



## Combined interpretation of multiple geophysical techniques: an archaeological case study

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In order to locate and ascertain the dimensions of an ancient orangery, we explored an area of about 70 m x 60 m in the Rheinsberg Palace Garden (Germany) with multiple geophysical techniques. The Rheinsberg Park, situated about 100 km northwest of Berlin, Germany, was established by the Prussian emperors in the 18th century. Due to redesign of the architecture and the landscaping during the past 300 years, buildings were dismantled and detailed knowledge about some original buildings got lost. We surveyed an area close to a gazebo where, after historical sources, an orangery was planned around the year 1740. However, today it is not clear to what extent this plan has been realized and if remains of this building are still buried in the subsurface.

Applied geophysical techniques include magnetic gradiometry, frequency domain electromagnetic (FDEM) and direct current (DC) resistivity mapping as well as ground penetrating radar (GPR). To get an overview of the site, we performed FDEM electrical conductivity mapping using an EM38 instrument and magnetic gradiometry with caesium magnetometers. Both data sets were collected with an in- and crossline data point spacing of ca. 10 cm and 50 cm, respectively. DC resistivity surveying was performed using a pole-pole electrode configuration with an electrode spacing of 1.5 m and a spacing of 1.0 m between individual readings. A 3-D GPR survey was conducted using 200 MHz antennae and in- and crossline spacing of ca. 10 cm and 40 cm, respectively. A standard processing sequence including 3-D migration was applied.

A combined interpretation of all collected data sets illustrates that the magnetic gradient and the EM38 conductivity maps are dominated by anomalies from metallic water pipes from belonging to the irrigation system of the park. The DC resistivity map outlines a rectangular area which might indicate the extension of a former building south of the gazebo. The 3-D GPR data set provides further insights about subsurface structures and relevant geometries. From this data set, we interpret the depth and the extent of foundation and wall remains in the southern and central part of the site indicating the extent of the old orangery. This case study clearly illustrates the benefit of using multiple geophysical methods in archaeological studies. It further illustrates the advantage of 3-D GPR surveying at sites where anthropogenic disturbances (such as metallic pipes and other utilities) might limit the applicability of commonly applied mapping techniques such as magnetic gradiometry or EM38 conductivity mapping.