



Fosse Way original survey. Credit: Headland Archaeology



Fosse Way features sprayed onto ground in relation to post-strip geophysics. Credit: Headland Archaeology

# Quantum archaeology: a paradigm in field methodology and geophysics?

*The development of post-strip geophysics for excavation*

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This article follows a presentation at the ClfA conference in 2024 in Chester. While there are a wide range of applications that are associated with geophysics, most focus on prospection identifying and defining where we should dig. Even though post-strip geophysics has been done before, its benefits have not been well enough articulated to achieve traction within the industry. This idea originates from a paper entitled 'Archaeological feedback in geophysics' published in *Archaeological Prospection* in 1996 (Boucher, 1996) and was resurrected through the need to drive innovation into major infrastructure projects in 2018, specifically the A14 and subsequently on HS2. Since then, Headland have undertaken several tests over a range of geologies and sites. The results from these are still nascent and we recognise these are early days. However, having overcome some difficulties in building the method into current field practice, now is a good time to update the profession on progress to date.

## Philosophy

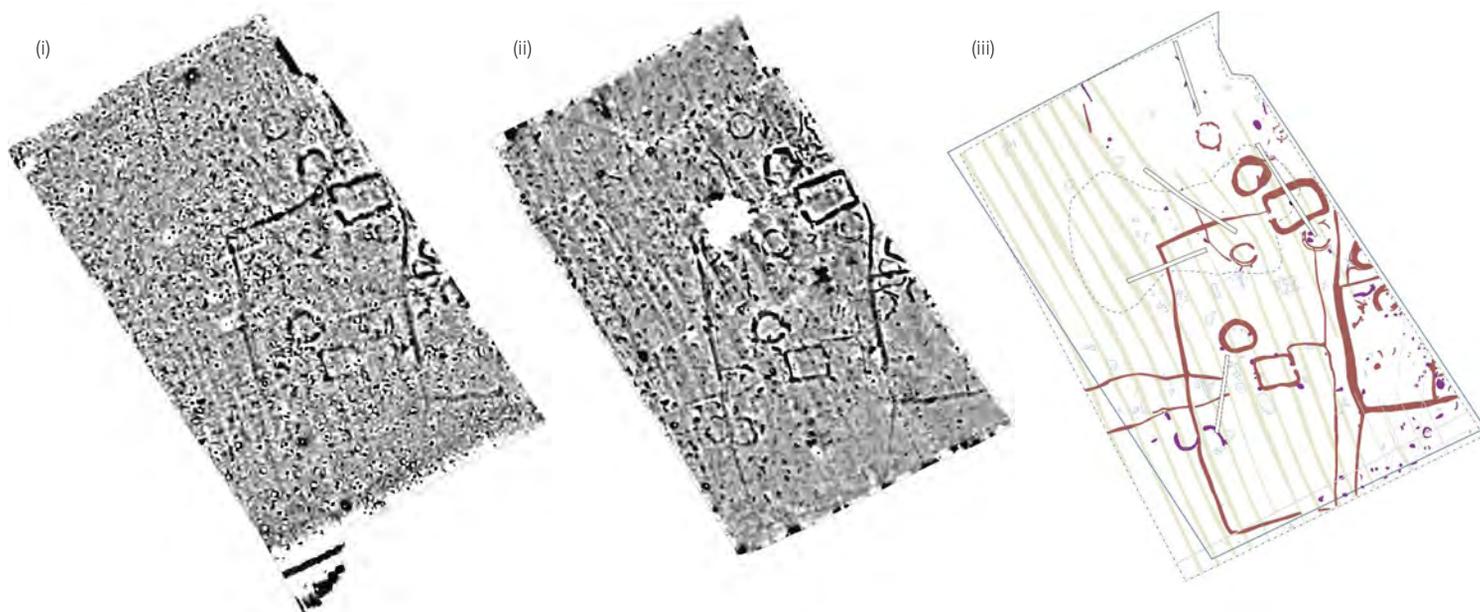
The method – titled post-strip geophysics – is defined by the removal of topsoil prior to conducting a geophysical survey (usually a second one). This eliminates the background noise present on most sites, leaving just archaeological and some geological responses.

Currently, we strip and visually map sites. While this results in an initial plan of features, for various reasons (omission, later exposure, interleaving deposits, colluvium, etc) many more features can 'appear' during the fieldwork stage, adding time and cost to the work and undermining attempts at an early holistic strategy for the project. We have found that post-strip geophysics helps to better manage archaeological works and we are working towards how to establish better-structured excavation strategies based on the results.

