

The use of GPR in Archaeology: the structural detailing of buried Roman baths

Roberta Santarelli⁽¹⁾, Luca Bianchini Ciampoli⁽²⁾ and Andrea Benedetto⁽³⁾

⁽¹⁾ Roma Tre University – roberta.santarelli@uniroma3.it

⁽²⁾ Roma Tre University – luca.bianchiniciampoli@uniroma3.it

⁽³⁾ Roma Tre University – andrea.benedetto@uniroma3.it

INTRODUCTION

This study evaluates the feasibility of GPR for the structural detailing of buried Roman baths. Up to now, studies on the analysis of data deriving from GPR prospections regarding thermal complexes have mainly focused on retrieving and completing the plan-views and studying the different phases of the structures. Scientific contributions concerning the identification of hidden bath among the other possible buried structures by means of GPR are still lacking

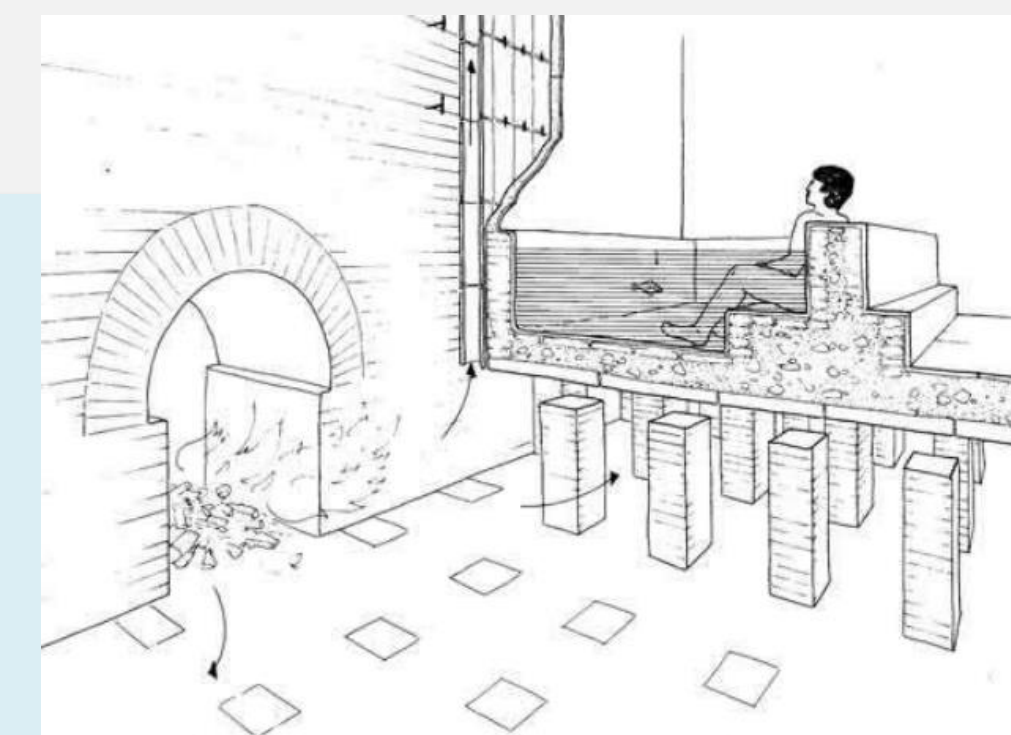


Aerial view of the Maxentius Complex and the plan of the excavated baths.

The survey through Ground Penetrating Radar has been carried out in the Maxentius Complex, along the ancient Appian Way in Rome. Precisely an area of the site occupied by a thermal building (2nd century AD), partially brought to light during the 2nd half of the last century then buried and no more visible. The remains of the baths complex are characterized by three rectangular tanks (15.50 m wide and 19 m long). On the southern side another tank with an apse shape is located and part of its roof is still visible at a height of 7.20 m.



Roman baths:



An iconic example of space articulation and composition with different shapes. Romans considered baths spaces both for health and hygiene care and meeting places where anybody could go. *Thermae* were often provided with luxury furnishing and impressive architecture according to the possibilities of the client, who frequently coincided with the Emperor himself. According to the specific function of these structures, which required the warming of entire pools and rooms for bathing, they were realized through remarkable technical solutions, like the hypocaustum system: an underground space in which the hot air heated by ad hoc ovens (*prae-furnia*) flew among a network of small pillars supporting the floor (*suspensura*) were the tanks were located, and thanks to the wall cavities made by *tubuli* (hallow bricks). Despite the evident evolution of this kind of buildings in the transition from the Republican period to the Imperial age, the planimetric scheme and the main spaces (*calidarium*, *tepidarium*, *frigidarium* and *sudatio*) remained roughly unvaried.

