



Non Destructive Assessment of the Mycenaean Tomb of Acharnon. Athens, Greece.

Authors : Sónia Santos Assunção , Klisthenis Dimitriadis,
Yiannis Konstantakis, Vega Pérez Gracia
E-mail: sonia.assuncao@upc.edu

Vienna - 30 th April 2014

This work was partially supported by the COST Action TU1208 "Civil Engineering Applications of Ground Penetrating Radar"



COST is supported by the
EU RTD
Framework Programme



ESF provides the COST Office
through a European Commission
contract



The Council of the European Union
provides the COST Secretariat

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- Location
- History
- Constructive characteristics
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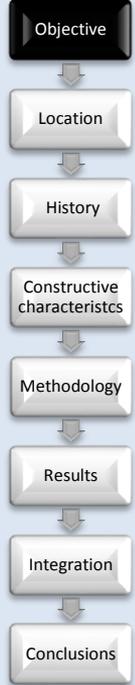
Objective

1. THE DROMOS

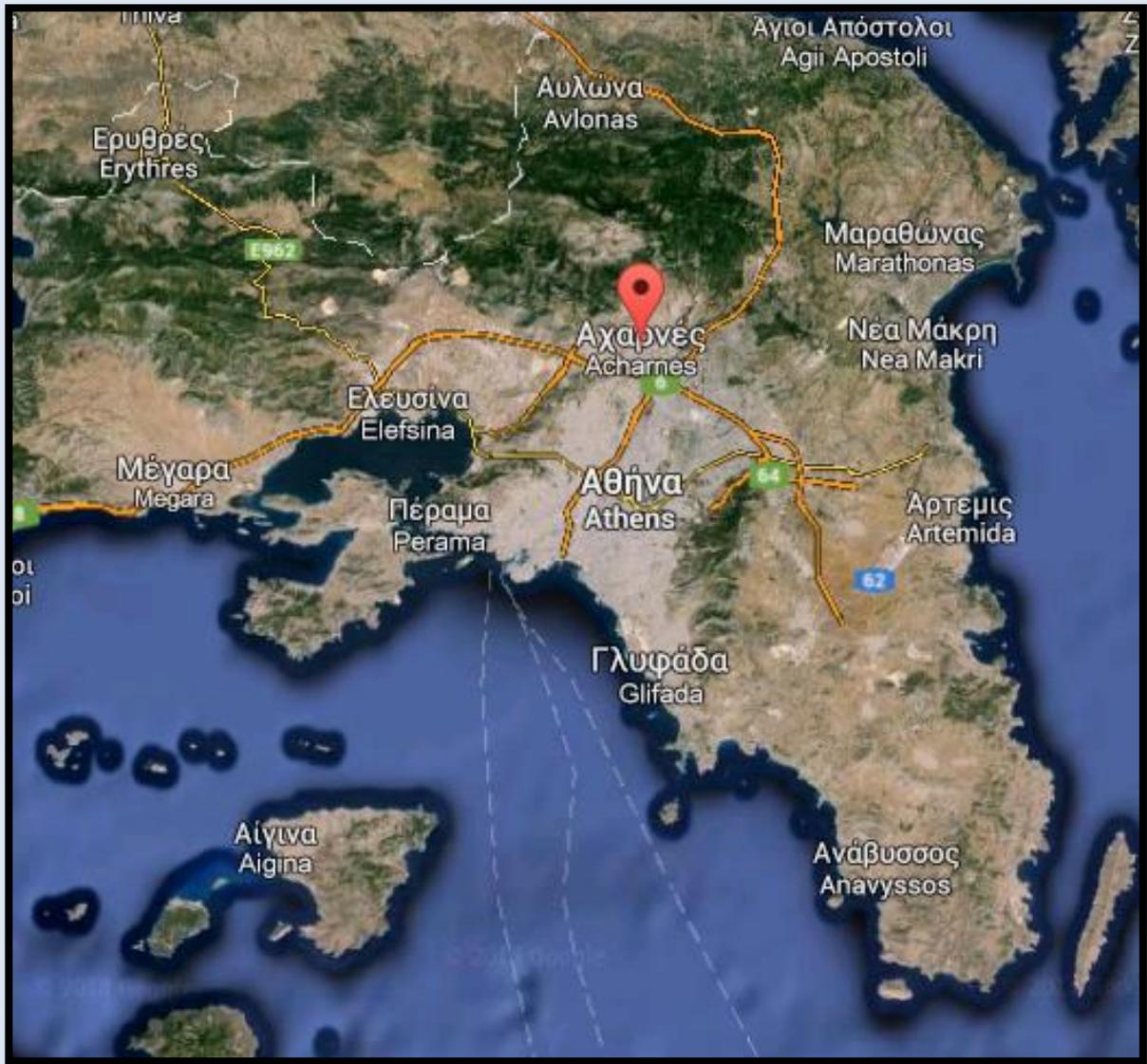
2. THE TOMB WALL

- Velocity of propagation in the stones
- Circular scans (Scan)

3. THE SURFACE (OUTSIDE AREAS)



Location



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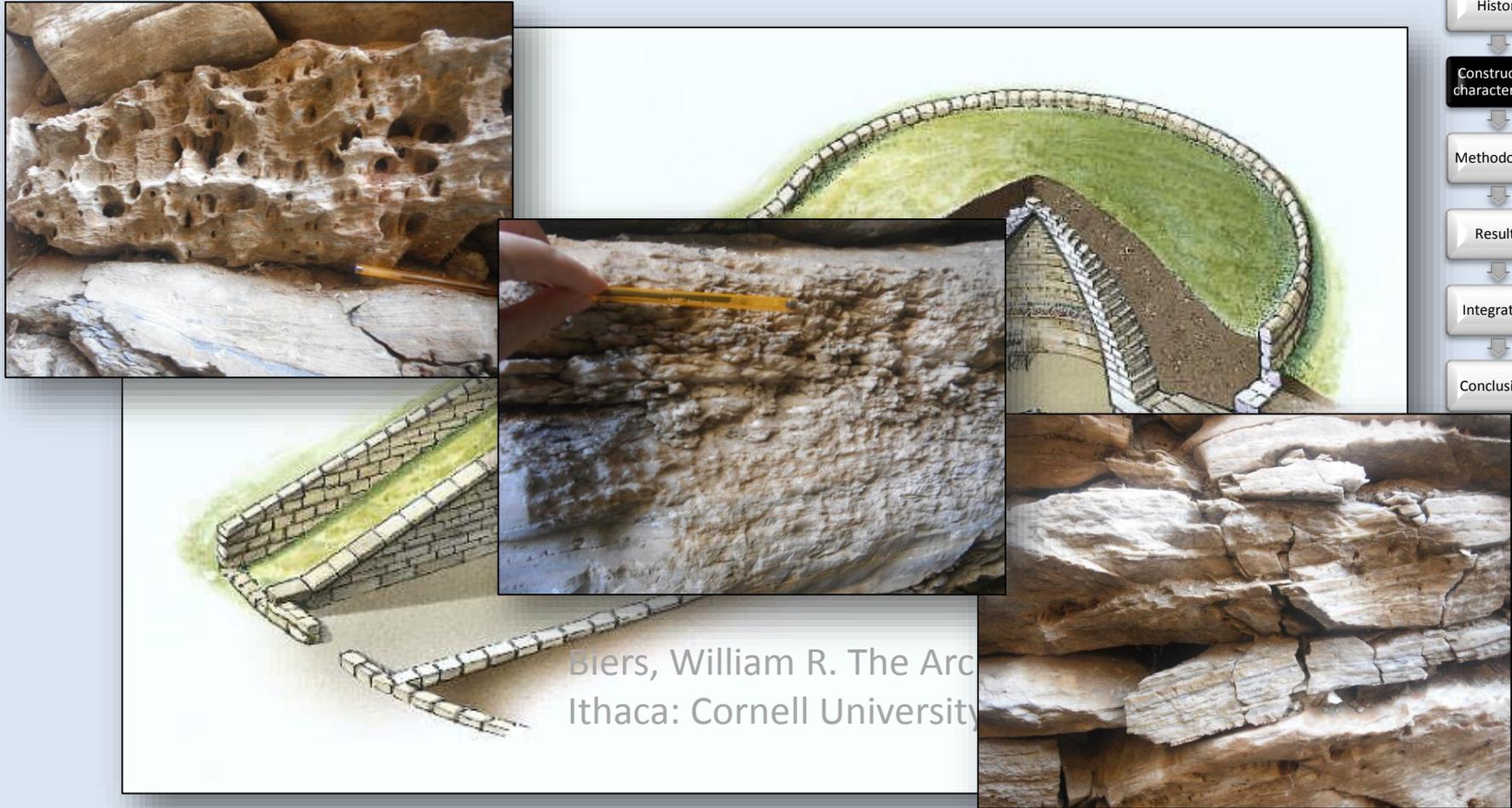
History

Mycenean Period **Tomb of Acharnon**– Prehistoric age (1600 BC – 1200 BC)

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Constructive characteristics



Biers, William R. The Archaeology of Ithaca: Cornell University

- The structure of this Mycenaean Tomb (14th – 13th c. BC).
- Composed by a corridor that connects with a 5.4 by 2.7 m entrance.
- The interior part is 8.74 m high with 8.35 m diameter.

