B. S. Ottaway

Archaeological Relevance of Cs-Magnetometry

Aerial survey and field walking of a freshly ploughed field lead to the discovery of a new site in 1981: the Galgenberg near Kopfham in Lower Bavaria. To find out more about the size and extent of the site a survey was carried out by Dr. Helmut Becker of the Bayerisches Landesamt für Denkmalpflege, Munich, using for the first time in Europe the highly sensitive caesium magnetometer. The measurements, taken manually at 1m intervals, indicated complex ditch systems with several features inside and outside the enclosures. The main, oval enclosure seemed to have one entrance with foreworks lying directly in front of it. It was this plan that guided our subsequent excavations at the Galgenberg for the next nine years.

A subsequent caesium magnetometer survey, taken semi-automatically at 0.5 m intervals with digital graphic evaluation, gave a much more detailed picture of the main enclosure. Constant comparison of excavation and caesium magnetometer results led to improved, fully automated data collection and digital evaluation now widely used by Becker and his team. This method was used to produce a survey covering a large area on the Galgenberg, indicating the presence of at least six enclosures, which might otherwise have remained undetected.

Although the magnetometer survey had provided the 'blue print' for the excavation it was only by excavation that the full extent of the complexity of the prehistoric remains and their relationship to one another became clear (Ottaway, 1999). For instance, the forework to the entrance, suggested by the caesium magnetometer survey to be a relatively simple structure, had undergone at least three major structural changes. These had transformed the entrance from one surrounded by a cluster of square features to an entrance which was most probably embellished and strengthened by two forework buildings which were arranged in such a fashion that entry into the enclosure was by two or three relatively narrow gaps left between the forework structures and the ditch. Entry into the enclosure was much more controlled than before and could, if necessary, be defended easily and effectively. The forework and some of the structures around the terminals of the ditch had been whitewashed, which must have given additional visual impact. The result must have been imposing, restricting vision and movement into the enclosure. It was more of a statement of control, protection and defence than it had been for previous generations.

Deposits in many of the other features inside and outside the enclosure speak of phases of decommissioning and deliberate deposition of artefacts, followed by destruction horizons and a shift in the nature of deposits.

To conclude, only through the complementation of prospection and excavation can the full picture of the prehistoric landscape and the sites contained therein be explored.

Reference

B. S. Ottaway 1999. "A Changing Place. The Galgenberg in Lower Bavaria from the fifth to the first millennium B.C.", *BAR International Series* 752

A. E. Patzelt, M. Waldhör, B. Greiner

Resistivity and GPR Survey of two Early Mediaeval Grave Yards in Southern Germany

Introduction

The routine application of geophysical prospection for archaeological subsurface structures have been established during the last decades. Major benefits arise from the *fast and non-destructive* documentation of archaeological objects even on large areas. Most common, magnetometer surveys with hand held fluxgate magnetometers are carried out. Beside this, resistivity, electromagnetic and ground penetrating radar (GPR) measurements are used, when investigation sites are not suitable for a magnetic survey.

Here we want to present the results of two surveys on Early Middle Aged yards in the cities of Weinstadt and Kirchheim/Teck (Baden-Württemberg, Southern Germany). Both sites have been investigated with resistivity meters and GPR, respectively. In general the survey of single graves is relatively difficult, as the objects are quite small and the physical contrast to the surrounding subsoil is often very low.

Survey in Weinstadt – stone-lined Merowingian graves

A field of about 5,000 sqm was investigated for stone-lined graves, which were suspected due to some earlier archaeological investigations. Resistivity and GPR measurements have been carried out, as both methods seemed to be suitable to detect single graves, lined or covered with limestone rocks, in loess ground. An earlier magnetic prospection with a fluxgate magnetometer (FM36, Geoscan) yielded no results on archaeological structures due to the local soil conditions.

The GPR survey with a 400 MHz bistatic antenna (Ramac GPR, Mala) on part of the area yielded no clear results. Hence, the total area was measured with a resistivity meter (RM15, Geoscan). We used the standard Twin Probe configuration with a mobile probe spacing of 0.5 m. According to the small scale of the archaeological objects a narrow sampling interval of 0.5 x 0.5 m was chosen. It was expected that limestone rocks (marking single graves) in conductive loess soil corresponded with relatively high resistivity values. Figure 1a shows the result of the resistivity survey, together with the location of later excavated stone-lined graves. The data quality of the survey is less good in the eastern part of the investigated area due to the rough terrain there. Several small areas with local high resistivity values (Fig. 2) occur in the middle and the east. Most of these areas correspond with a stone-lined grave, as the later excavation has shown. However, the graves without a stone frame were not detectable by the resistivity measurements. Although the resistivity survey was not able to resolve all stone-lined graves, the approximate position and extension of the grave yard was recognizable from the resistivity survey. Hence, the geophysical prospection has been a helpful tool in planning and execution of the archaeological excavation. An excavated Early Middle Aged stone-lined grave is shown in Figure 2.

