluation of this site rapidly and under any weather conditions while keeping the works to timetable and budget. This comprised geochemical survey spaced on a 20m grid across the 7.8ha site with measurements taken using a portable XRF machine (Figure 1). This allowed the project to be completed to timetable whilst also producing a data set that could be compared with the evidence for buried archaeological remains as identified by the pre-existing geophysical survey. It is very unusual to use geochemical survey to undertake large-scale archaeological evaluation and even rarer for such an approach to be deployed in a commercial archaeological context. The results have been compelling, showing a clear correspondence between certain key elements including phosphorous, zinc, copper and potassium and the areas of archaeology as identified by the geophysics, and similarly low counts where the geophysics identified little or no archaeology (Figure 2).

Figure 1 A geochemical sample being taken in the field using the portable XRF machine (© Fusion JV)

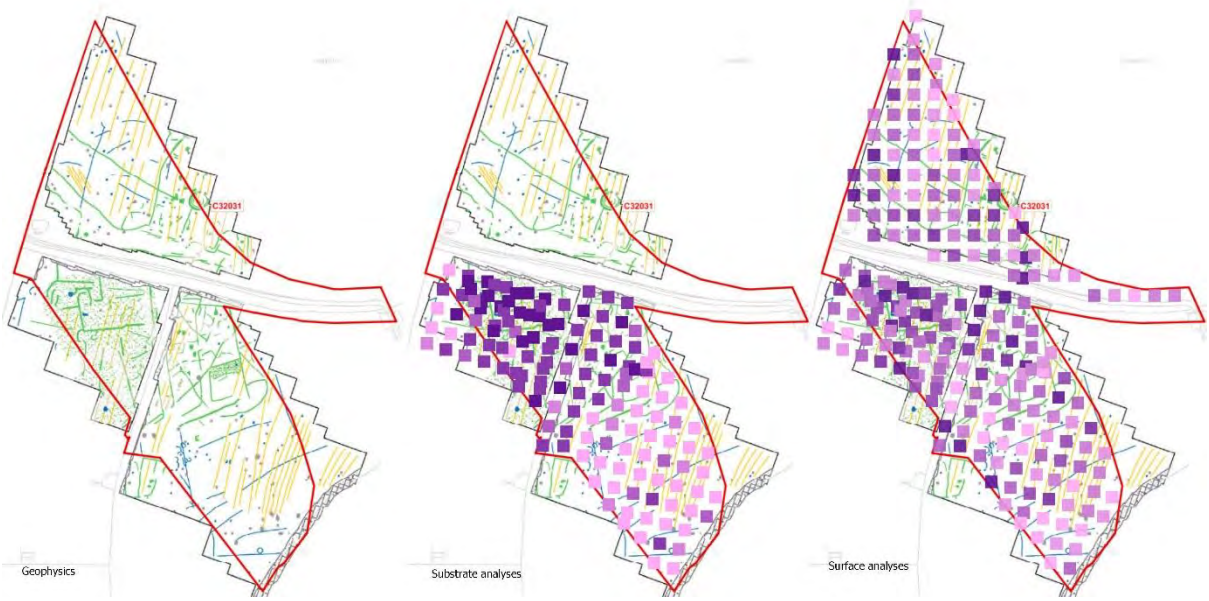

Figure 2 A geophysics interpretation plot with archaeological anomalies highlighted in green with the results for phosphorous (P) overlain in purple, showing the measurements for samples taken from the surface as well as from the top of the substrate. The correlation with the geophysical evidence can be clearly seen, with the darker the colour the higher the concentration of phosphorous (© Fusion JV)

The extensive geochemical survey approach was selected for use on this project because it was non-invasive, high precision, rapid and cost effective, and there was an opportunity to innovate and test the technique in a way in which it is rarely if ever utilised. Identifying ways to improve archaeological prospection and evaluation forms a key research question as part of the HS2 archaeological works and there was an appetite to test this novel application. The elemental range produced by portable XRF analysis can provide data that indicates a range of practices including burning (Mg, K, P), burial and disposal of animal remains (Ca, P), craft-working, especially metalworking (Cu, Sn, As, Pb), and a broad range of domestic activities (P, Cu, Zn, Pb). In this way the geochemical approach provided an appropriate method for rapidly and accurately assessing a large land parcel in advance of national infrastructure development that required a high level of information to inform the mitigation strategy. Another benefit of using this technique was that it minimised impact on the surviving buried archaeology, which meant key relationships will stay intact until the mitigation phase.

The technique has proved very useful in helping to delimit the extent of buried archaeological remains at Ladbroke. It has also shown that there is evidently patterning to the human use of the site and further geochemical sampling on a finer-grained grid will help provide understanding of intrasite activities and their zoning across the site, as well as how this may have changed over time as the site evolved. The technique has also provided hints of other types of archaeological residues that may survive on the site; for example the presence of lead might imply the use of pewter tableware or other non-ferrous activity on the site, and this will help in framing research questions when mitigation takes place. Given the speed, accuracy, spatial precision and cost effectiveness of applying this technique in this way, it shows considerable promise for wider use in UK pre-determination evaluation works, where it could be ideally applied alongside geophysics and/or fieldwalking in advance of highly targeted evaluation trenching, or be sufficient to inform the type and extent of any necessary mitigation works. Its use during open area excavation or strip, map and sample excavations provides a further context of use at the site-based scale, where greater detail can be produced and questions

addressed in relation to the specific use of key structures, buildings and spaces across a given site. The utility of geochemical survey in archaeology is only just beginning to be tapped and its potential and roll out in a commercial archaeological context is an exciting prospect.