

Archaeometric prospection using electrical survey predictive deconvolution (ESPD)

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Once upon a time archaeological prospection was carried out mainly using electrical techniques. These days magnetic techniques and GPR are used by preference. However, we have shown that electrical surveying combined with the technique of predictive deconvolution is very effective at finding buried features where the shape of the feature can be predicted in advance. One such type of feature is the Grubenhäuser (or sunken-featured, sunken-floored building, or SFB). Grubenhäuser exist in the archaeological record as individual well-defined oblong pits that have been filled and buried with other material. Aerial photographs at New Bewick in Northumberland, northern England (UK Grid reference NU061206) showed quasi-rectangular features similar to those on aerial photographs at the nearby Anglo-Saxon palace of Milfield (NT941339) which had been confirmed by excavation to be Grubenhäuser.

Several electrical resistivity surveys were carried out over the area with an ABEM Mk II Terrameter and a multiplexing box serving 31 electrodes in line at any given time. Both double-dipole and Wenner configurations were used with an electrode spacing of 1 m. Data was acquired in blocks of 30 m by 30 m during a period of dry summer weather while the field was under young winter wheat. The Wenner array produces a characteristic 'M' or 'W' shaped response over filled in excavations such as those expected to represent a Grubenhäuser. While this seems a disadvantage in the first instance, it can be used to improve the data. Such anomalies were present in the raw New Bewick data. The resulting data were analysed using 1D and 2D predictive deconvolution in order to remove the Wenner response. The deconvolution was carried out using an inverse matrix element method. The filtered results indicated the presence of an anomaly that is consistent with a Grubenhäuser measuring about 5 m by 4 m and with a pit depth of 0.6 m below 0.5 m of topsoil. The results also showed broader areas of increased resistivity which have been attributed to compaction resulting from human and animal movement.

Following the geophysical study the site was excavated (T. Gates and C. O'Brien "Cropmarks at Milfield and New Bewick and the Recognition of Grubenhäuser in Northumberland." *Archaeologia Aeliana* 5th series, Vol XVI, 1988, 1-9) and a Grubenhäuser was discovered at the site. The excavated Grubenhäuser measured 4.7 m by 3.9 m with a pit depth of 0.5 m below the base of the topsoil. The deconvolved Wenner data performed better than the double-dipole resistivity survey but was marginally slower.