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# Multi-frequency electromagnetic sounding tool EMS. Archaeological discoveries. Case stories.

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The electromagnetic frequency induction sounding device EMS created in Institute of Geophysics SB RAS. For few years the device is used for archaeological exploration.

The materials presented herein are made in cooperation with Institute of Archaeology SB RAS, Novosibirsk, Russia; University of Ferrara, Ferrara, Italy; GEOSTUDI Astier srl., Livorno, Italy.

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Figure 1

## CICAH-1 SETTLEMENT; WESTERN SIBERIA, RUSSIA

Cicah settlement belongs to Late Irmenskaya culture, XIII century BC.

Prior to excavation work on Cicah-1 settlement, all the sites were studied using EMS-2 device. As the result we had have before the excavation the detailed geoelectric maps and geoelectric sections with layout of archaeological objects. This data allowed to change drastically the strategy of archaeological exploration. Before excavation we had the absolutely new information concerning objects planigraphy and structure. The big volume of excavation work after the geophysical research let us verify the geophysical data and correct the methods of research. One of the feature of the software is the possibility to create cross-sections according to relief. The geophysical data allows to discover burial graves on the tillage at a side of the Cicah-1 settlement and burial ground belonging to the same ages as the settlement.

Cicah-1. Site 15-1. Pseudo 3D view. 21.07.02

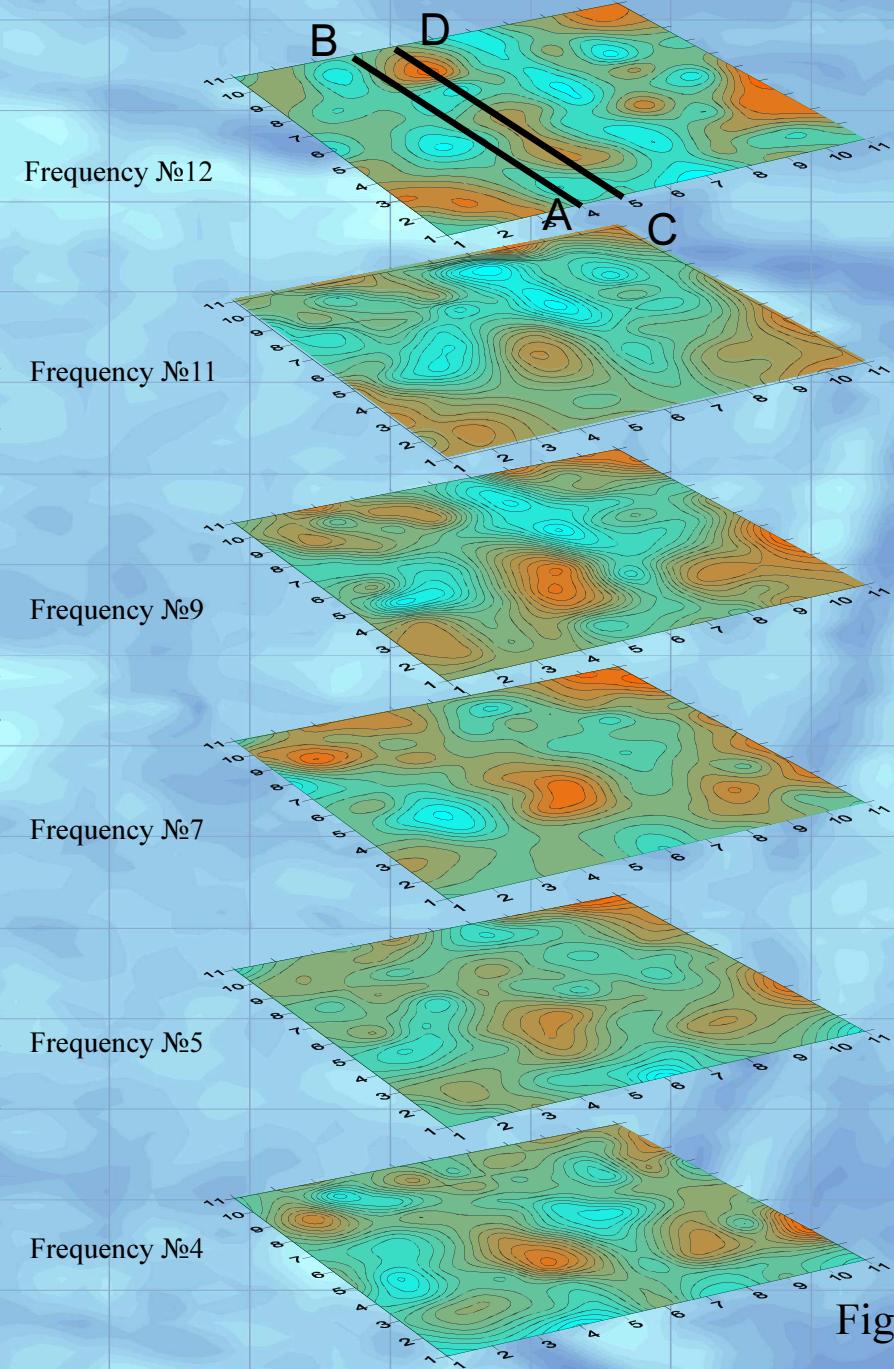
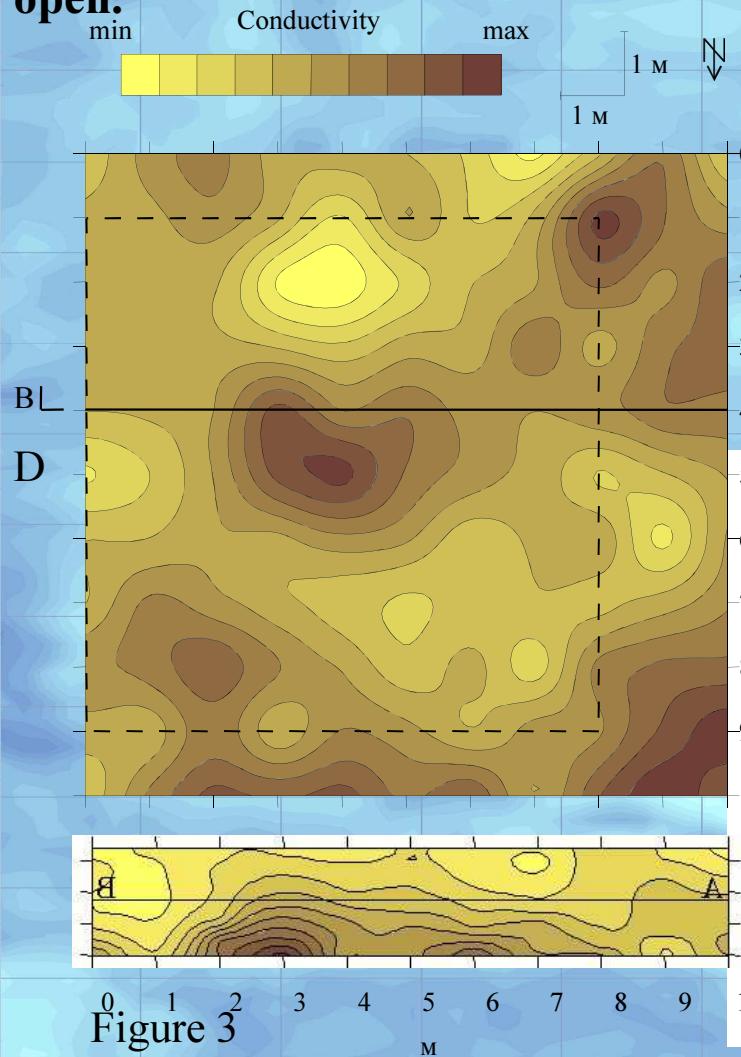