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Methodology

GPR:

Objective: to define possible inner structure , layers and voids /finding archaeological targets

Microresistivity:

Objective: to define resistivity values and characterize materials

Passive Seismic:

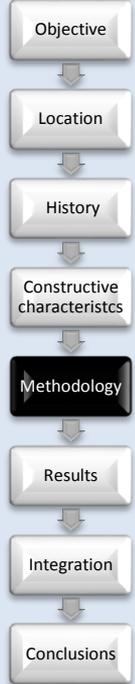
Objective: to measure vibrations that could affect the integrity of the structure

Chemical analysis :

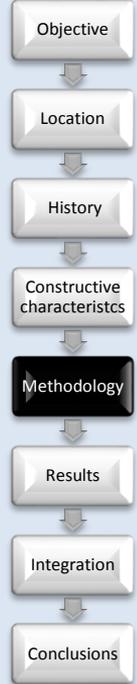
Objective: to determine salinity in material and soil

Endoscopy:

Objective: to obtain direct information about inner targets and structures



Methodology -Visual analysis



Methodology – Microcamera inspections



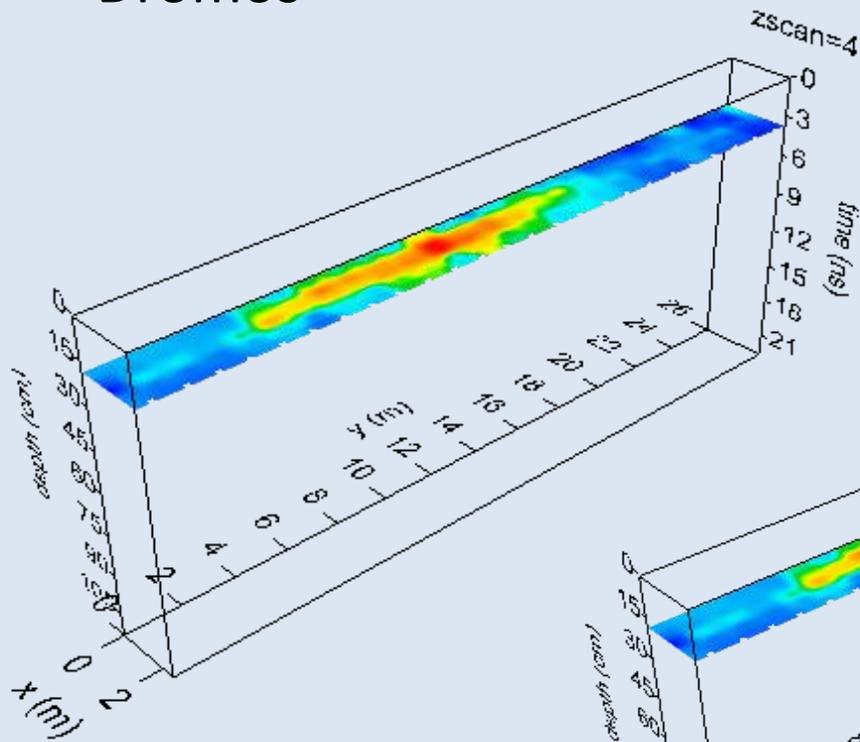
GPR

Dromos area

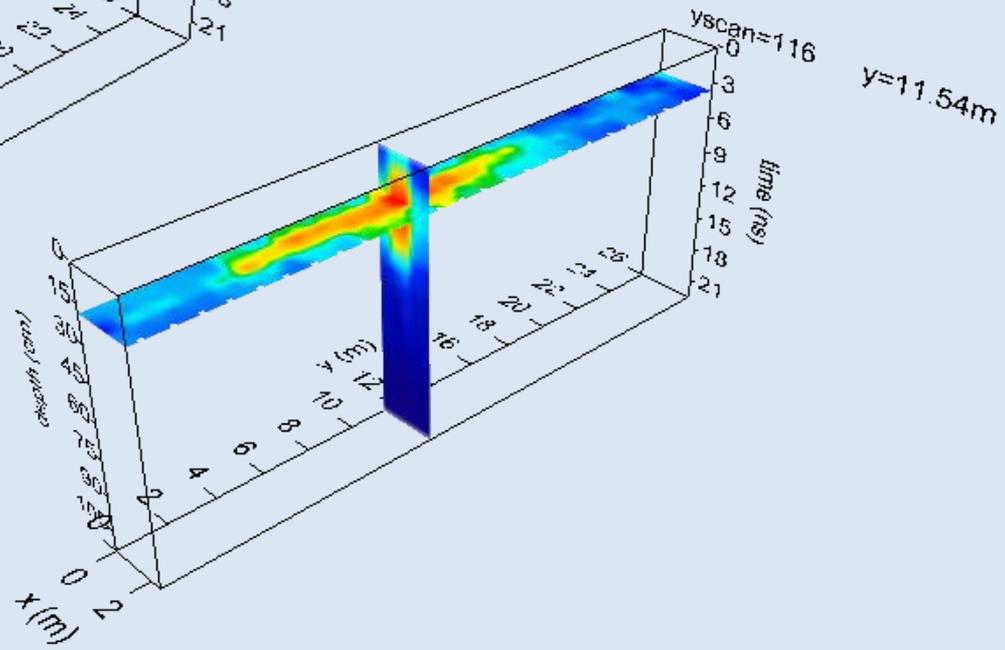


GPR Results

Dromos



Stairs

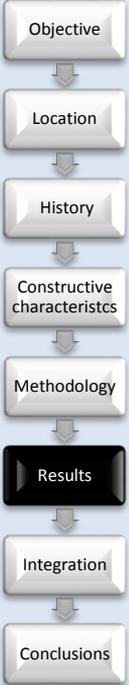
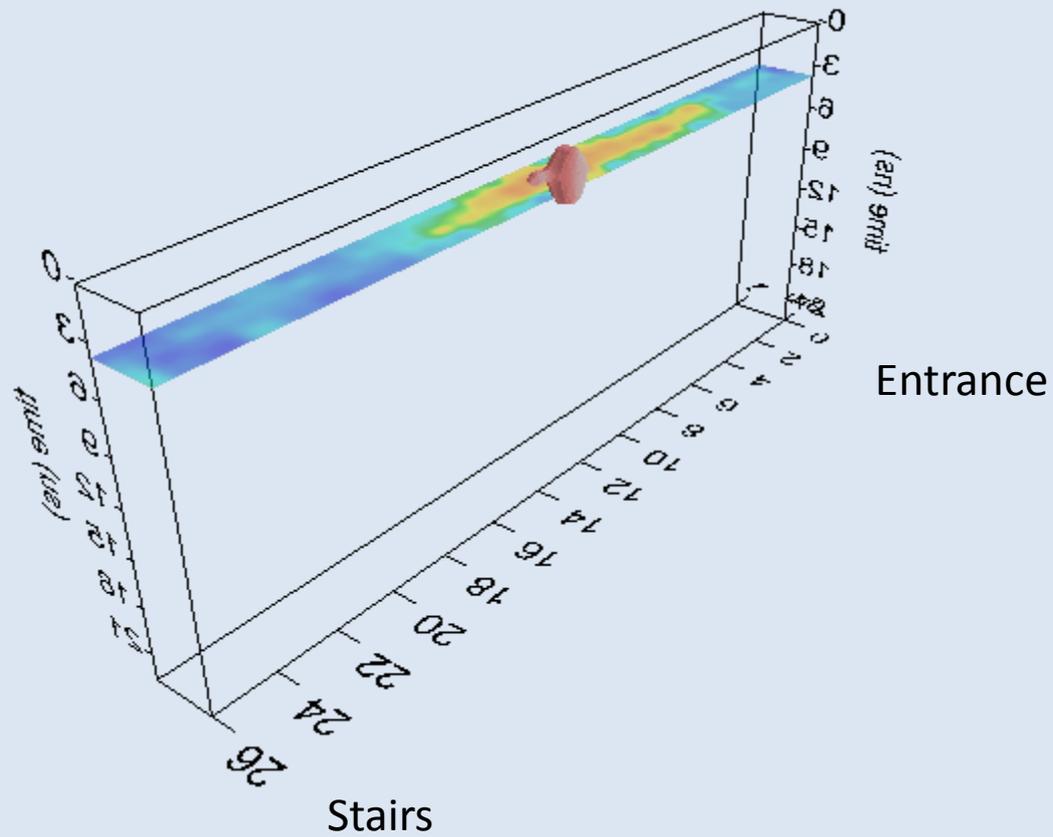


