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Geophysical investigation at “Villa del Casale” Piazza Armerina (EN).

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***Abstract* –The Roman Villa at Piazza Armerina, which has been on the UNESCO list of sites since 1997, is an exceptional example of a prestigious residence from the late antique period.**
In order to plan new excavations in the area close to the villa's warehouses and in other parts not yet investigated, geophysical surveys were undertaken in the summer of 2022. In this paper, the interesting results will be presented.

I. INTRODUCTION

The Roman Villa at Piazza Armerina (Enna) (Figure 1), which has been on the UNESCO list of sites since 1997, is an exceptional example of a prestigious residence from the late antique period. The individual architectural and figurative elements of the villa are found elsewhere in contemporary residential architecture, but none of the other known villas has the same complexity. Ever since the residential part of the building was brought to light in the 1950s, the extraordinary complex of figured mosaics (Figure 2) particularly attracted the attention of scholars and visitors. Nevertheless, the mosaic should be analyzed not only from an art-historical point of view, but also for its value as an ideological and historical document, as a cross-section of the history of customs and mentality that can provide information on the culture and life of an entire era. Equally important and indicative is the information that comes from the analysis of architectural typologies, wall paintings, and architectural decoration, together with all the elements of material culture. In a global view of the monument is also important to analyse the territorial and historical context and the transformations during the centuries, as most recent research has been done, also with the help of modern technologies. After the first excavations carried out in the 1950s [1], and various campaigns carried out subsequently up to the 1980s and 1990s, systematic research took place starting from 2004 by the Sapienza University of Roma. Until 2014, regular excavations were carried out, also accompanied by studies on the territory and geophysical investigations [2]. Many scientific investigations have been also carried out for the preparation and implementation of the restoration and musealization project of the villa, completed in 2012 [3]. An agreement between the Archaeological Park of Morgantina and the Roman Villa del Casale in Piazza Armerina and the CISEM (Inter-University Centre for Studies on Late Antique Housing in the Mediterranean (https://centri.unibo.it/cisem/it), based at the University of Bologna, has been signed in 2021 to resume systematic research and enhancement activities. In 2022 an excavation started in the area close to the villa's warehouses where geophysical surveys had already been carried out, giving interesting results (Cozzolino, Mauriello, Monna 2019).
As part of the lunch of scientific research which also provides the development of a GIS platform for the management of pre-existing documentation, it was undertaken a campaign of geophysical surveys in some unexcavated areas (Figure 3), for a better understanding of the monument and to direct future research. Ground Penetrating Radar (GPR) and Fluxgate gradiometry were used. In this paper the GPR data results will be presented.

Fig. 1. Villa del Casale

Fig. 2. examples of the precious mosaics

Fig. 3. areas investigated with geophysics

II. GEOPHYSICAL DATA ACQUISITION AND PROCESSING

The GPR surveys were performed with a RIS MF Hi-Mod GPR System of IDS equipped with an array of two multi-frequency antennas using simultaneously 200 and 600 MHz antennas mounted on a survey cart equipped with an incremental encoder. The 200 MHz and 600 MHz data were acquired in continuous and reflection mode with a time window of 160 ns and 80 ns, respectively, samples per scan set at 512 with a resolution of 16 bits and a transmit rate of 100 kHz. (Figure 4)

Fig. 4. photo relating to the measurement phases with a GPR

The GPR acquisition was supported by a topographic survey that gave the possibility to georeference the obtained data that were managed with a Gis software.

GPR raw data have required some processing operations addressed to reduce the noise of the measurements and attenuation phenomena. A Gpr-slices software was used (GPR-SLICE Software (gpr-survey.com)).

The results of magnetic processed data are show in Figure 4

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In the area 1 (Figure 3) the acquired data identified very interesting reflections within the depth ranging between 0.30 and 1.20 m as the depth slices of Figure 5 shows. Since the buried archaeological structures appeared so shallow, in accordance with the information of archaeologists, only the data obtained at the greater frequency characterized by a better resolution are considered.
Already at a depth of a few meters (0.3-0.5m) some main anomalies can be clearly distinguished (dashed black lines in Figure 5), referable to probable masonry structures. While always in Figure 5 S indicates the probable presence of a road.