Figure 2

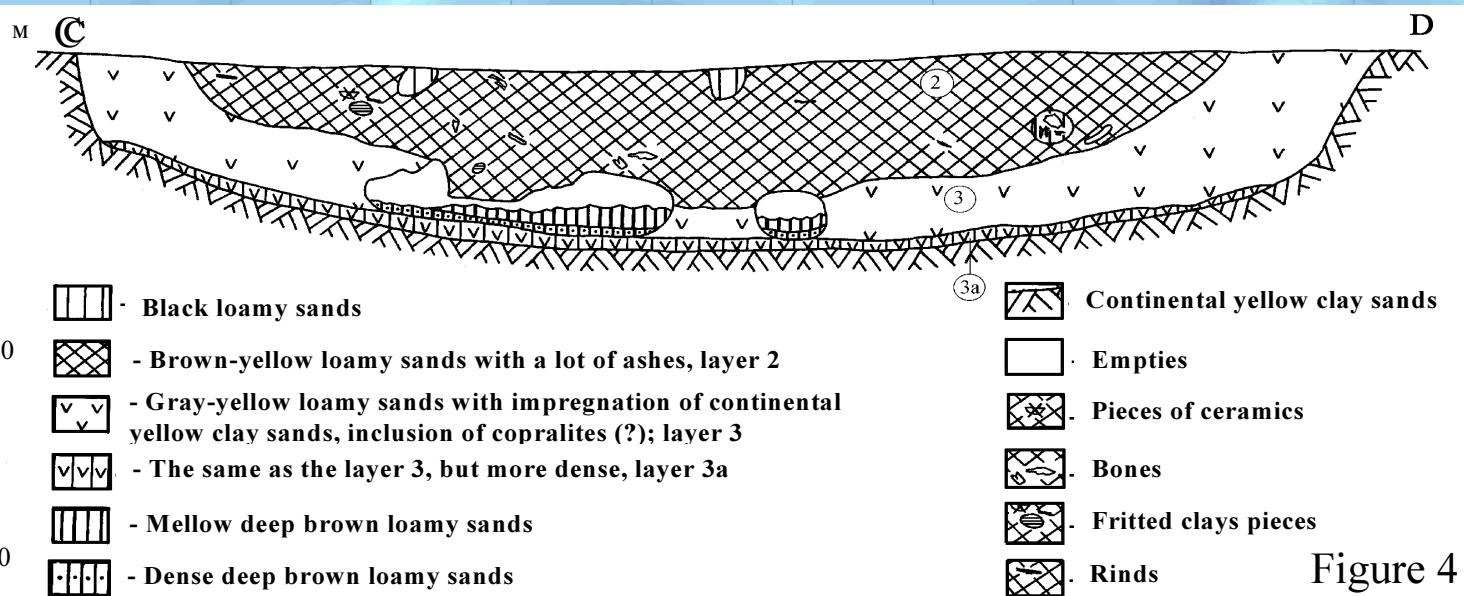
Figure 2 shows the pseudo 3D view of site #15-1. The picture was obtained right in the field after 2 hours of data acquisition (site dimension 10 per 10 m, stations every 1 m) and 20 min of data processing. We were interested in high-conductive anomaly along AB line. Based on the pseudo 3D view and AB cross-section, shown on Figure 3, the site was open.



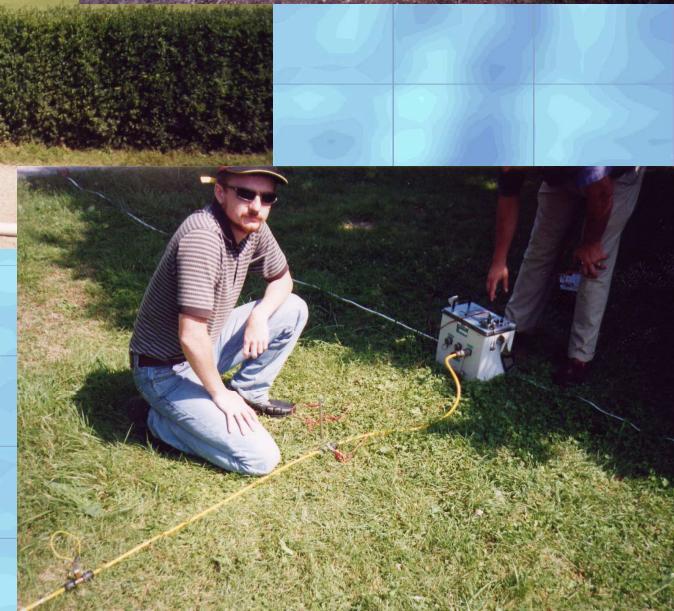
The result of site #15-1 excavation. On the figure 3 the map of frequency #7 data and AB cross-section are shown.