OBJECTIVE

The aim of the study is to focus on the possibilities of GPR to detect buried archaeological remains and in particular architectural features and to interpret the function of buried structures. Moreover to identify the anomalies deriving from the specifically bath-related structural characteristics, such as the *hypocaustum*, with its double floor, and the activity of the *prae-furnium* from which the hot air started its circulation through an arch and after that below the floor and between the walls of the *calidarium*.



The grid and the survey on the field.

METHODOLOGY

Ground Penetrating Radar (GPR) is well known as a viable equipment for locating buried archaeological remains. Its effectiveness is mostly due:

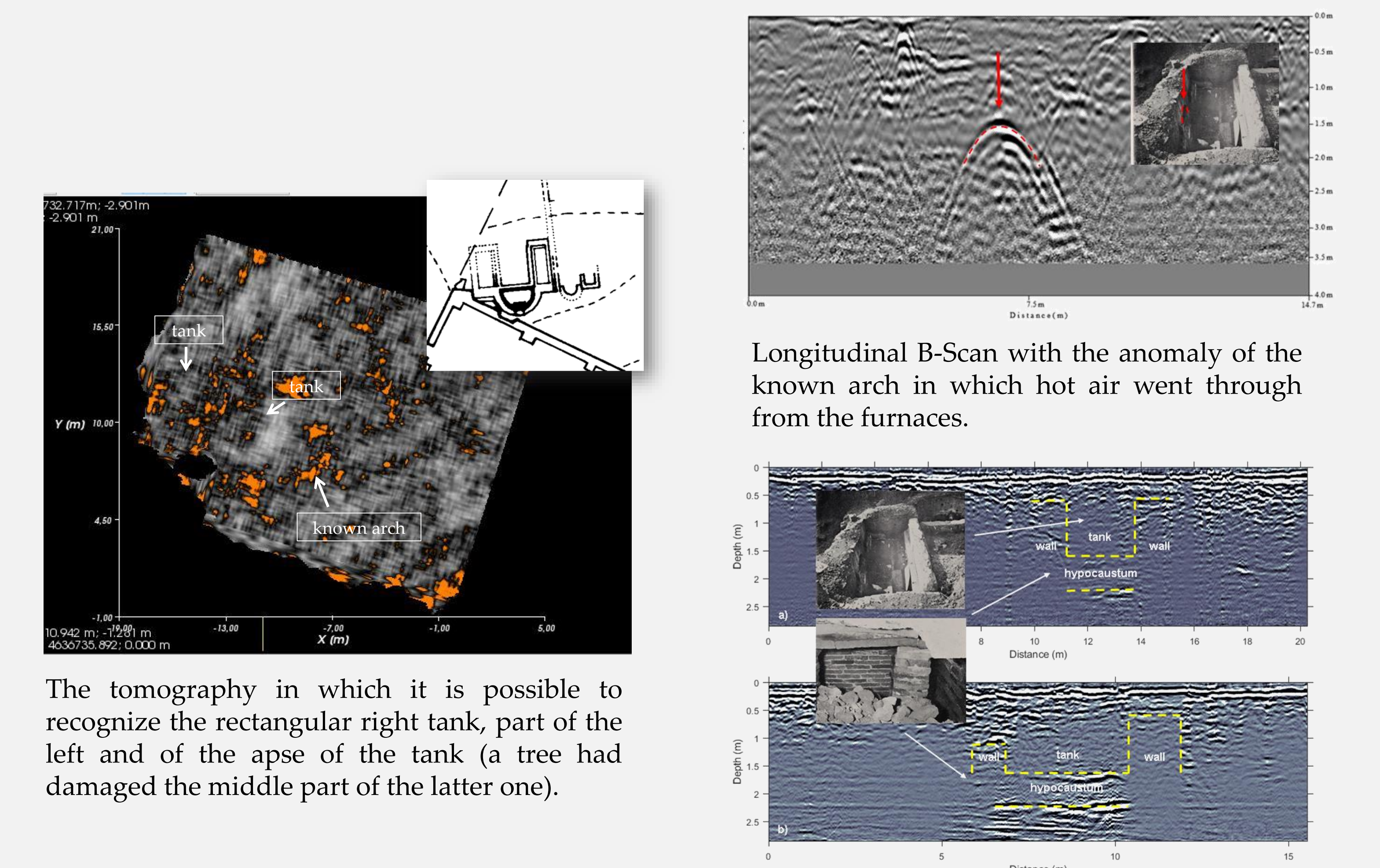
- to a wide range of available antenna frequency systems,
- to the enormous amount of information retrieved
- to the possibility to obtain a tomographic plan view of the area investigated.

