

Geophysical investigation at the St. Maria del Monacato di Villa Eucheria (Frosinone, Italy)

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Abstract – The monastery of St Maria of Monacato was built on the foundation slab of an imposing Roman villa dating back to the 2nd-1st century BC. In March 2023 a geophysical survey campaign was undertaken to identify the buried remains of the villa and direct the excavations.

I. INTRODUCTION

Villa Eucheria is dates back to Roman times, when patricians, emperors and generals used to build sumptuous villas along the consular roads and in the most pleasant places.

It was, therefore, a Roman villa and belonged to the *Equizia* family. The few ruins, some drums, clay material, some stretches of terracotta pipes, and a marble panel belonging to a patrician tomb are the miserly elements, not sufficient to make a satisfactory historical reconstruction. It is evident that the monastery of St Maria di Palazzolo (dating back to 1134) was built on the foundation slab of the Roman villa (Fig. 1). To investigate the ancient buried structure present in the subsoil and related to the Roman villa, geophysical investigations were undertaken.

A ground penetrating radar (GPR) method was chosen. The GPR surveys were carried out in two areas (Fig. 1). GPR surveys were carried out using a stream C (Fig. 2) georadar system equipped with 32 antennas at central frequency of 600 MHz. The georadar is equipped with a GPS system that allows to obtain a precision of 2-3 cm.

II. GEOPHYSICAL DATA PROCESSING AND INTERPRETATION

The quality of the raw data was moderate thanks to a series of expedients adopted in the acquisition phase. However, in order to try to eliminate a noise component, present in the data, and to allow simple interpretation of

the data themselves, a processing was carried out [1].

The data analysis highlighted a good penetration of the electromagnetic signal which allowed to investigate up to a depth in times equal to 70 ns which correspond to a depth of about 2.4 considering an average speed of propagation of electromagnetic waves in the subsoil equal to about 0.07m/ns.

The analysis of the data acquired in the area 1 results highlighted (Fig. 3) some hyperbolic reflections (A) of the electromagnetic signal linked to the probable presence of structures of archaeological interest at depths between 0.6 m and 1.0 m.

Also, in area 2 the analysis of the data shows (Fig. 4) some hyperbolic reflections (A) related to the probable presence of structures of archaeological interest at depths between 0.6 m and 1.0 m.

The planimetry of the profiles, acquired in a grid with a step of 0.1m, made it possible to spatially correlate, in a 3D way, the anomalies present on each section using the analysis of the amplitude of the events reflected within assigned time intervals (time slices) [2, 3].

The type of analysis applied to the study area gave satisfactory results. The blue colour indicates a weak amplitude of the reflected signal (substantially homogeneous material); the colours from light blue to more intense red indicate variations in the amplitude of the reflected signal and therefore the presence of significant electromagnetic discontinuities. The variations in amplitude (therefore in colour) in the same slice indicate horizontal variations in the electromagnetic characteristics of the medium being investigated. Figure 5 shows the amplitude slices relating to the area 1. In them, it is possible to identify alignments indicated with A relating to probable archaeological structures (walls).

In the area 2 the depth slices (Fig. 6) show other interesting structures (A) that could be related to archaeological features.



Fig. 1. The site with the surveyed areas.



Fig. 2. The stream C system.