Figure 5



# The villa of Demidoff



The medieval ages villa was destroyed in XIX century AC. The purpose of work – to find the subsurface remains of the building behind loamy filling. Survey was effected using GEM-300, 2D DC resistivity tomography, georadar and EMS-2.

Figure 6 shows the maps based on GEM-300 (on the left) and EMS-2 (on the right) data at the same frequency. Subsurface structure can be seen on EMS data map.

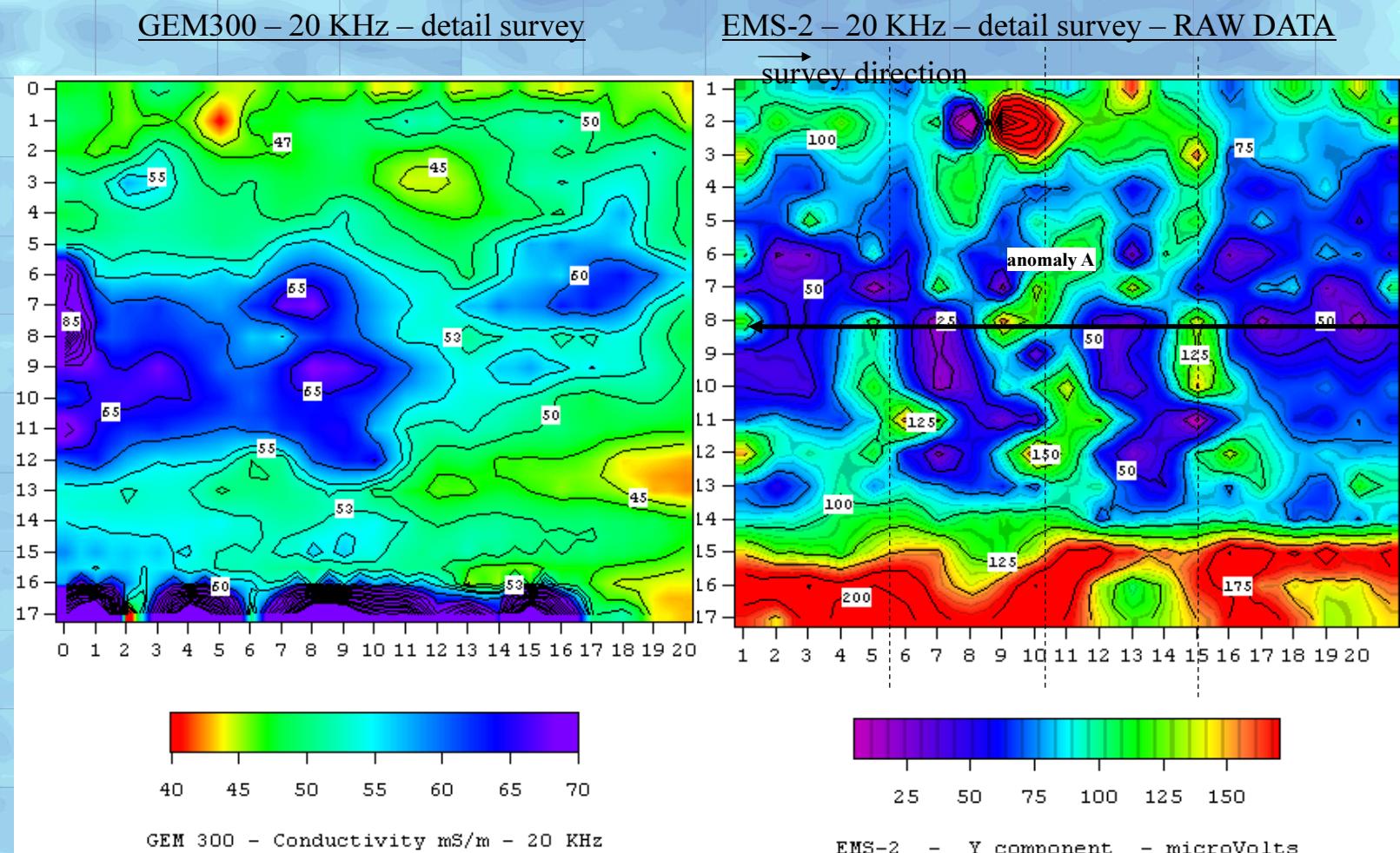


Figure 6