The inspection was carried out by covering the area following the trapezoid-like grid (cell size: 0,50 x 0,50 m). The data were collected using the Hi-Mod system, manufactured by IDS Georadar, equipped with two paired ground-couple antennas. The nominal frequencies of the antennas are 200 MHz and 600 MHz.

RESULTS

The analysis of the data has shown some significant results concerning the structural and functional features that could be useful to identify specific elements for easily recognizing this kind of structures by geophysical surveys.

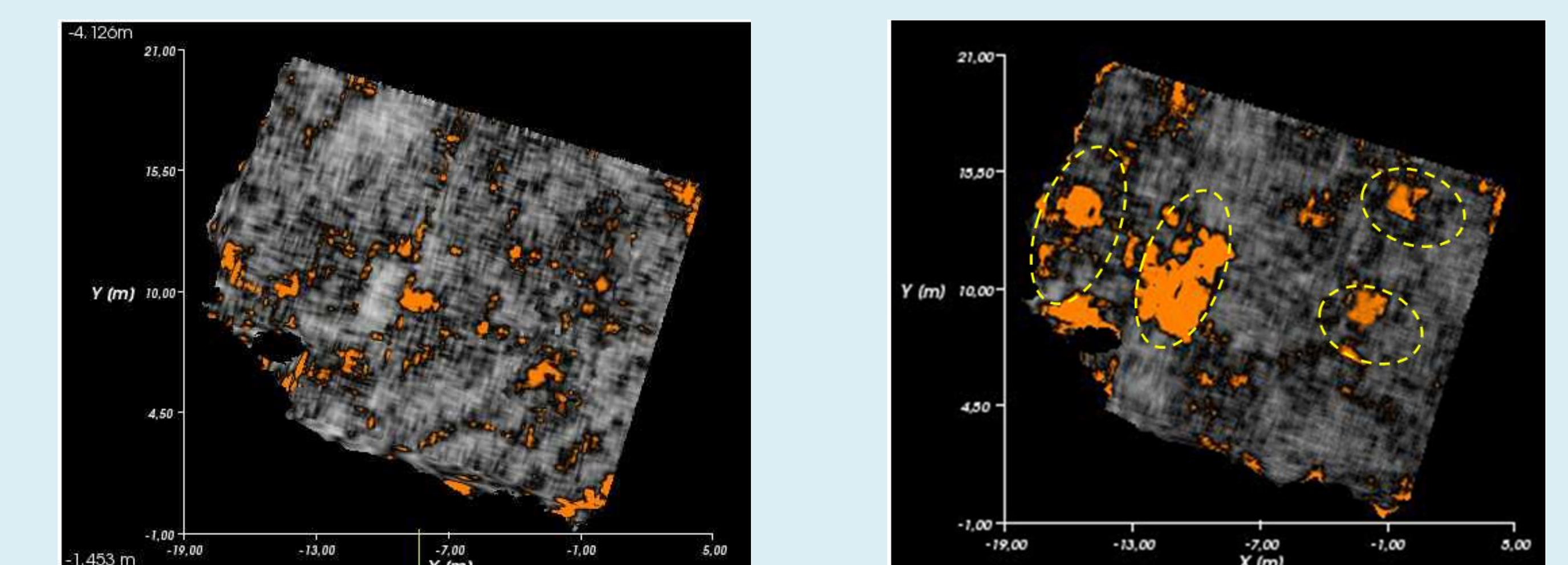
- It was possible to identify the main ancient buried structures and features (like *hypocaustum* and the arch) already detected during the last century's excavations.



The tomography in which it is possible to recognize the rectangular right tank, part of the left and of the apse of the tank (a tree had damaged the middle part of the latter one).

The a) longitudinal and the b) transversal B-Scan of the tanks.

-The tomographic analysis stressed out a wall pattern that seems to suggest the presence of further rooms in the top-right side of the area and highlighted the presence of two further tanks, suggesting the possibility of further rooms to be located close to the known ones.



The tomography with highlighted the wall pattern.

The tomography with highlighted the potential presence of further tanks.

- In general terms GPR demonstrated a great applicability to archaeological purposes.