

Ten years of archaeogeophysics

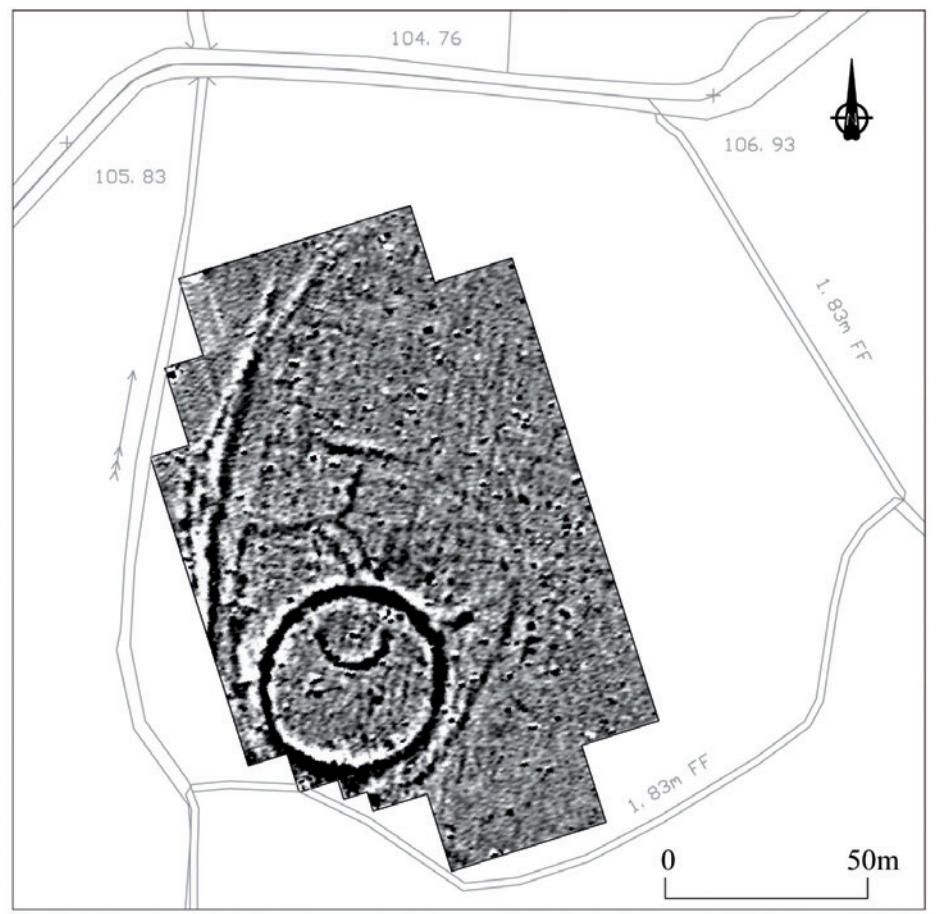
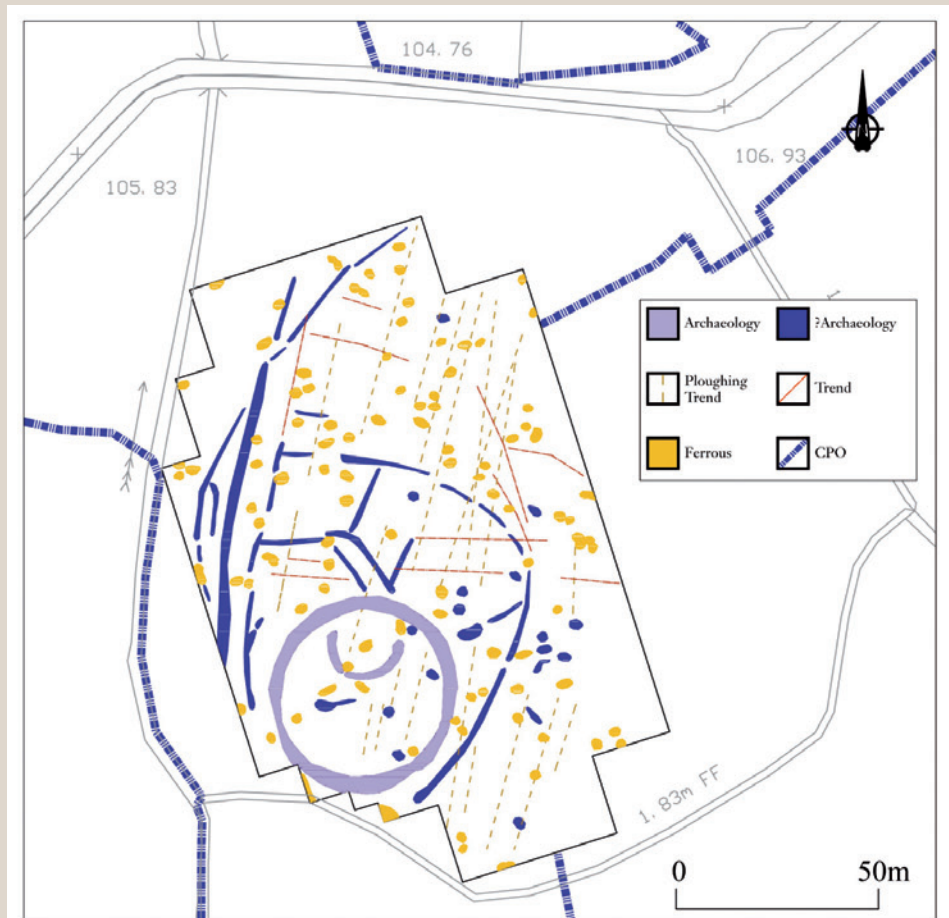
The use of archaeogeophysics on road schemes over the last decade is being reviewed as part of the NRA Fellowship Programme.