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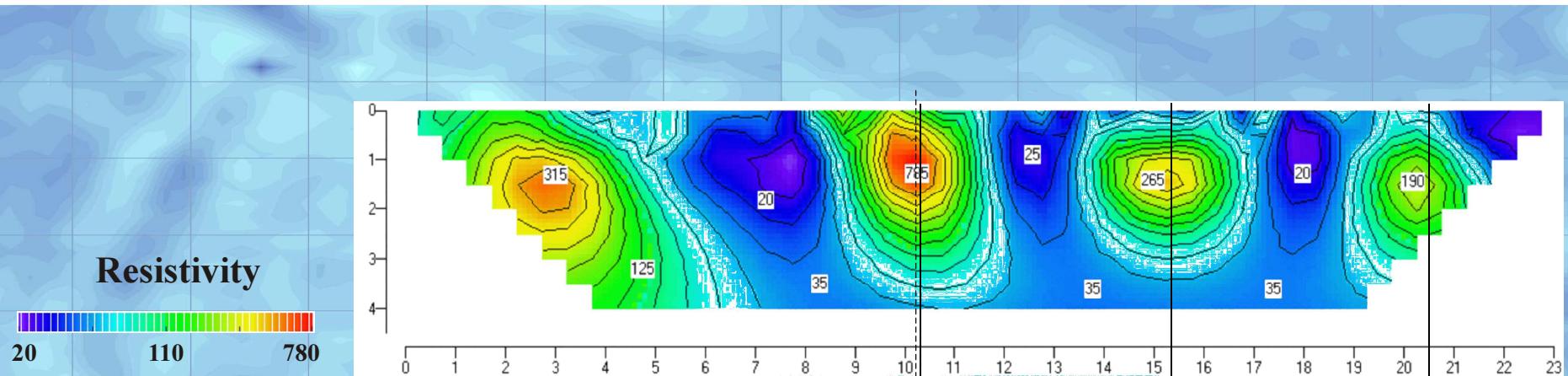


Figure 7a

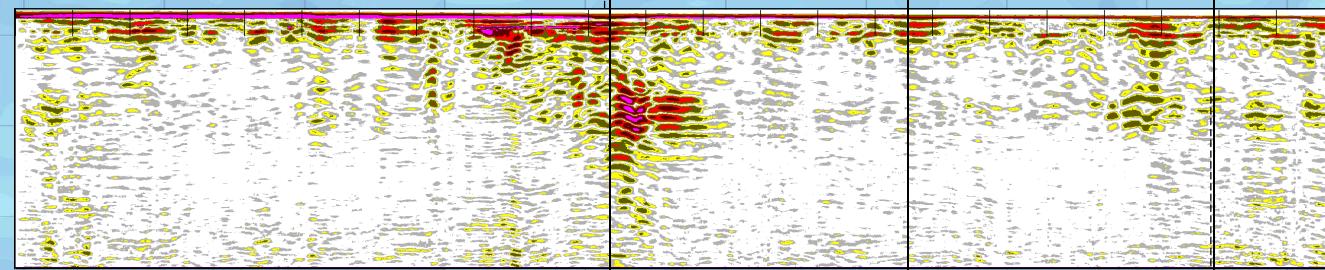


Figure 7b

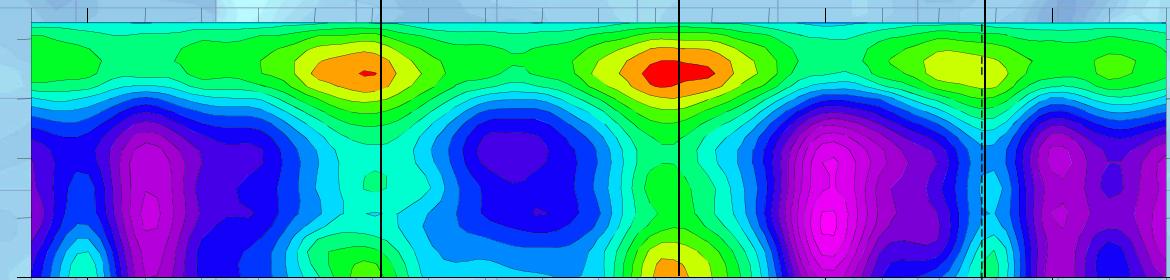


Figure 7c  
Conductivity

Geoelectrical cross-section obtained by various methods shown on Fig. 7. DC tomography (Fig.7a) shows 3 resistive anomalies. The most resistive can be seen on the georadar cross-section (Fig.7b). The third section based on EMS data shows the vertical shape of anomalies.



