Brú na Bóinne Remote Sensing Project

Application of Remote Sensing techniques at Brú na Bóinne World Heritage Site, County Meath, Ireland

Ian Hill
Department of Geology, University of Leicester, England

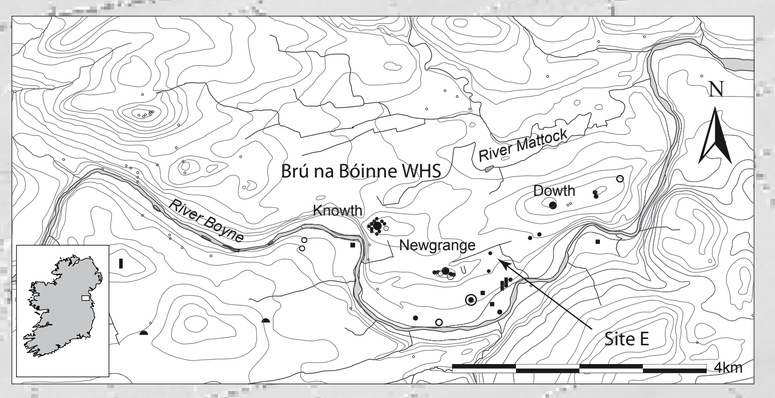
Kevin Barton
Landscape and Geophysical Services, Claremorris, Co. Mayo, Ireland

Conor Brady,
Humanities and Social Sciences Research Centre, Dundalk Institute of Technology, Ireland

Liam Williams,
Department of Geology, University of Leicester, England

Martin Krajňák,
Comenius University, Bratislava, Slovakia

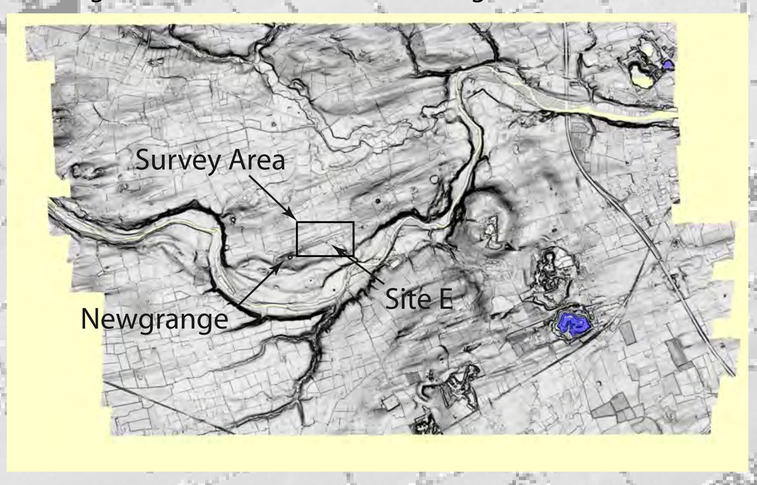
Introduction



Brú na Bóinne, has been an important ritual, social and economic centre for thousands of years. It was designated a UNESCO World Heritage Site (WHS) in 1993. Although extensive research has been undertaken, this has focused on the excavation of some monuments. Little extensive systematic field survey of the wider landscape has taken place. We still lack an in-depth understanding of the site's broad range of archaeological monuments, from the Neolithic passage tombs to the Battle of the Boyne (AD 1690) battlefield, and the landscape and communities that shaped them.

Worldview-2 panchromatic image of Brú na Bóinne with the location of Newgrange Passage Tomb (Data courtesy of Digital Globe).

The Brú na Bóinne Research Framework document (Smyth et al. 2009) has advocated a shift in research focus away from sites and towards landscape. It is in this area that remote sensing techniques have an important role. The current project addresses this aim and is field testing a range of geophysical techiques that will be used in a large-scale systematic remote sensing survey and will be integrated with other remote sensing datasets.



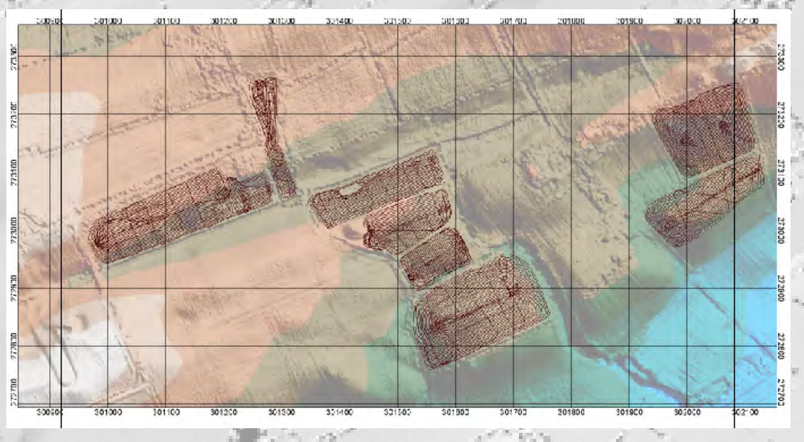
Slope-shaded LiDAR image. (Data courtesy of Meath County Council and the Discovery Programme)