Entrance

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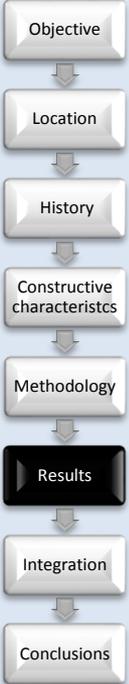
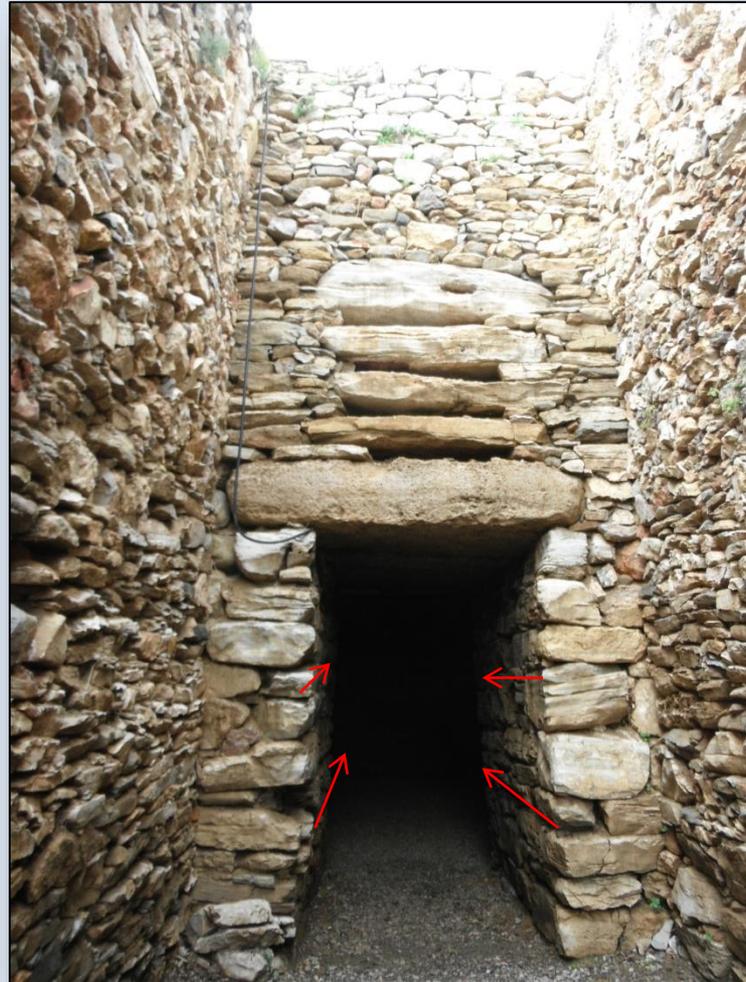
GPR Results

Dromos



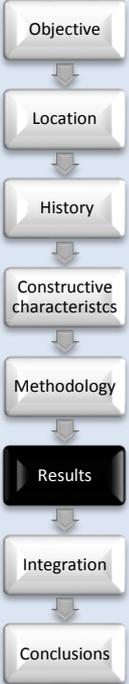
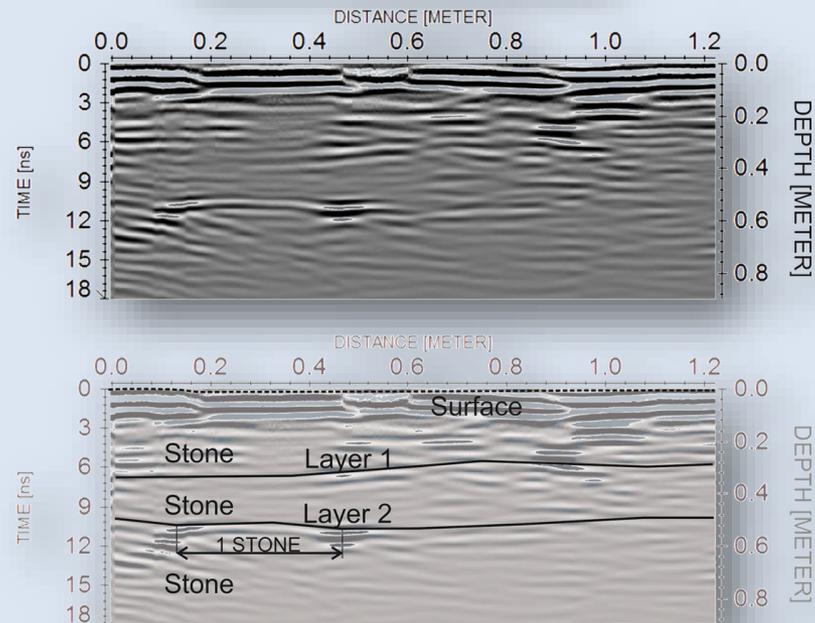
GPR Results

Entrance



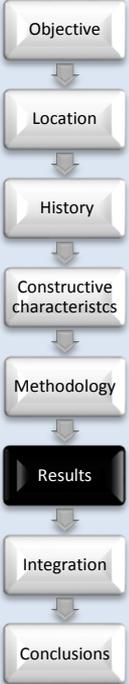
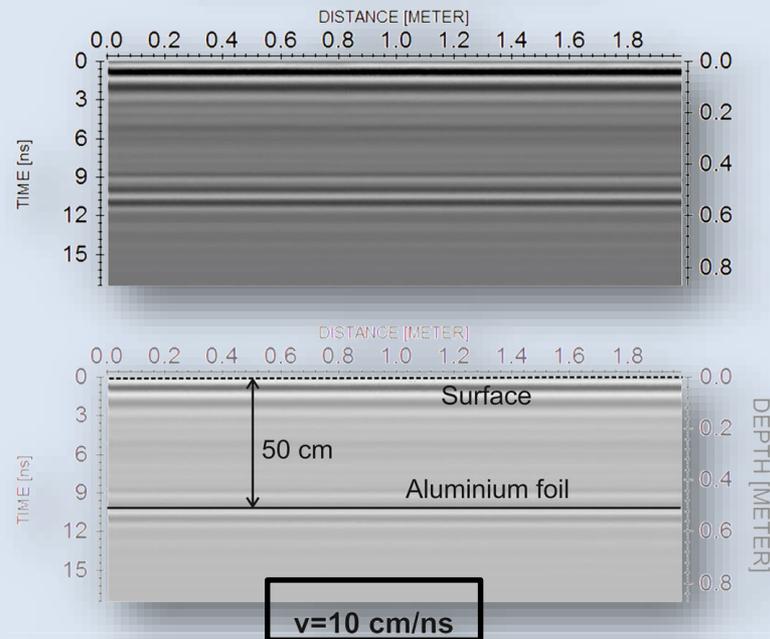
GPR Results