By James Bonsall, an archaeological geophysicist currently undertaking research for a PhD at the University of Bradford

Geophysical survey consists of a range of methods for exploring below the ground surface, allowing archaeologists to 'see beneath the soil' by means of remote sensing. This form of non-invasive prospection operates by measuring differences, or anomalies, in the magnetic, electrical and other properties of the earth capable of being detected by instruments. Such anomalies can be caused by the presence of ferrous artefacts and a range of archaeological features and structures.

Between 2001 and 2010, the NRA managed 241 road schemes in various stages of planning, construction and completion. Of these, 71 separate schemes were assessed with archaeogeophysical surveys, culminating in 171 unique geophysical reports. In the last issue of *Seanda* (Issue 5 [2010], p. 5), Rónán Swan (NRA, acting Head of Archaeology) announced a review of these surveys as part of the NRA Fellowship Programme. The review is being carried out by James Bonsall, Dr Chris Gaffney and Prof. Ian Armit from the University of Bradford in the UK. Irish company Earthsound Archaeological Geophysics is acting as the university's industrial partner in the research. The review will closely examine the use of archaeogeophysical surveys with respect to their initial objectives and to what extent such surveys have been of benefit to the NRA over the last decade. Geophysical survey is regularly used to identify or map archaeological sites at an early stage in the planning process and is one of many methods used by the NRA to help mitigate and minimise the impact of a road scheme.

Of the 171 geophysical assessments, 79% were subsequently excavated by professional archaeological consultants. This data is currently being used to determine the success



Magnetometer survey results (top: interpretive drawing, bottom: greyscale image) from Baronstown 1, Co. Meath, an early medieval ringfort identified on the M3 Clonee–North of Kells motorway scheme. The Dunshaughlin–Navan section of the M3 had a 79% success rate for identifying archaeological sites via geophysical survey. (Image: GSB Prospection Ltd)

or otherwise of archaeogeophysics on NRA schemes. While the data review is at an early stage, some preliminary statements can be made from a 272 km sample of road corridor surveys across the country. The techniques used included magnetometry (366 hectares), magnetic susceptibility (94 km) and earth resistance (5 hectares). Archaeological geophysics identified about 50% of excavated archaeological sites (either in part or in whole) in the 272 km sample of road corridor.

A countrywide analysis of the data shows that:

- geophysical surveys were used in 23 counties in Ireland, giving very good coverage across variable landscapes and soils.
- 60% of the surveys were carried out in Leinster. This reflects the large number of investigations along the M3 (a scheme which is represented by 26 geophysical assessments in all, accounting for 15% of the NRA data across Ireland), the M7/M8 and the N9/N10.
- 27% were from Munster. Most of these were from the N25 Waterford City Bypass and a number from the proposed M20 Cork–Limerick motorway.
- 11% were from Connacht. This includes a 163-hectare assessment—an area the size of 125 Gaelic football pitches laid end-to-end—from the M6 Galway–Ballinasloe, which is the largest geophysical survey area that has since been excavated.
- 2% of geophysical surveys were carried out in Ulster.
- Irish companies carried out 77% of all geophysical surveys for the NRA, the remainder were UK contractors. In recent years, fewer UK contractors have carried out work for the NRA owing to the presence of new Irish companies.



NRA archaeologists Martin Jones and Paul O’Keeffe learn how to use Ground Penetrating Radar from Heather Gimson during a workshop hosted by Earthsound Archaeological Geophysics. (Image: NRA Fellowship Programme, Earthsound Archaeological Geophysics).



The latest technology—in this case a new electromagnetic device—being used by the author to assess its suitability for road schemes. (Image: NRA Fellowship Programme, University of Bradford)

As well as reviewing the legacy data from the last decade, the NRA Fellowship Programme has also collected new data. This includes 35 new geophysical surveys across the country to investigate the effect of variables such as climate, geology and landscapes upon archaeological features. We are also assessing the very latest in geophysical technology. The fieldwork has given NRA archaeologists the opportunity to assist in and observe geophysical surveys as well as learning about the latest developments and instruments.

There have been considerable technological and methodological advances in archaeogeophysics over the last decade. Just one example of change that directly benefited the NRA was the addition of different types of geophysical instruments that can be mounted on to a single vehicle or platform. These have created a cost-effective, three-fold increase in survey speed and coverage since 2001. What do the next 10 years have to offer? We are examining the use and development of the very latest technologies and trends to see how these can be applied to road schemes today and in the near future. We are assessing instruments that measure magnetic and electrical properties of the soil simultaneously; wireless Bluetooth connections between geophysical instruments, computers and GPS (Global Positioning Systems) that can help to create instant data analysis in the field; articulated and motorised equipment that can increase productivity and survey resolution, as well as 3D technologies to help predict the depth of a site as well as its areal extent.

The review will also disseminate the results of the surveys to the public. A small collection of geophysical reports have been available for a number of years on the M3 scheme website (www.m3motorway.ie/Archaeology); the majority of all NRA reports are publicly available (i.e. they are held by the National Museum of Ireland and the National Monuments Service Archive), but are not easily accessible. To rectify this, part of our review will see the creation over the next year of a publicly accessible web database of NRA geophysical surveys and reports from across the country. The review will be completed in October 2012 and we will continue to report our progress in future issues of *Seanda*.