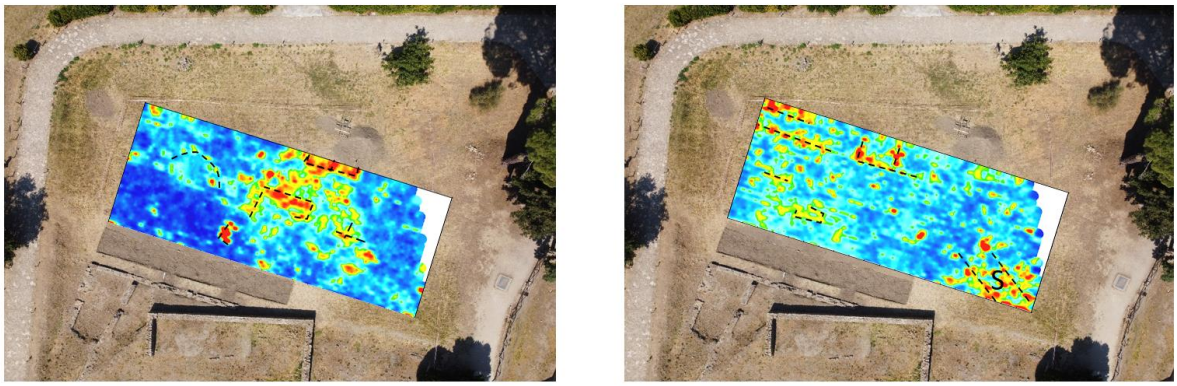

Fig. 5. Area 1: depth slices superimposed on the drone photo (600MHz antenna) the dashed black lines indicate structures of probable archaeological interest

The 3D visualization through the amplitude isosurfaces (Fig. 6) better identifies (in a 3D way) the probable structures of archaeological interest, while the virtual excavation (Fig. 7) spatially positions them within the investigated area.

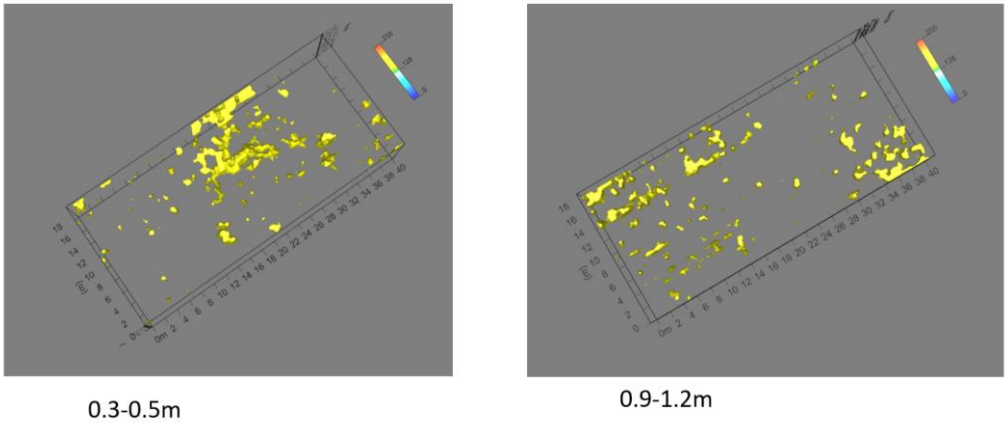

Fig. 6. Area 1: Amplitude Isosurfaces (600MHz Antenna)

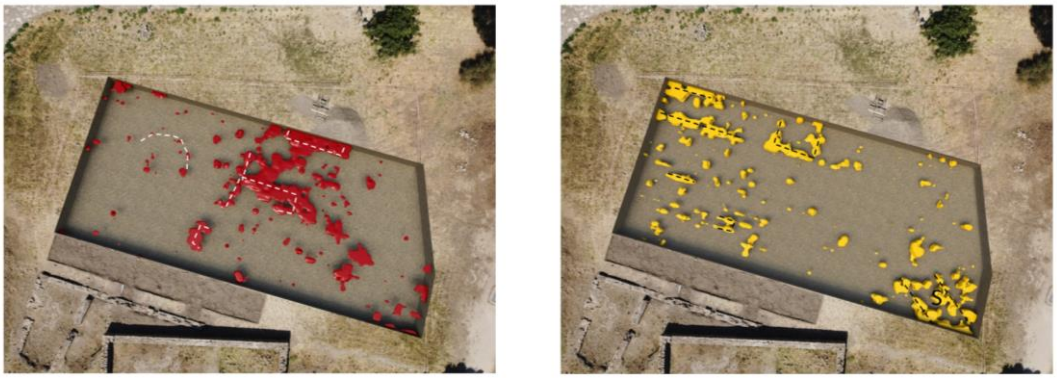

Fig. 7. Area 1: virtual excavation with amplitude contours (600MHz antenna): the dashed black and white lines indicate structures of probable archaeological interest

III. CONCLUSIONS

The presented approach, based on the use of different geophysical methods of investigation, highlights how it is a good starting point for planning excavation activities saving time and money. Moreover, the integration of different techniques can effectively support the detection of a potential archaeological site from one side, while from the other one can give the possibility to reconstruct the ancient urban and rural planning without expensive excavations or strongly reducing them.

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geophysical survey.