This includes looking to develop a more stratified approach to sampling sites with better-targeted interventions, maximising our understanding of these locations. Current sampling strategies rely on structured sampling (eg, a ditch slot every 10m), usually a regular and fixed percentage by feature type with a view to securing some information as to the date and nature of features. We find that post-strip geophysics can also further refine where to target interventions.

We have undertaken tests using the most commonly applied method. We know it will work, because it has already done so in locating the site. However, what if before digging a single feature we could

- locate features not visible to the naked eye, or present beneath colluvium?
- know the relationship between features?
- identify where pottery, environmental material or other artefacts are most likely to be present?
- know where to find iron objects without metal detecting or out of range of the metal detector?
- identify burning in situ, even where no visible trace remains?



*Fosse Way original survey (i), post strip survey (ii) and excavation plan (iii). Credit: Headland Archaeology*

- use more information to help us interpret the site?

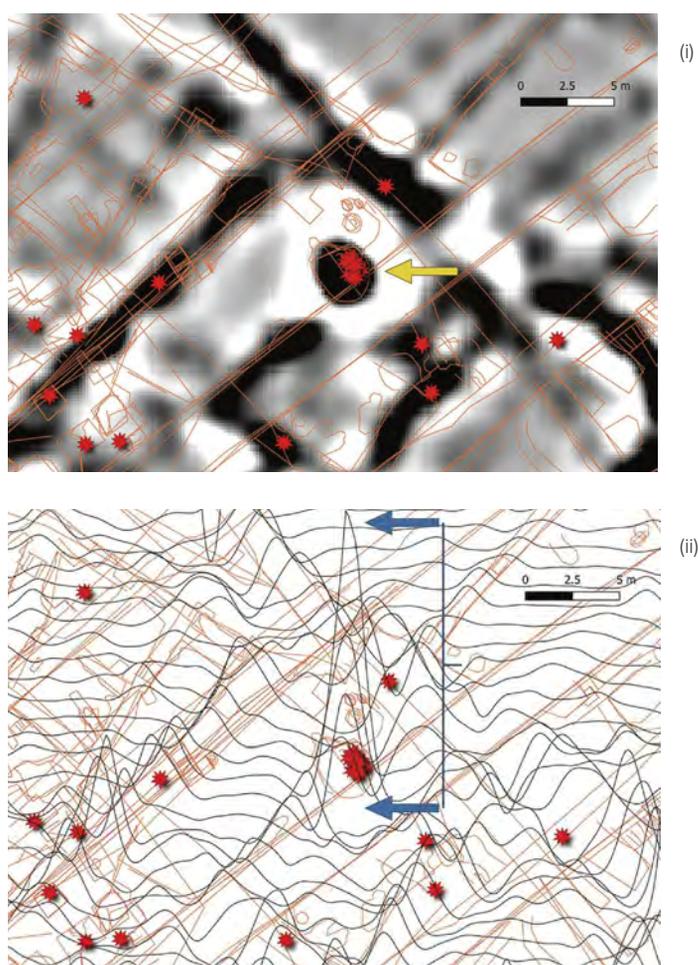
These six objectives have been used to shape our approach to post-strip geophysics. In addition, the use of other methods/equipment could enable us to assess the depth of features, identify randomly magnetised soils (these are not easily detectable using standard fluxgate gradiometers) and assess and compare magnetic direction and intensity.

### Some initial results

HS2 provided one of the best opportunities for a pre-planned 'post-strip' survey. A site at Fosse Way contained several mid-Late Iron Age enclosures and interlinking ditches from the original geophysical survey, but trenching failed to identify the presence of any features associated with these. Knowing the archaeology was difficult to see on this site, LM JV, advised by WSP, took a decision to implement the innovation being worked on by Headland Archaeology and commission a scheme of post-strip geophysics. Plots from the site clearly demonstrated the reduction in ferrous responses following removal of the topsoil. On this part of the site, it was necessary to spray the outline of geophysical anomalies on the ground for site staff to target their interventions. While it did allow the successful excavation of a site that from the trenching results might not have been possible, we were only able to address one of the six objectives listed above.

Other work undertaken across a range of projects has had the aim of establishing proof of principle for the rest of the objectives. A site in Warwickshire provided responses that clearly illustrate an association between a concentration of finds and a strong magnetic response. The red stars in Figure A represent Romano-British pottery sherds, a cluster of

which were found beneath this response. In other locations there were just isolated single sherds of pottery within the excavated segments.



