Geophysical surveys to assist the INSTAR Boyne Valley Landscapes Project at the Brú na Bóinne World Heritage Site, County Meath, Ireland.

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Historically aerial photography, and latterly LiDAR, have been used to identify and map new sites in the Brú na Bóinne World Heritage Site (WHB), an internationally significant archaeological landscape known for its Neolithic passage tombs, other monuments and megalithic art (Fig 1). The landscape is largely comprised of the floodplain and terraces of the River Boyne which are adorned in a combination of pasture and tillage crops.

Fig 1 Location of the Brú na Bóinne WHS and its Principal Visible Monuments

The INSTAR (Irish National Strategic Archaeological Research) Boyne Valley Landscapes Project is in response to some of the key issues to be addressed in the research strategy published in the Brú na Bóinne WHS Research Framework (Mayforth, 2009).

Key issues to be addressed where geophysical survey can be of assistance include:
- Reconstruction and modelling the palaeoenvironment and landscape development
- Establishing the nature and extent of later prehistoric activity
- Understanding the structural sequence and phasing of the passage tombs
- Investigating the sequence of monuments between Newgrange Passage Tomb and the River Boyne
- Integrating monuments and landscapes
- Understanding land-use change
- Investigating the archaeology of the River Boyne

The project is developing an integrated and comprehensive landscape archaeological model for the Boyne Valley, with a focus on linking changing land use and environment to the known landscape of ancient monuments and settlement. The project has aimed to collate all available landscape and environmental data into a GIS database for modelling purposes, and use this database to identify areas of likely change in the natural and cultural landscapes. Ground-truthing of specific areas of the river system against the model developed from the GIS database is being carried out, and then integrated into the GIS, providing a comprehensive dataset for model of landscapes and river history in the Boyne Valley.

Ground-truthing involves a combination geophysical survey and coring to obtain material for sedimentological and geochronological analysis and for radiocarbon dating. Surveyed zones, targeted by landscape analysis using LiDAR, include identified sites as well as previously unenumerated sites with high archaeological potential.

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Fig 2 LiDAR image showing the core area of Brú na Bóinne WHS and low topographic profile sites LP1 and LP2

Fig 3 LiDAR image of site LP1

Fig 4 Schematic gradiometry results

The gradiometry results (Fig 6) partially map the northern part of LP1 (Fig 3) where there appear to be two parallel curving ditches (G1 & G2). The remaining part of the topographic anomaly (G3) does not have a strong magnetic expression. This may be due to the nature of the sediments on the lower part of the sloping terraces and agricultural activity. There are two previously unrecognised features at the south and at the east of the survey area. The southern feature is presently interpreted as a sinuous ditch (G14 & G15). It could represent the course of a drain forming an old field boundary which runs parallel to the current boundary. The eastern feature is a sinuous ditch (G7) some 18m in diameter possibly enclosed by a ring of pits (G8) giving an overall diameter of some 30m.

To the south there are a number of irregular short linear and arcuate features (G9). To the north-east of the survey area there appears to be a number of linear features trending northeast to southwest towards the northern double ditch feature (G10).

The south to north ERT transect location is shown overlaid on the magnetic gradiometry image (Fig 5). The modelled pseudo section with draped topography is given in Fig 6. The topography draped on the section has an all relief exaggeration. There are two main features seen in the section with a higher resistivity 'low' lying in the lower ground (R1) and low resistivity material forming the higher ground (R2). There is an apparent, the height variation between the lower ground to the south and the higher ground to the north. There is an intermittent, thin lower resistivity veneer of variable thickness lying on the 'low' (R3). Low resistivity is also seen under the 'low'. The intermediate resistivity zone from 10m to 12m along the section seems to correlate with the strong double ditch feature seen in the north of the magnetism gradiometry data (Fig 6, G1 & G2). From the magnetic gradiometry data, G2 lies at 30m along the section and G1 at 10m. The next step in the investigation of this site is a coring transect based on the geophysical results.

Fig 5 ERT line location

The south to north ERT transect location is shown overlaid on the magnetic gradiometry image (Fig 5). The modelled pseudo-section with draped topography is given in Fig 6. The topography draped on the section has an all relief exaggeration. There are two main features seen in the section with a higher resistivity ‘low’ lying in the lower ground (R1) and low resistivity material forming the higher ground (R2). There is an apparent, the height variation between the lower ground to the south and the higher ground to the north. There is an intermittent, thin lower resistivity veneer of variable thickness lying on the ‘low’ (R3). Low resistivity is also seen under the ‘low’. The intermediate resistivity zone from 10m to 12m along the section seems to correlate with the strong double ditch feature seen in the north of the magnetism gradiometry data (Fig 6, G1 & G2). From the magnetic gradiometry data, G2 lies at 30m along the section and G1 at 10m. The next step in the investigation of this site is a coring transect based on the geophysical results.

Fig 6 ERT Results

Fig 7 LiDAR image of LP2

Fig 8 Gradiometry results

Fig 9 Earth resistance results

In the gradiometry results (Fig 6) the central feature (G1) is some 18m in length with curving terminates’ at both ends each some 7m in length. The width of the feature is less than 5m. G1 is enclosed by a discontinuous band of positive gradient (G2). The feature is presently interpreted as a ditched oval enclosure and is transected to the west and north by a road and field boundary respectively. The discontinuous nature of the anomaly prevents any recognition of possible entrances. There are a number of linear features cutting, running close to or possibly overlapping the oval enclosure. G3 is a ditch cutting the enclosure and is possibly a remnant field boundary. It has a small offset where it cuts and possibly represents the southern element of the enclosure which may indicate that it postdates it. G4 indicates two slightly curving ditching intersecting at ninety degree on or close to the eastern margin of the enclosure. They may be remnant field boundaries. G6 is a linear that partially cuts across the southeast corner of the enclosure. Its discontinuous nature makes it difficult to interpret its function. It would be related to an entrance to the enclosure. G9 indicates two possible continuous enclosing elements of a small oval feature. The feature appears to lie within a slightly coextensive the north eastern sector of the large oval enclosure. There is a number of pit-like features within and without G6 and also small, subtle anomalies which might be related to an entrance in the south east.

The resistivity results are given in Fig 9. R1 maps the central feature as seen in the magnetic gradiometry data (G1). The feature has the lowest resistance measured during this surveyed. The next highest resistance is denoted by R2 which takes the form of a circular or slightly oval area enclosing R1. R3 denotes the highest resistances which surrounds R1 & R2. The resistance contours found here clearly define R2 as an enclosing element of R1 within the background and resistances of R3. We currently interpret these results as being due to a destroyed passage tomb. The next step in the investigation is a larger scale earth resistances survey followed by an ERT transect.