Entrance - Odometer



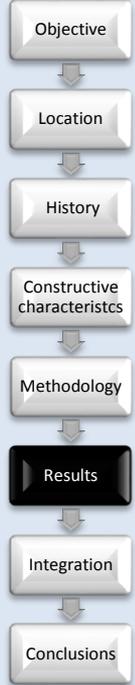
GPR Results

Entrance - Time



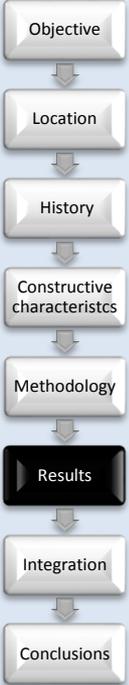
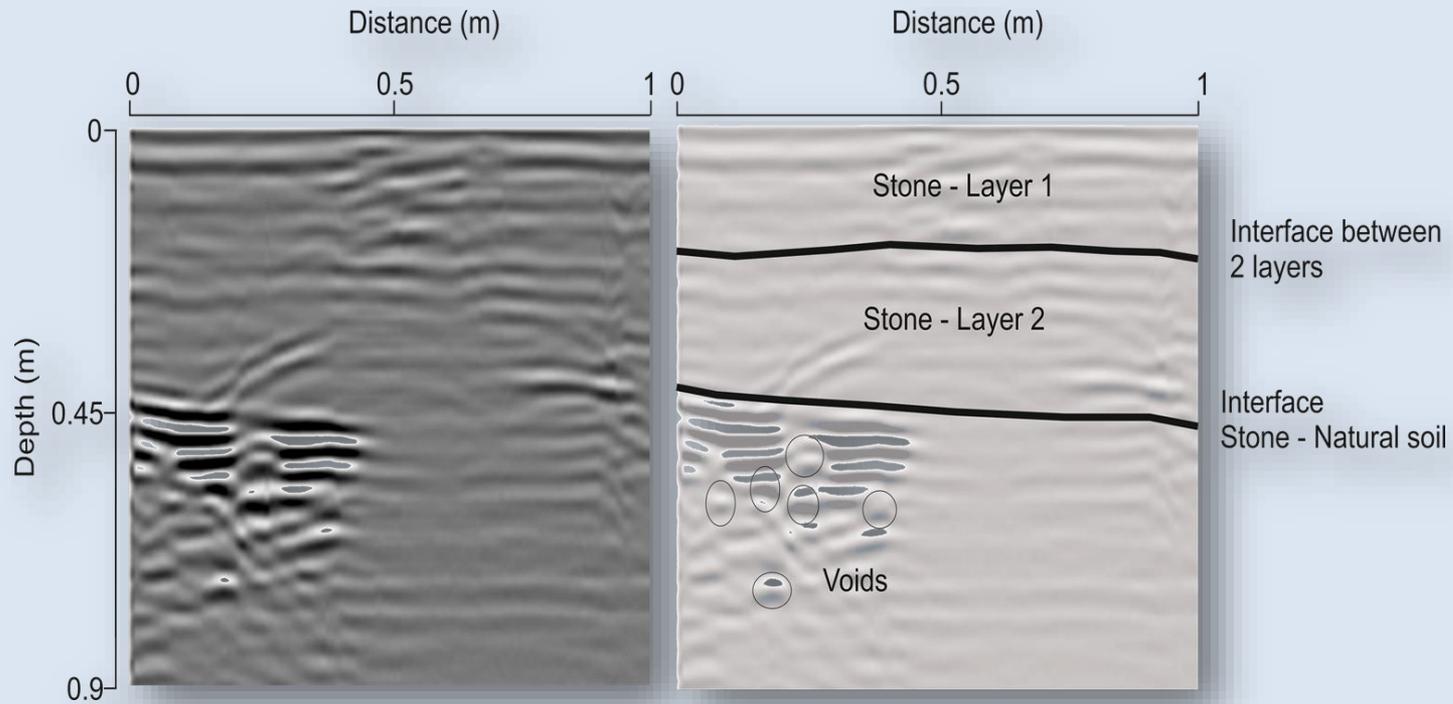
GPR

Tomb interior Wall



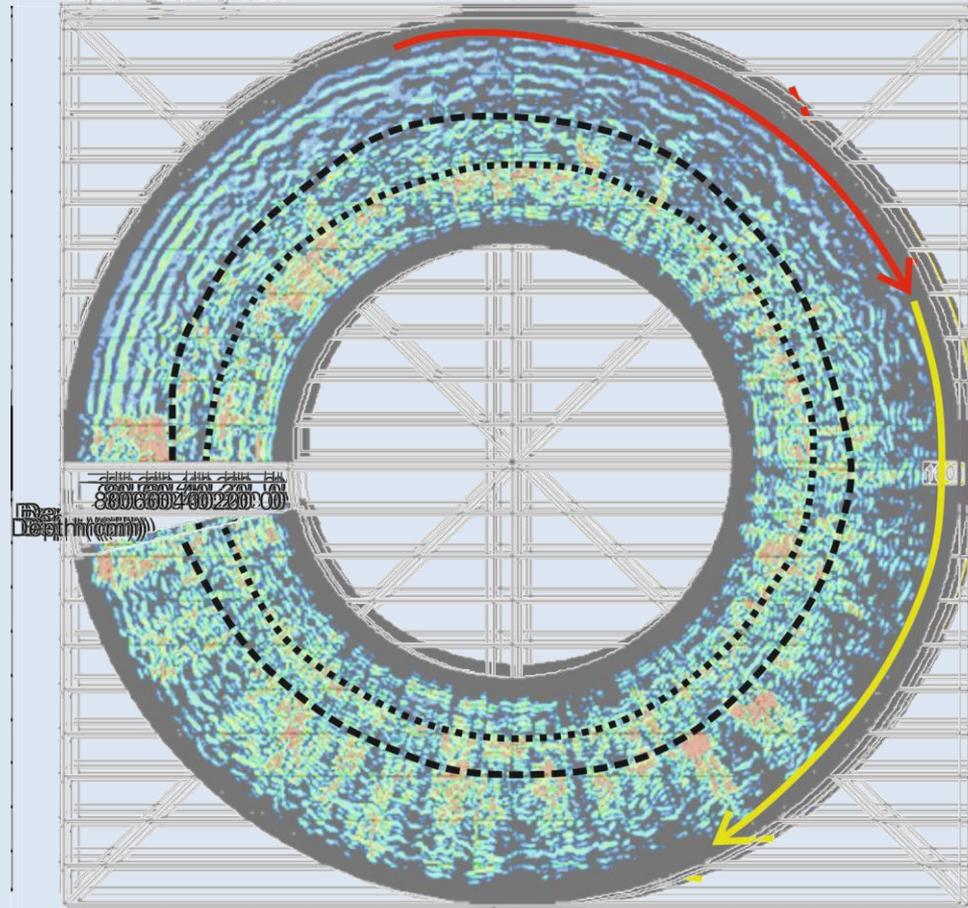
GPR Results

Wall – 2D Radargrams



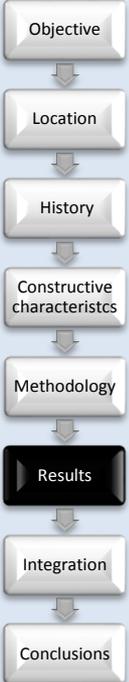
GPR Results

Wall – 2D circular Radargrams



Legend

- | | | |
|---------------|--------------------------|-----------|
| · · · Layer 1 | — High attenuation | — Anomaly |
| — Layer 2 | — High amplitude anomaly | |