Survey Area

Equipment - GEEP System

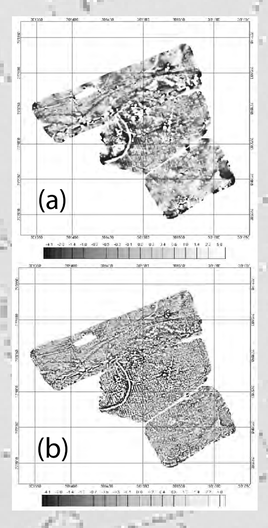
The GEEP system comprises a tractor unit with datalogger and Wi-Fi antenna. The sled is configured with 4x caesium vapour sensors spaced 1m apart, a centrally mounted DualEM 421S 6-receiver coil EM system, GPS antenna and 3-axis compass. Data are transmitted in real time via the Wi-Fi link from the tractor unit to a datalogger in the trailer unit for quality control.

Survey Tracks



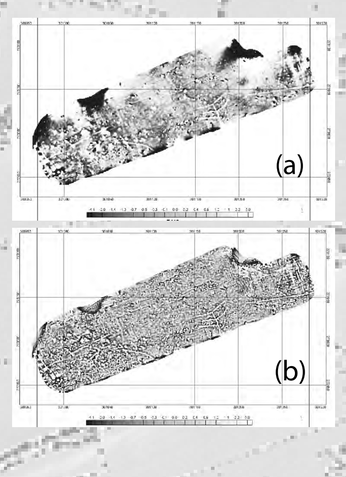
GEEP survey tracks superimposed on LiDAR basemap.

F112 Total Field & Vertical Derivative Magnetic Data



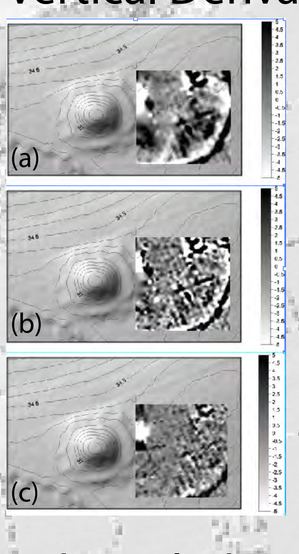
The total field data from all 4 magnetometer sensors are combined to produce (a) and filtered to produce the derivative data in (b), which is comparable to the data collected by magnetic gradient systems such as the Bartington gradient system. The derivative (or gradient) data emphasize the short wavelength anomalies from shallow near-surface sources.

F116 Total Field & Vertical Derivative Magnetic Data



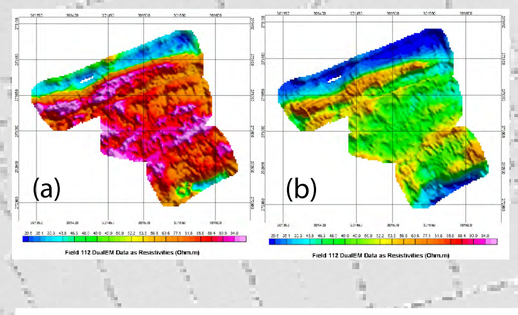
F116 lies to the W of F112 and is part of the same topographic unit on which Newgrange passage tomb stands. Earlier work indicates that there is a significant palimpsest of features in the field immediately to the E of the tomb. These point to prolonged episodes of intense activity. The newly acquired GEEP data confirm the suspected scale and extent of this activity on the Newgrange Ridge. Images: (a) total field anomaly map; (b) vertical derivative.

Comparison of Bartington Vertical Gradient Data with GEEP Vertical Derivative Data



Preliminary results from a comparison of magnetic data collected near Site E using the GEEP with caesium vapour sensors and a hand-carried Bartington dual fluxgate gradiometer; (a)GEEP Total Field data (nT), (b) GEEP Vertical Derivative data (nT/m) and (c) Bartington Vertical Gradient data (nT/m).

F112 Electromagnetic Data



The EM data is collected synchronously with the magnetic data. It has much lower spatial resolution than the magnetic data, but shows the relationship of the archaeology to the soil, subsoil and shallow bedrock geology. Images: (a) resistivity values at nominal 1m depth, (b) at nominal 2m depth. The data is displayed as resistivity values in Ohm.m and clearly shows the areas of alluvium (blue – low resistivity) from the ridges of shallow bedrock (orange/red – high resistivity). The major geological feature run WSW-ENE parallel to the trend of the topography, while there is also a smaller scale but widespread lineation running NW-SE.

Acknowledgements

This project was facilitated by the generous cooperation of Pascal and Kevin Hand and the Hand family, landowners.
We acknowledge the help and advice of Tom Condit, National Monuments Service DAHG