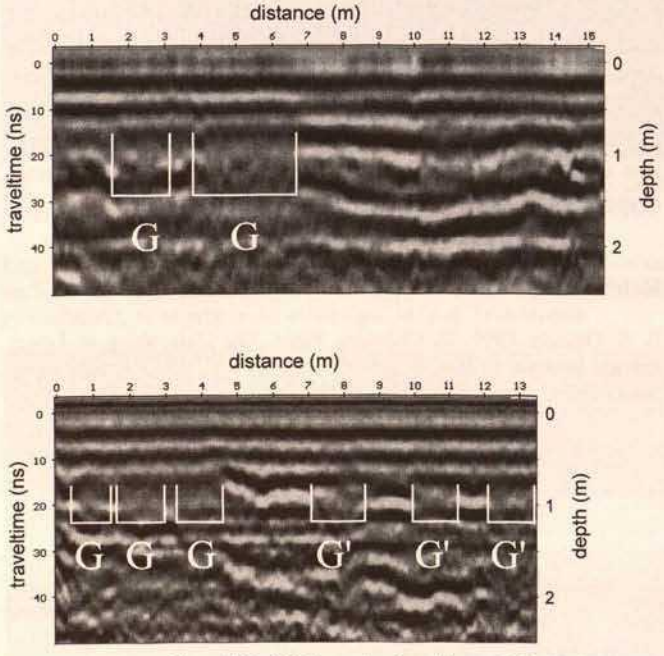

Fig. 1. GPR profiles (400 MHz) at the location of Kirchheim/Teck. Upper profile: Two known graves are located at profile coordinates of about 1.5 m to 7 m. Depth of the graves is approximately 1m. To the right undisturbed sedimentary layering is recognizable. Lower profile: At profile coordinates 0.3 m to 4.5 m three graves are located. Indications for the position of three additional graves are given at a distance of 7.2 m–8.5 m, 9.8 m–11.2 m and 12.0 m–13.5 m, respectively. G: known grave, G': grave suspected according to the radar data and confirmed by later excavation.

Fig. 2. Processed resistivity values and location of subsequent excavated stone-lined graves at the location of Weinstadt. Relatively high resistivity values often correlate with limestone-lined graves in the loessy ground. Hence, the center of the Early Middle Aged grave yard could be detected by the geophysical measurements. However, the single stone-lined grave in the west could not be recognized from the resistivity measurements

Survey in Kirchheim/Teck – Alemanian graves

The investigation area, a meadow of approximately 1,400 sqm, is located in the inner city of Kirchheim/Teck. The area is part of a large Early Middle Aged grave yard, and over 100 single graves have been found at building sites in the vicinity. Magnetic measurements could not be carried out, as the area was partly lined with a several meter high metal fence. Hence, a resistivity survey (RM15, Geoscan) of the area in Twin Probe configuration with a sampling interval of 0.5 x 0.5 m was carried out. According to the expected depth of the graves (0.7 m–1.0 m) a spacing of 1.0 m for the mobile probes was chosen. However, from the resistivity survey only gross geologic features (changes in thickness of the alluvium) could be recognized. No indication on archaeological objects could be obtained, while the subsequent following excavation yield several graves at the investigated area. While the archaeological excavation was in progress, GPR measurements with a 400 MHz bistatic antenna (Ramac GPR, Mala) was performed over partly excavated graves. A radar profile over two known graves is shown in Figure 1 (upper profile). At the right half of the GPR profile undisturbed, continuous sedimentary layering is visible. The graves clearly show up as zones of weak reflection with the sedimetary layering being interrupted. This pattern was assumed to be typical for graves at the local geologic conditions and further GPR measurements have been performed in the nearest vicinity of the excavation. Indications for additional graves were found at several locations, an example is given in Figure 1 (lower GPR profile).

Summary

In principle, resistivity and GPR surveys are suitable for the detection of graveyards or even single graves. However, graves without a stone frame or stone cover might not be visible in resistivity measurements. Surveys have be carried out with a high sampling interval and test measurements over already known graves are helpful. Nevertheless, the success of a survey still strongly depends on the local geologic conditions.