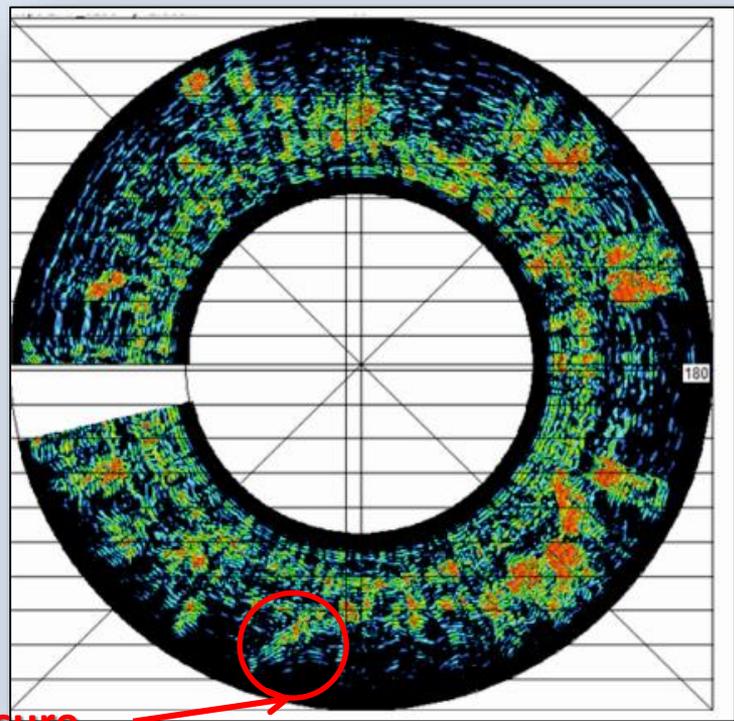
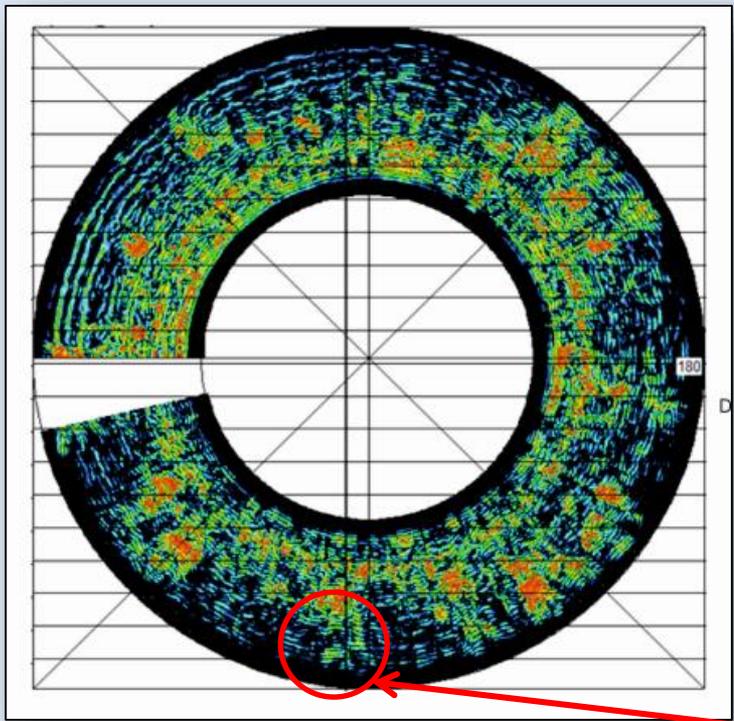
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Height

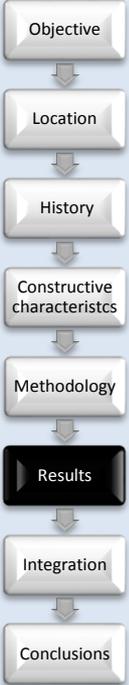
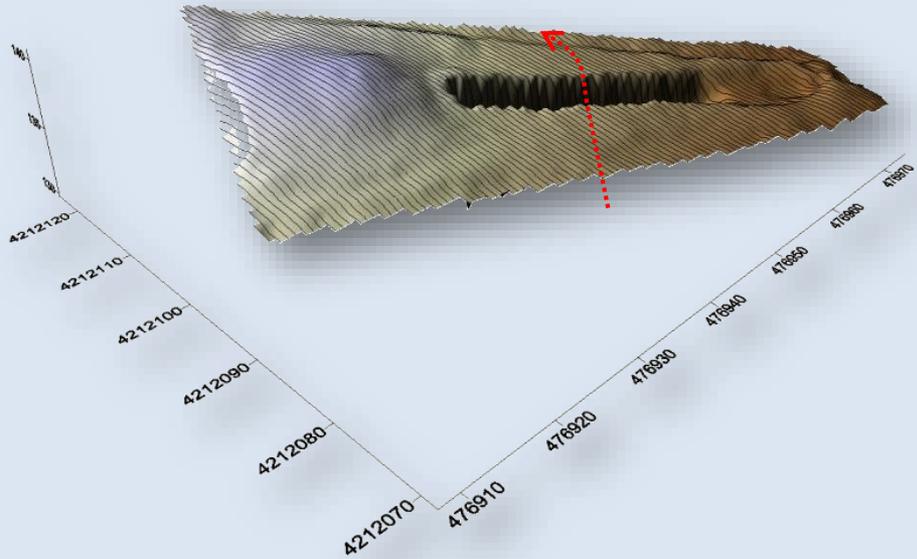
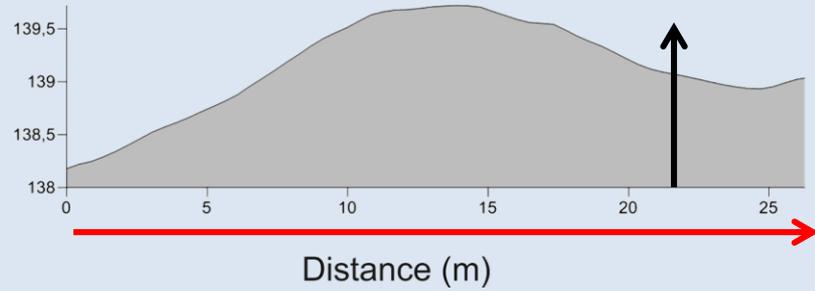
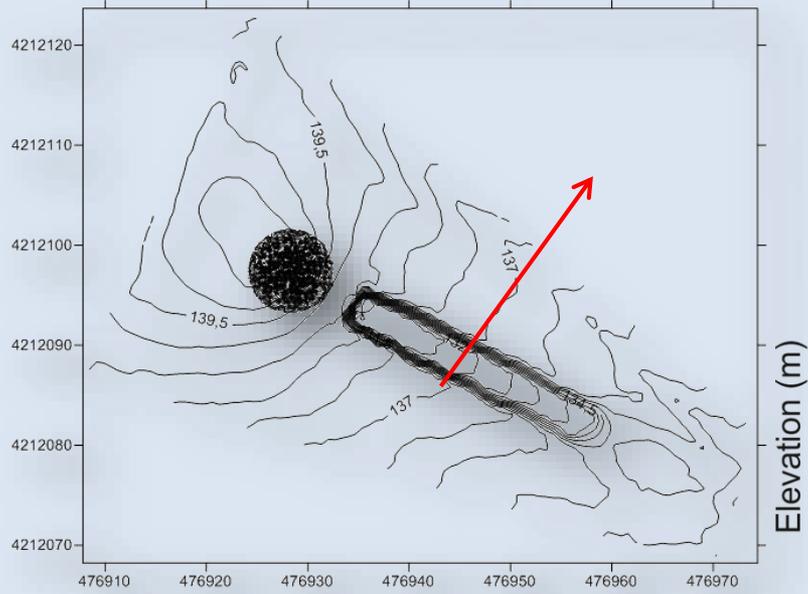
191 cm

213 cm



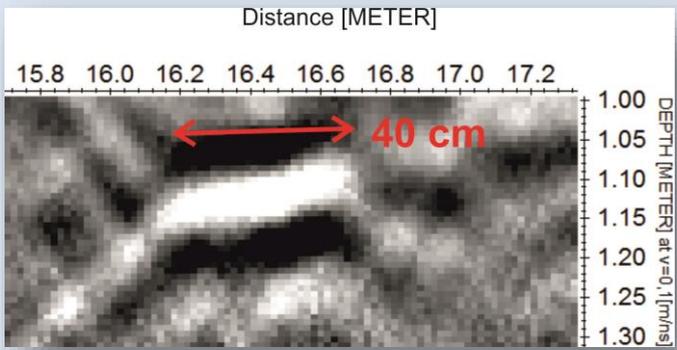
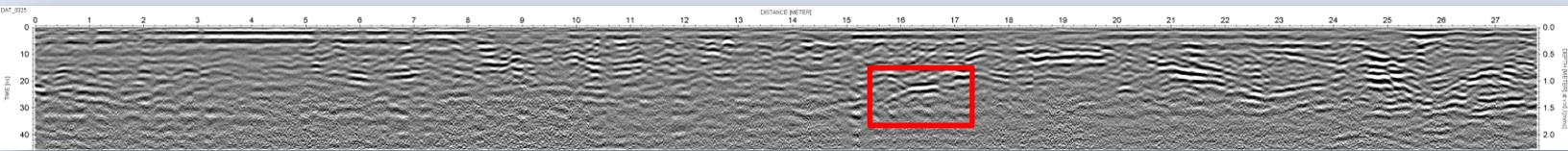
Fissure