Figure 8a

One of the anomalies was immediately excavated by power shovel. The wall was discovered. The wall was built using stones and dried bricks.



Figure 8b

# Roman thermae near by Vada town

An unexplored part of archaeological site near Vada town was studied with IRIS DC tomography device, GEM-300 and EMS-2. The layout of the site shown on Fig.9.

The piece of the wall was found after presentation of the field data to archaeologists.

Figure 10 shows the maps done by GEM-300 (10a), 20 kHz; DC tomography (10b) and EMS-2, 20.5 kHz.

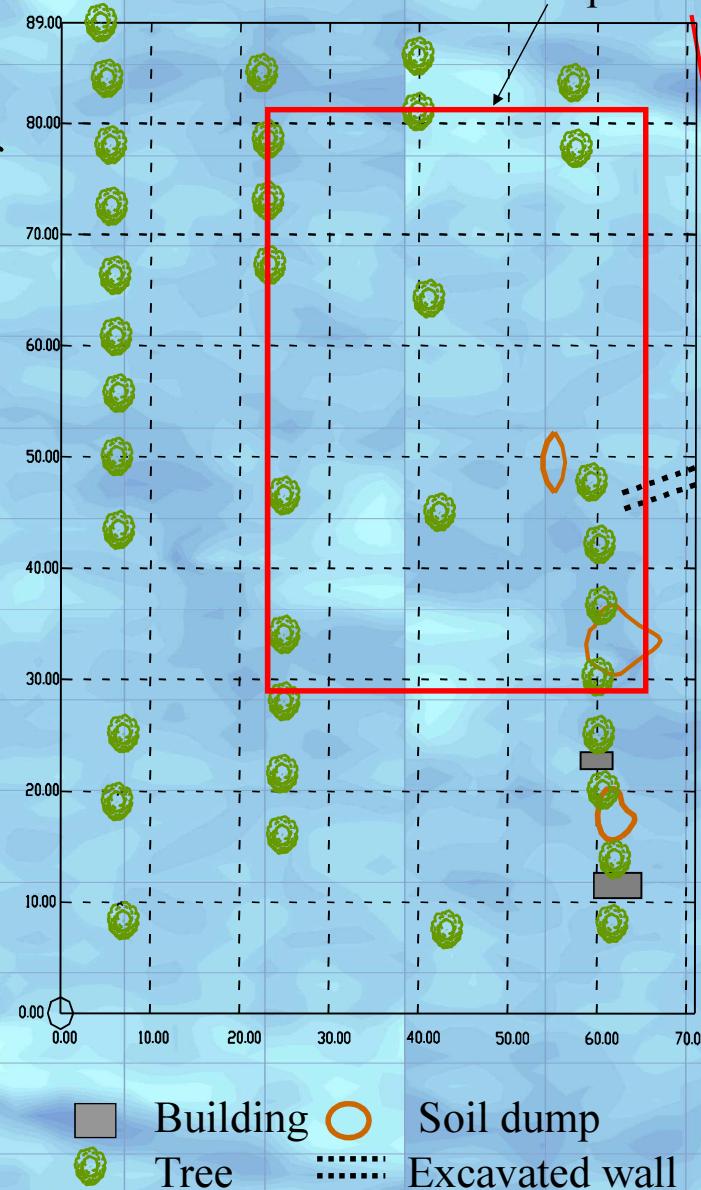
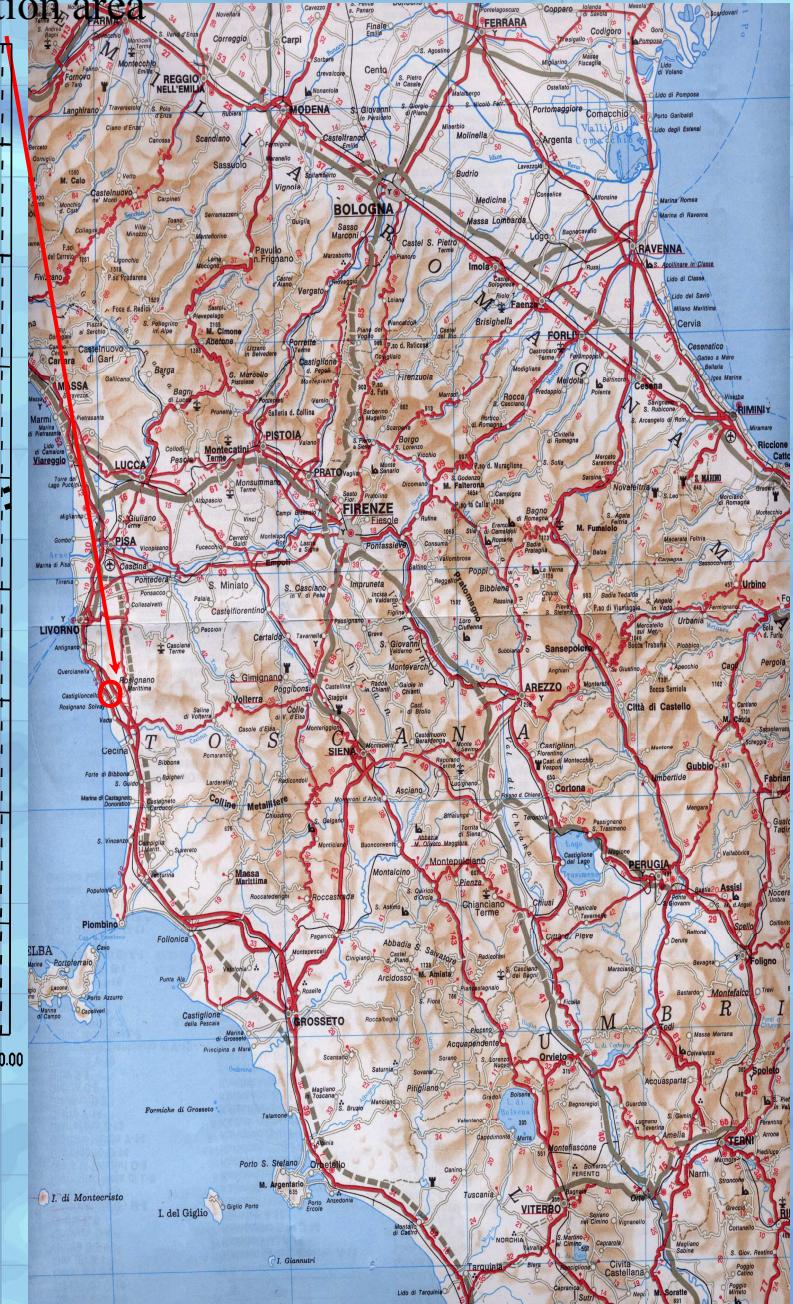