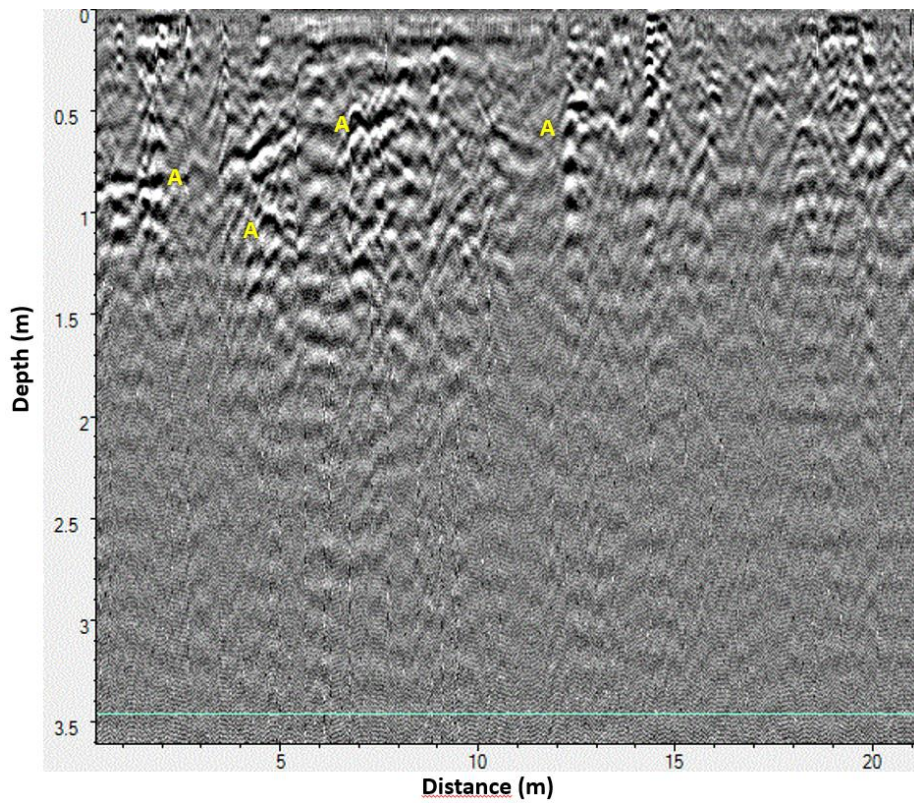


Fig. 3. Processed radar section acquired in the area 1.

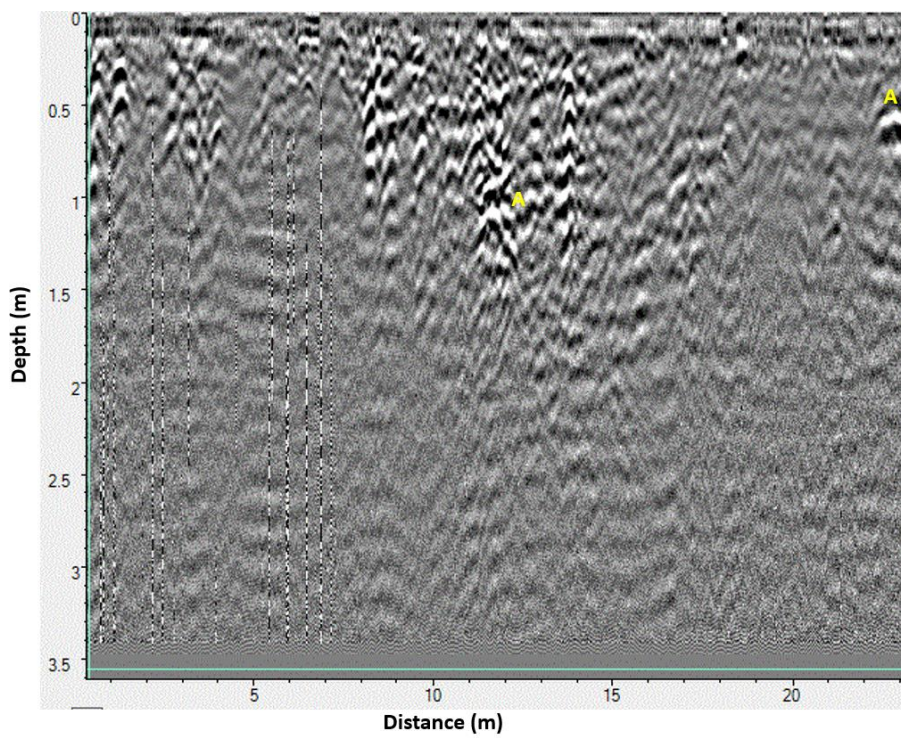


Fig. 4. Processed radar section acquired in the area 2.