GPR Results - Surface

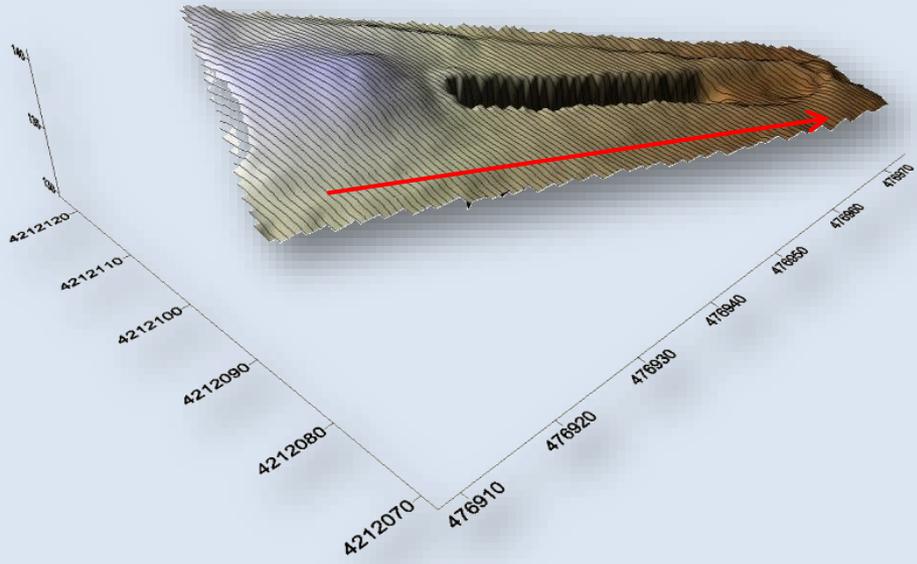
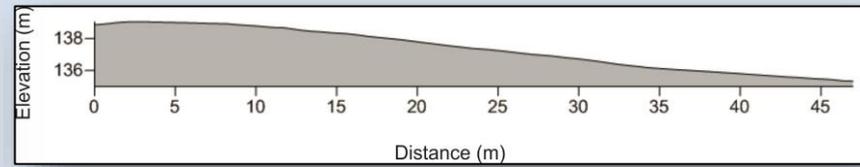
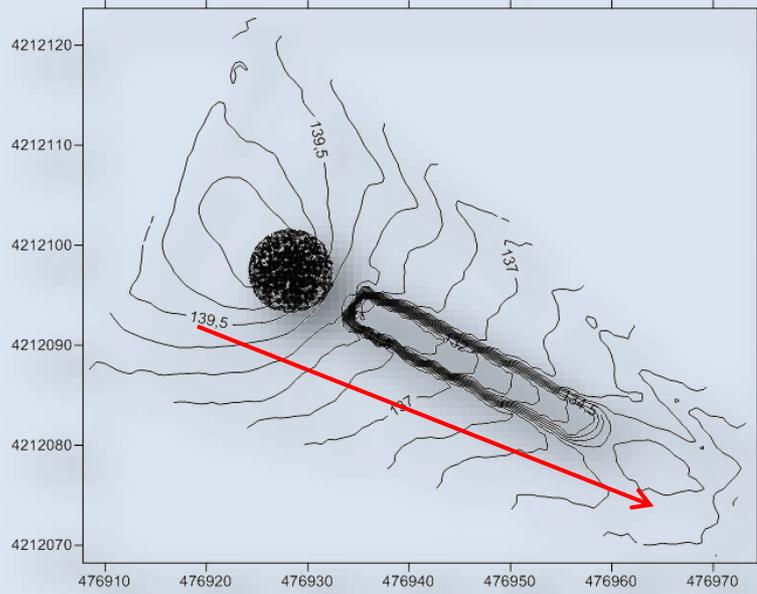


GPR Results - Surface

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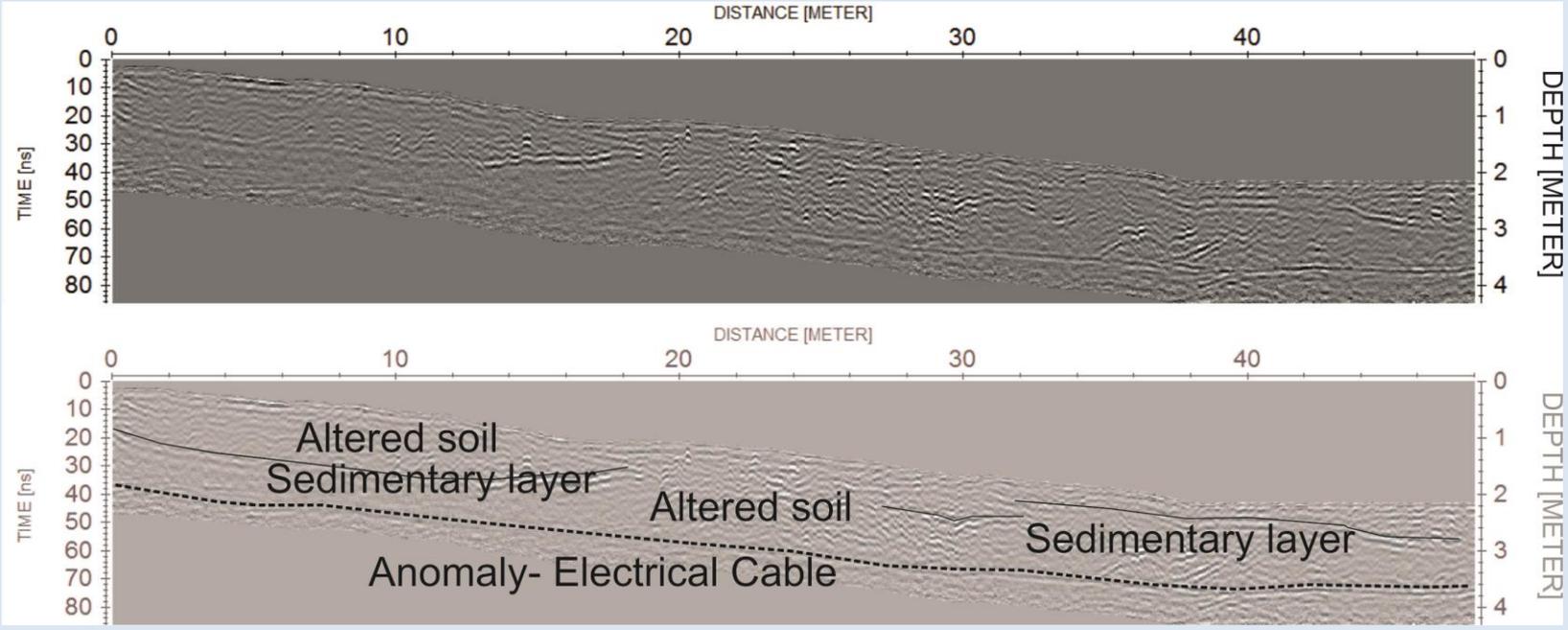
GPR Results - Surface



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Integrated geophysical methods

✓ GPR:

Objective: to define possible interior structure , layers and voids /finding archaeological targets

✓ Microresistivity:

Objective: to define wall thickness, degree of stone deterioration, determine the resistivity values of the Tomb building materials

•Passive Seismic:

Objective: to measure ambient vibrations that could affect the integrity of the structure

•Geochemical analysis :

