

## Integrated Geophysical Prospection of Roman Villas in Austria

Geophysical prospection of Roman villas is one of the major interests of archaeologists working in the former Roman provinces Pannonia, Noricum and Raetia. We present various sites situated all over Austria in different geological context. All of them cover at least 3 ha and might be situated in grass land as well as ploughed fields.

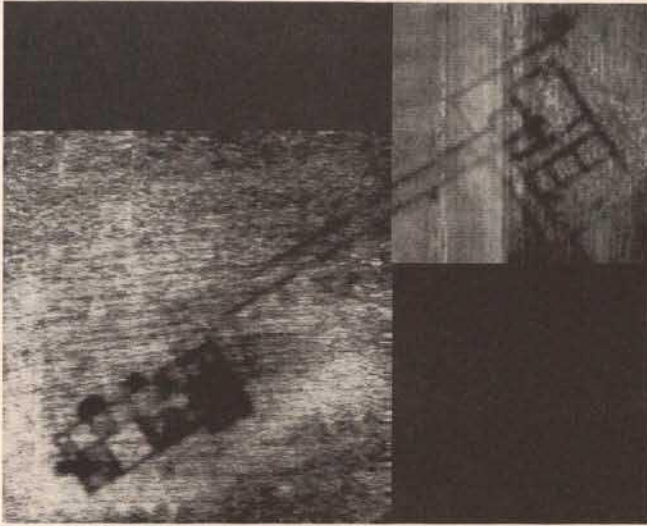
The villas were prospected by an integrated approach using high resolution caesium gradiometers (0.1 to 0.005 nT / 0.5 x 0.125 m grid), multiplexed RM15 resistivity meters (0.5 x 0.5 m grid,  $a = 0.5$ ; 0.1 m) and PulseEKKO 1000 ground penetrating radar (GPR) (0.5 x 0.05 m. grid). Magnetics is mainly used to produce a large scale (> 5 ha) overview of the sites overall structure combining main buildings, economical buildings, roads, field system and the very often nearby cemetery. Selected parts of the magnetically prospected area indicating walls are additionally surveyed using resistivity mapping and/or high resolution GPR. As the resistivity contrasts of walls are much higher than their magnetic contrasts they show up very clearly. GPR adds important 3D information on the detected buildings. GPR is adequately applied to this type of Roman monuments i.e. data is measured in 0.5 x 0.05 or 0.5 x 0.1 m raster using 450 MHz or 900 MHz antennas and with digital recording of the data. While magnetic and geoelectrical methods are standardly applied and widely accepted, the archaeological application of GPR still suffers from insuitable survey logistics, data processing, visualisation and interpretation techniques. The theoretically high archaeological potential of the method so far could not be presented to the archaeologists convincingly. GPR produces large amount of data with high information density. Visualisation of data mainly is done in B&W or colour coded representations of received amplitudes by time and distance in single sections known as "radargram". These representations of single sections show typical diffraction and reflexion patterns and are not easily understandable. One even could assume that it is nearly impossible for lay-men or unexperienced archaeologists to interpret anything in such a radargram. To use the high archaeological potential of this method new techniques of processing are necessary for producing objective and reproducible results. One of this techniques is the use of horizontal time slices as regular GPR data representations. Such a time slice is created by summarizing (or averaging) the reflected energy of the radar waves over a time window at any discrete reading of the regular or irregular measurement grid. We consequently propose here the use of a 3D data block of summarized amplitudes. This block might be cut through in any horizontal or vertical direction. The pile of horizontal time slices from GPR data might be animated for exploring the data. Magnetic, resistivity and GPR data are visualised accordingly as digital images and combined in a GIS for archaeological interpretation by thematic mapping and attributal description. Based on the archaeological evidence derived from the combined interpretation of the geophysical results we produce a 3D archaeological reconstruction of the roman villas, presenting a comprehensive archaeological interpre-

tation model. These models based on geophysical prospection data might also be animated producing understandable presentations of our heritage concealed beneath the surface for archaeologists as well as lay-men.

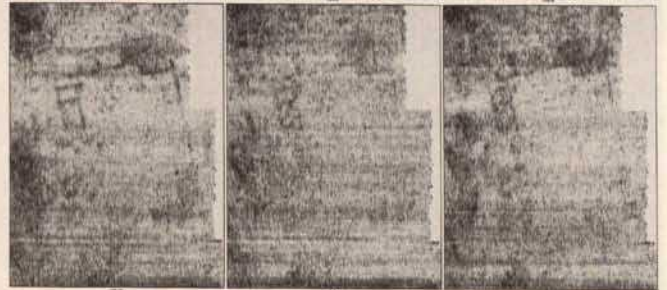
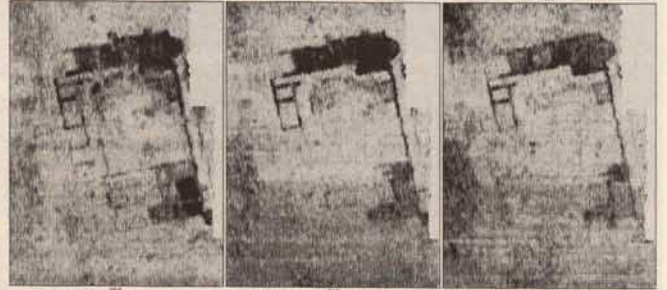
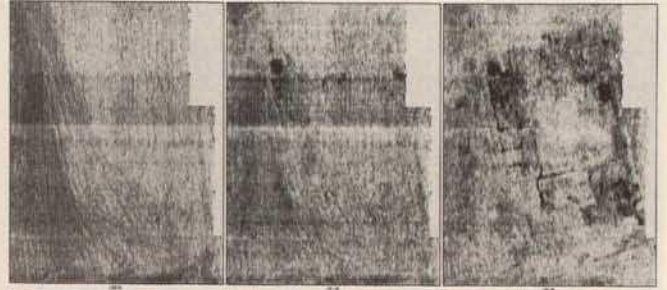
Fig. 1. Resistivity map of a Roman villa rustica at Altheim-Weirading showing the main building and the nearby bath

Fig. 2. GPR time slices of a Roman villa suburbana near Oviavum/Wels

Fig. 3. 3D visualisation of the villa rustica at Altheim-Weirading based on prospection results



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The building is a large, rectangular structure with a central courtyard. The building is surrounded by a fence and is located in a rural area. The building is made of brick and has a gable roof. The building is a large, rectangular structure with a central courtyard. The building is surrounded by a fence and is located in a rural area. The building is made of brick and has a gable roof. The building is a large, rectangular structure with a central courtyard. The building is surrounded by a fence and is located in a rural area. The building is made of brick and has a gable roof.

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