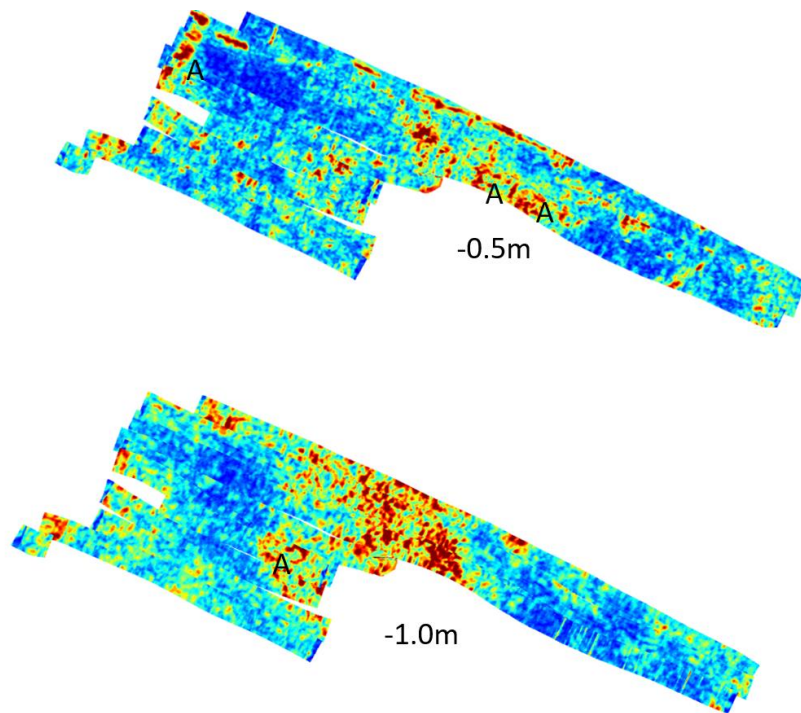


Fig. 5. Area 1: depth slices.

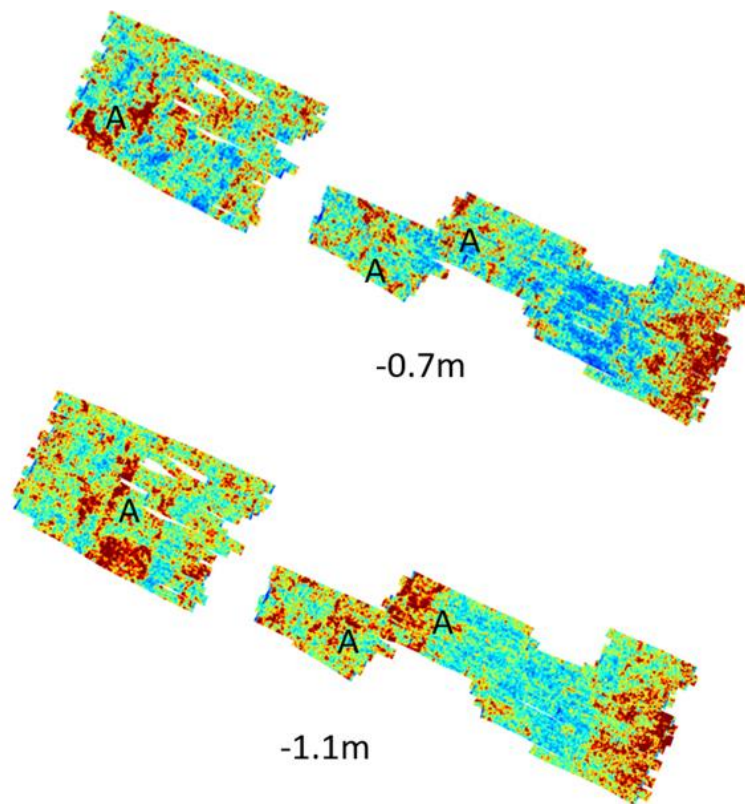


Fig. 6. Area 2: depth slices.

III. CONCLUSIONS

The geophysical investigations have provided good results regarding the identification of structures present in the shallow subsoil. The GPR method made it possible to extend the investigation to a depth of approximately 2.4 m, highlighting anomalies probably attributable to structures related to the buried Roman villa.

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