*Figure A: Grey scale plot showing response from quantities of cultural debris in Warwickshire (red stars are finds locations) (i) and corresponding X-Y trace plot (ii) showing relative intensity of response from quantity of cultural debris. Credit: Headland Archaeology*

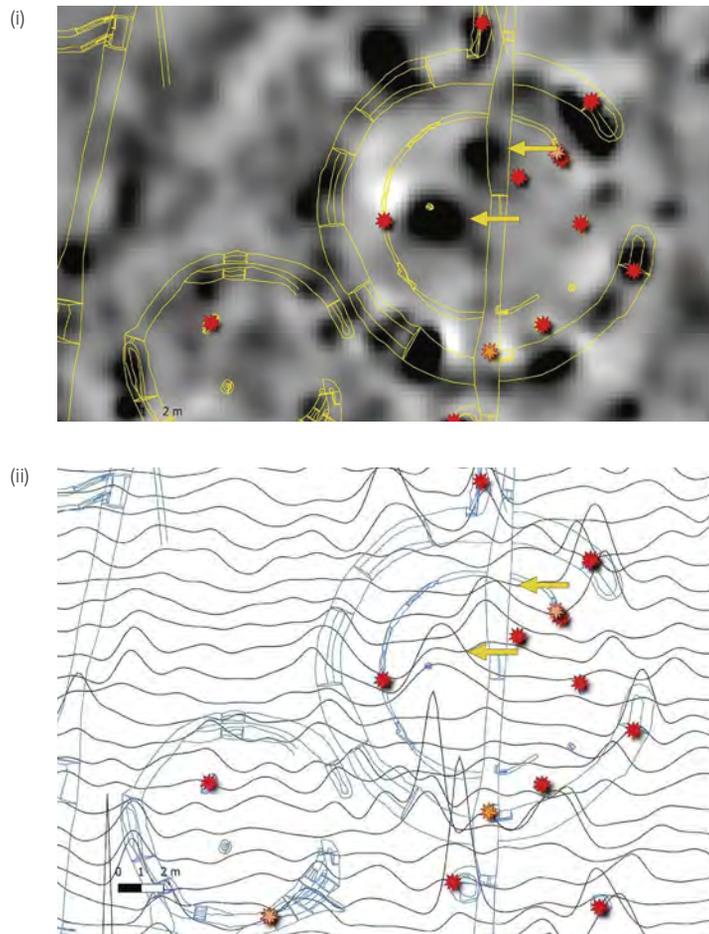


Figure B: Possible evidence for burning inside an Iron Age workshop in the north of England (red stars are iron slag finds spots (i) and (ii) ghost features that might be associated with the locations of smithy hearths. Credit: Headland Archaeology

*When developing innovative new methods, we have begun to learn that both the scientific and practical aspects of new techniques need to be progressed in tandem.*

The ability to recognise evidence for burning might be demonstrated on an Iron Age metalworking site from the North of England. In this case, the red stars in Figure B represent iron slag. Two enhanced magnetic responses can be seen within one of the circular structures found on the site, one of which had no associated slag find. Many of these structures were probably small workshops and those responses could be ghost (ie, not visible to the naked eye) magnetic anomalies beneath smithy hearths.

To date, our success at finding iron objects has been limited to horseshoes and a pick-axe head (intrusive within the Roman feature), and it is clear on some sites that interference from more recent iron objects can still survive in the post-strip data. For instance, the base of furrows from ridge and furrow still survive within the stripped area in the northwest portion of Fosse Way.

### Future challenges

With any innovation, what we find is that most people buy into the higher-level ideas and philosophies behind a new method, albeit with reservations over more scientifically demonstrated proofs of principle. The biggest challenge we face relate to introducing new activities into existing processes is the people factor. Translating a 'good idea' into everyday practice requires as much, if not more, effort than establishing

scientific principles. When developing innovative new methods, we have begun to learn that both the scientific and practical aspects of new techniques need to be progressed in tandem. Our focus for future work is to develop an approach that delivers all six of the above objectives at once and engages whole project teams. We are already starting to see very positive results from this approach.



### Andy Boucher

Andy is the Director of Commercial Operations at Headland Archaeology and has been working in commercial archaeology since 1986. He has developed innovative

approaches and has extensive knowledge of scientific techniques used on archaeological sites, including geophysical survey. He has worked for both English Heritage Ancient Monuments Laboratory and the French National Geophysical Research Centre and established commercial geophysics offerings across three different organisations.