

# Analyzing Historical 3D GPR Data from the Imperial Villa of Roman Emperor Trajan

## Overview

- CNR (ITABC) Rome wanted to map the buried remains of the ancient villa of Roman Emperor Trajan (Traiano)
- [GPR Slice](#) was used to build 3D radar volume visualization of the data for deeper analysis
- The team uncovered fascinating data about the archaeological site and its historic structures

The National Research Council (CNR) is the largest public research institution in Italy. Dr. Salvatore Piro, CNR (ITABC) Rome and Dr. Yasushi Nishimura, Narabunken Japan, collaborated on this archaeological project with Dr. Dean Goodman to detect and visualize remains of any structures beneath the ground.

Trajan ruled the Roman Empire from 98-117 AD and was famous for expanding the empire to its furthest boundaries. The emperor Trajan's villa is located at the foot of Mount Altuino, set on around five hectares of land. Although it was a magnificent residence for the emperor, the villa was not of extreme luxury like many others. Featuring a nymphaeum with stunning architectural fountains, statues and exotic plants, the Roman villa was described as an elegant hunting lodge.

## Challenge

Today, the former beauty of Trajan's villa can only be imagined as it truly was. However, thanks to geophysical investigations and advanced data analysis, some of the details of the structure can be revealed.

In 1999, Dr. Salvatore Piro, Dr. Yasushi Nishimura and Dr. Dean Goodman conducted GPR surveys over the site to gather data on the ancient residence.

After the surveys were complete, the GPR data required advanced post-processing to visualize and analyze the findings in detail.

## Solution

GPR Slice software was used to post-process the GPR data collected at the villa of Trajan. Since GPR Slice is a comprehensive software for post-processing GPR-software, the team were able to produce superior 3D images of the data.

## Results

The 3D radar volume was created from GPR profiles collected at 0.5m intervals. All the images were made by Dr. Dean Goodman with GPR Slice for DOS (not Windows). As this project took place in the late 90's, it was challenging in those days to do mosaic corrections and required adjustments to add different gains, regrid and iterate on a good match.

A surprising discovery was made in one area surveyed at the villa, revealing a large oval shaped structure buried underground, as seen on the image below.

This is estimated by archaeologists to be a garden pond that was probably used for domesticated eels - eels that were incorporated into a fish sauce to be eaten by the emperor.

The rectangular anomalies are believed to be military buildings on the villa premises.

In the radar image, other buildings collocated under the oval but weaker in reflected amplitude suggests that an earlier occupation of the site may have existed prior to the construction of Trajan's villa getaway.

Thanks to post-processing software like [GPR Slice or GPR Insights](#), it's possible to create detailed 2D and 3D images from any types of GPR data, whether it is to uncover history like in this case, or to visualize what's beneath the surface of our modern built world.

[Request a free demo now](#) and get access to the leading GPR data post-processing software.

## References

S. Piro, D. Goodman and Y. Nishimura (2003). [The Study and Characterization of Emperor Traiano's Villa](#) (Altopiani di Arcinazzo, Roma) using High-resolution Integrated Geophysical Surveys. *Archaeological Prospection* 10, 1-25. DOI: 10.1002/arp.203.



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