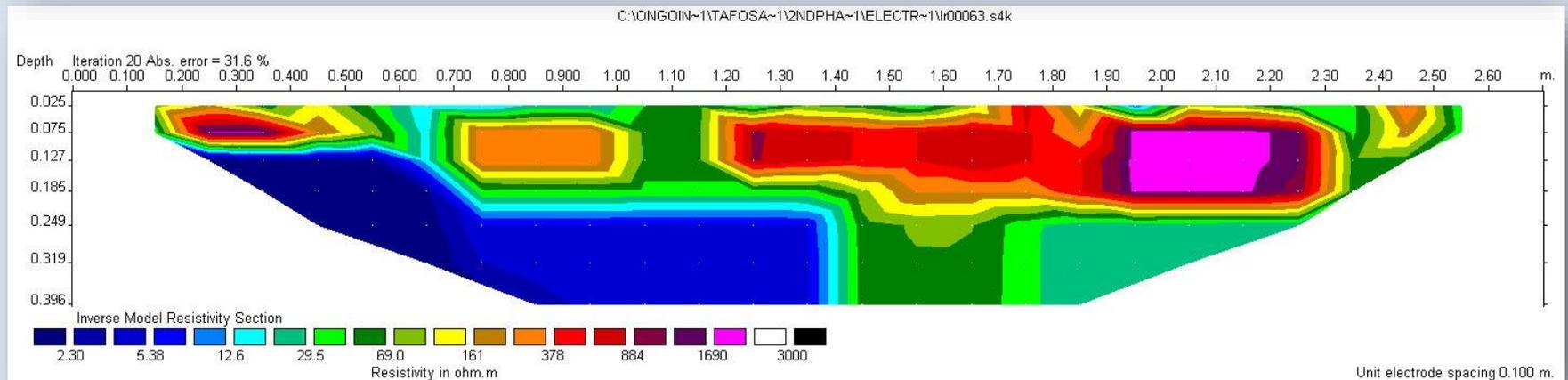
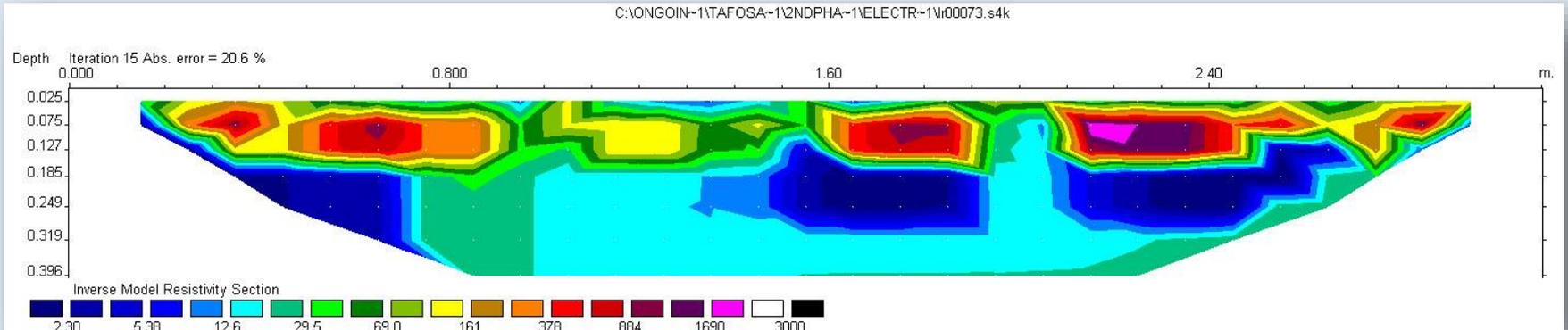
Objective: to determine the salt content in the Tomb building material and surrounding soils

✓ Endoscopy:

Objective: to obtain direct information about inner targets and structures

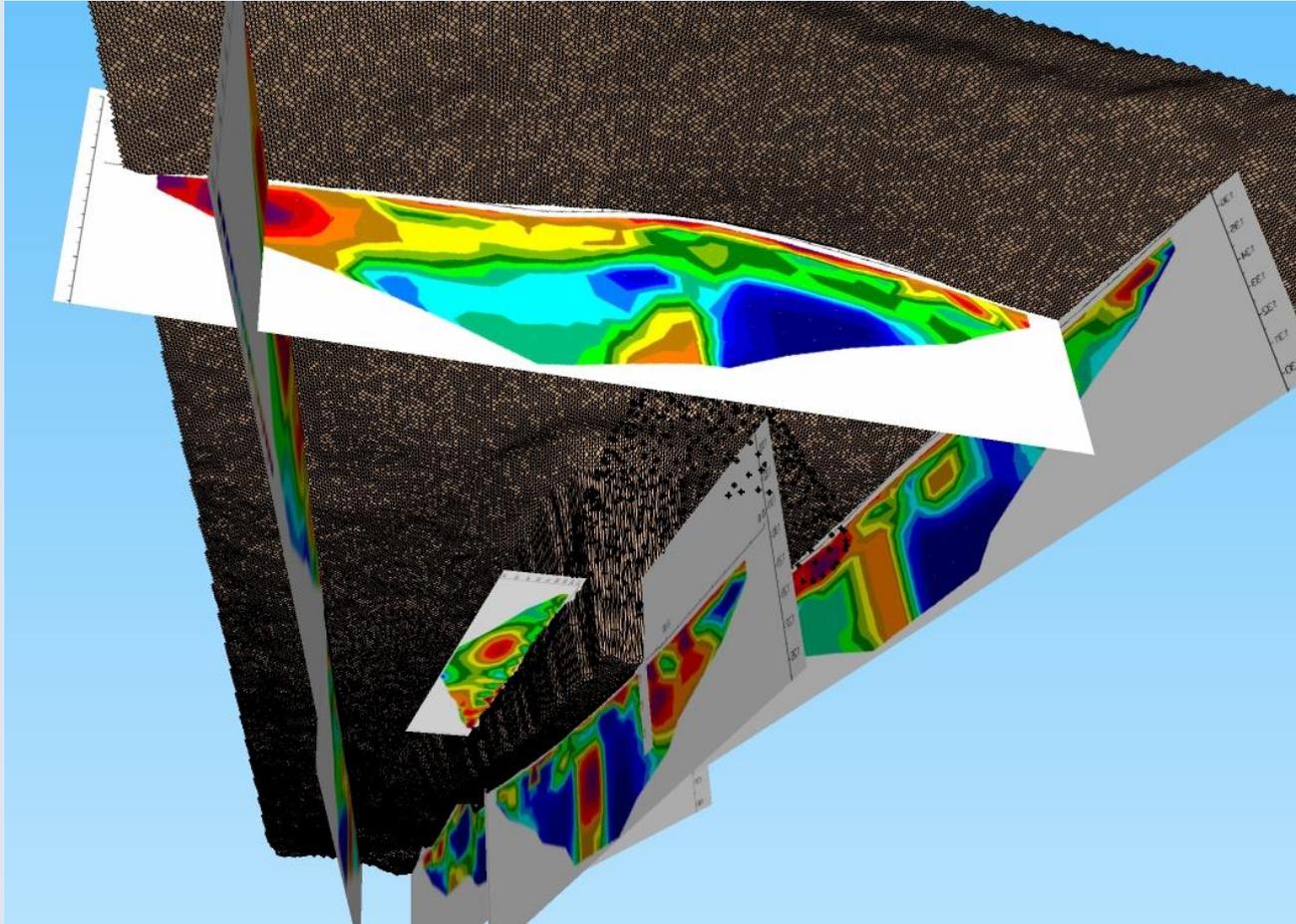
Integrated geophysical methods

Microresistivity



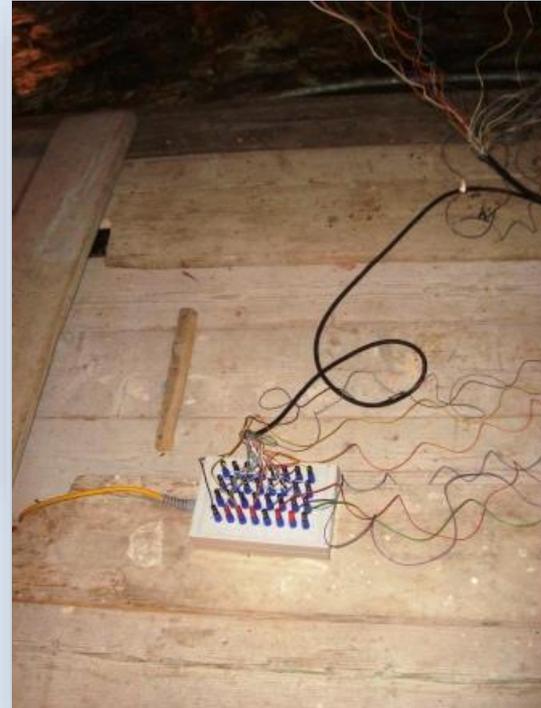
Electrical Resistivity Tomography (ERT)

Using the composite information such as geometry and resistivity, a view from below gives an idea on the subsurface setup.



Yellow and red zones are human constructions „floating“ in one very clayey geological environment.

Microresistivity surveys



Type of spread: 32 Electrodes multi electrode configuration.
Schlumberger – Wenner arrangement.

Seismic: MASW (Multichannel Analysis of Surface Waves)

In an effort to **quantify the effect** of the vibrations due to the heavy road traffic, one additional geophysical study on earth dynamics was realized. The first step to this direction was to establish a microzonation study of the subsurface of Tomb is realized.