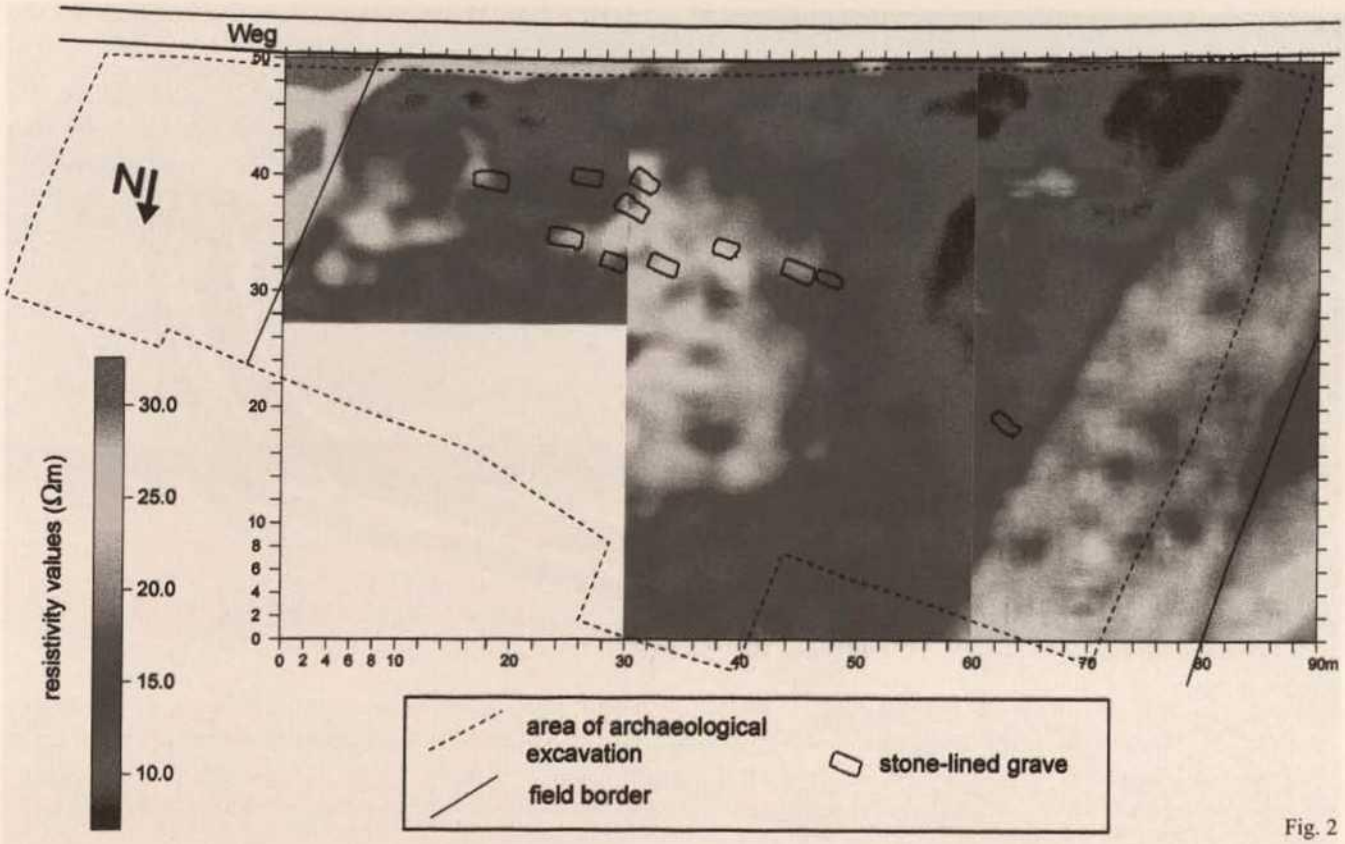

Fig. 2

A. Payne

Functional Variability in Wessex Hillforts : New Evidence from Geophysical Survey

Hillforts have attracted archaeological interest for much of this century, and debate on their function and significance continues to be central to the academic study of the Iron Age. The term hillfort covers a multitude of different types of site and their varying sizes, morphologies and situations strongly suggest a range of different functions. Reliable interpretation of the role of hillforts in Iron Age society continues to be hampered by the small number that have been extensively examined archaeologically. Despite major investment in excavation of hillfort sites in Central Southern England, even here the majority of sites still remain a poorly understood resource.

Two years ago a major programme of archaeological geophysics was started by English Heritage in partnership with Oxford University to investigate a wideranging sample of hillforts (20 sites in total) in the dense hillfort zone of Wessex. The project was