Figure 9

## EMS-2 exploration area



**GEM 300 – 20KHz – filtered  
data (quadrature)**

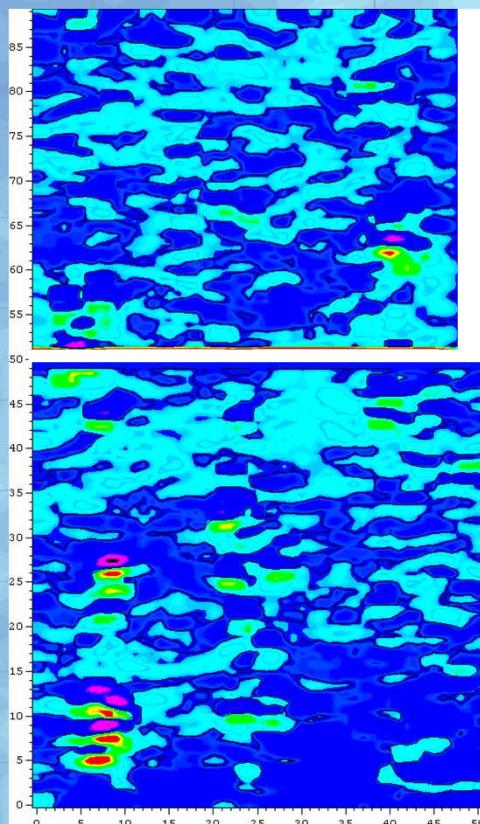


Figure 10a

**DC Resistivity Map**

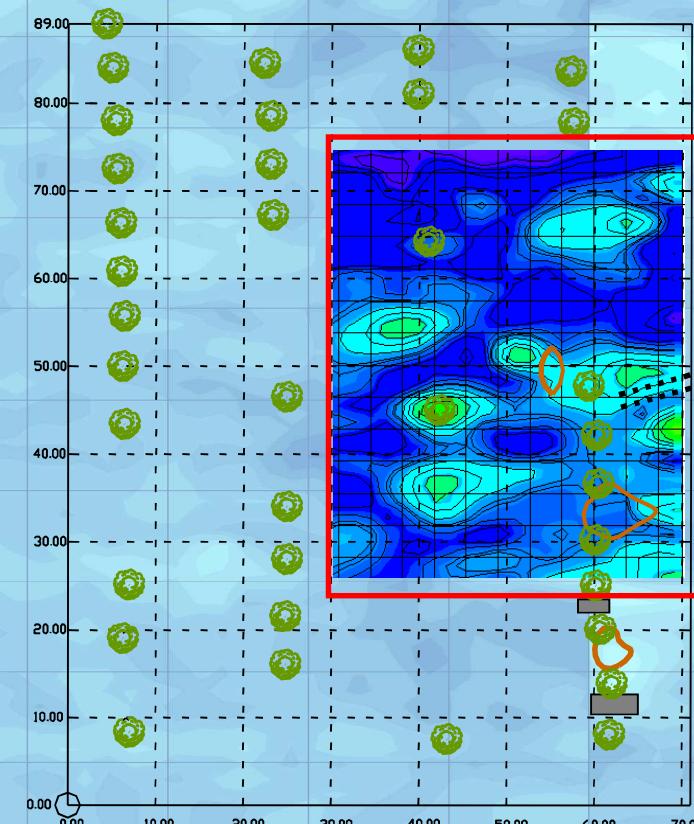


Figure 10b

**EMS-2 signal map. 20.5 kHz**

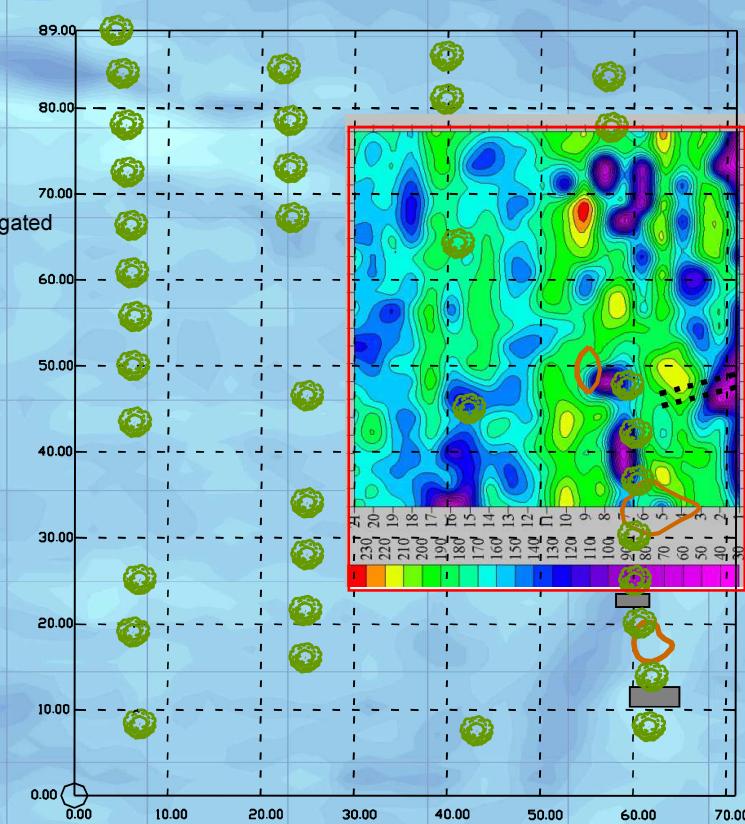


Figure 10c

## Pseudo 3D view of Vada thermae site.