The digital seismograph DAQLINK III of GEOSERVICE was used

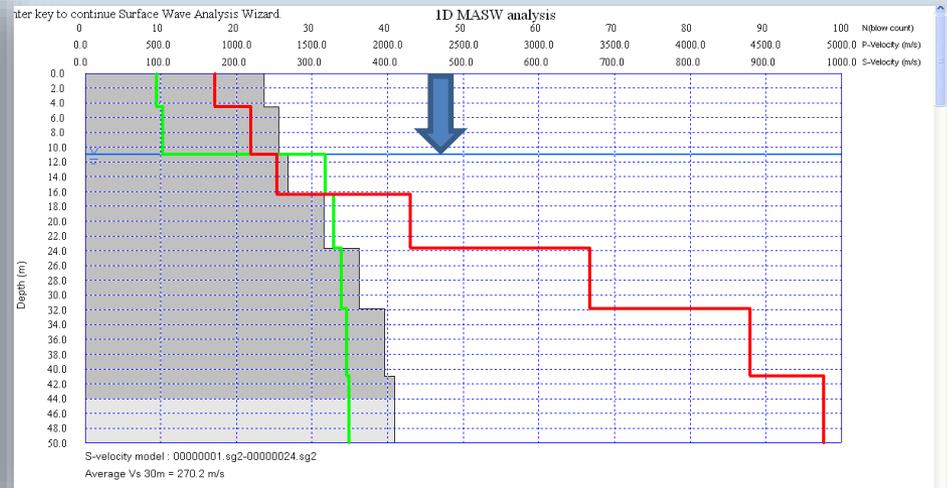
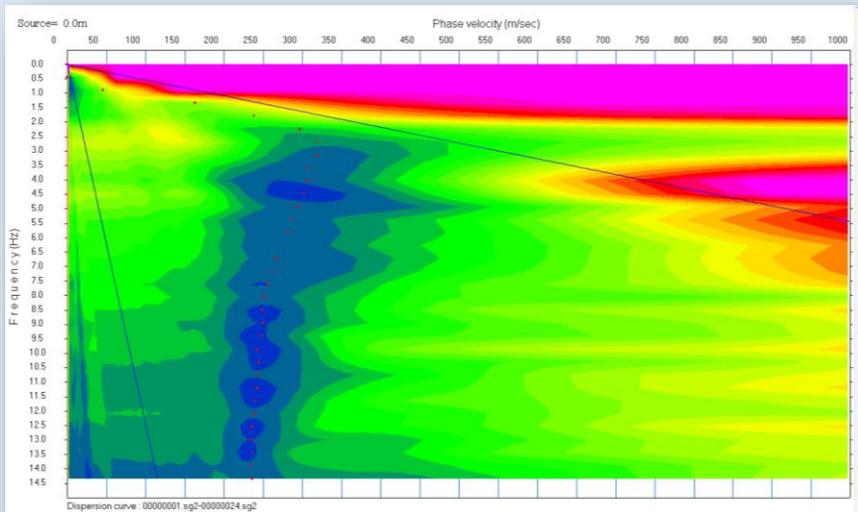


As seismic source, the ambient road traffic was used.

Passive seismics (MASW) have been applied with a circular 24 geophones spread

Seismic: MASW (Multichannel Analysis of Surface Waves)

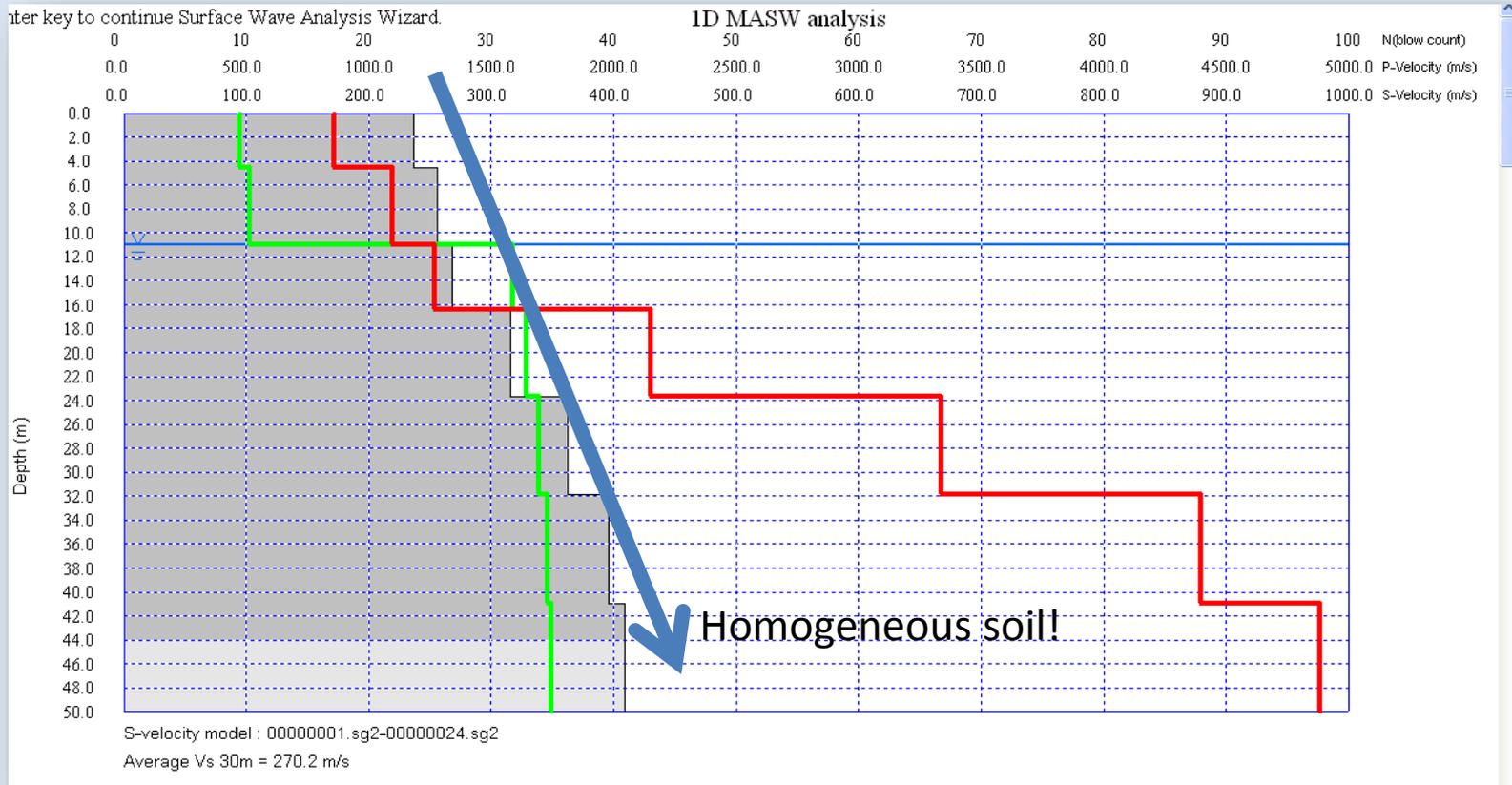
The phase velocity vs frequency diagram is plotted below, together with the shear wave velocity (Poisson's ratio) calculation.



The Tomb floor is located at the depth of 9 m from surface

Seismic: MASW (Multichannel Analysis of Surface Waves)

Shear wave velocity (Poisson's ratio) diagram details.



From the diagram is concluded that the average Vs is 270 m/sec for a confidence depth of 44 m. An obvious result is that the Tomb will never suffer from earthquakes!

Conclusions

1. An anomaly was detected at the Dromos (entrance to the Tomb) at 20 cm depth.
2. Two interfaces were detected at 25 cm and 50 cm depth related to stone-stone interface and stone-natural soil interface, respectively. Data confirmed the analysis *in situ* of the local thickness obtained with GPR (always > 40 cm thickness).
3. Local fissures have been detected at different levels.
4. High signal attenuation may be associated to high salt content. An anomaly repeated in several radargrams indicates a probable presence of a wall.
5. The Apex of the Tomb was detected at 1 m depth as indicated by the model Biers, 1980.
6. The integration of the ERT allowed locating voids and to confirm high clay presence.

Aknowlegments

- Geoservice, Geophysicist M.Sc. Klisthenis Dimitriadis and Mr Yannis Konstantakis for the opportunity, entire collaboration and efforts.
- To Dr. Vega Perez-Gracia that helped me and encouraged me during the STSM.
- To the 2nd Ephorate: Dr Eleni Andrikou, PhD Fotini Karasavva, Archaeologist Eirini Anagnostopoulou, M.Sc. Conservator Georgianna Moraitou and the Conservator Kanakis Hararis for the interdisciplinary labors and to interchange knowledge with the aim to produce high accurate scientific work.
- To the Municipalty of Acharnon: Archaeologist Elena Kassiotaki and to the Archaeologist Vasileios Avramidis for the constant support.
- Finally, to the guardian of the Tomb of Acharnon Mr Pantelis, to Mr Triantafyllos and to Mr Konstantinos for the collaboration during the data acquisition.

Thank you for your attention