

P273 ELECTROMAGNETIC INDUCTION FREQUENCY SOUNDING AS A PART OF GEOPHYSICAL COMPLEX WORK ON CICAH-1 SETTLEMENT, WESTERN SIBERIA

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SUMMARY

Prior to archaeological excavation of Cicah-1 settlement in Western Siberia (2001) the complex of geophysical works was done on the sites. Magnetometric survey made by German colleagues (Becker, Fastbinder, 1999) was followed by electromagnetic shallow-depth induction sounding implemented by Laboratory of electromagnetic fields, Institute of Geophysics of Russian Academy of Sciences, Siberian Branch. The sounding was implemented using the tool EMS-2 (electromagnetic scanner) developed in Laboratory. The electromagnetic data obtained were presented as maps and sections with distribution of em-signal shown. The signal reflects specific resistivity of the sounded ground. EMS-2 allow to find new archaeological object – necropol at a side of the settlement and to study in details Cicah-1.

INTRODUCTION

EMS-2 was developed in 1996-1998 in Laboratory of electromagnetic fields, Institute of Geophysics of Russian Academy of Sciences, Siberian Branch. The result that the tool developer had achieved is that he has created the sounding tool that able to operate on 14 frequencies with one antennas set.

The tool is intended to survey in depth up to 10 meters, that's why apart of engineering purposes (water saturation mapping, monitoring of subsurface communications, search for empties etc.) archaeology is the good matter to work with.



Figure 1

EMS-2 DESCRIPTION

The main features of the tool are:

Frequency range 2.5 – 250 kHz;

High speed of recording (8 seconds per point);

Number of frequencies – 14 that allow to obtain data for detailed cross-section building;

Portability: dimensions 275x40x20 cm, mass 12 kg;

Measurement limits: 1 – 300 Ohm·m;

Data processing software that select and prepares data for visualization using common used mapper.

The tool shown on Figure 1.

CICAH-1 SETTLEMENT RESEARCH

Above mentioned magnetometric job made visible the common view of the settlement. However, archaeological objects here are located in crumbly ground, borders between sediments and targets are heavily eroded and detailed study of targets is very important to reduce the scope of excavation work.

EM induction sounding was effected on selected sites on the net 1x1 meter. Both maps and cross-sections were build.

Figure 2 shows two cross-sections build on site 2 of settlement Cicah-1. Lighter areas correspond to high specific resistivity of the media. Building the sections we have used 5

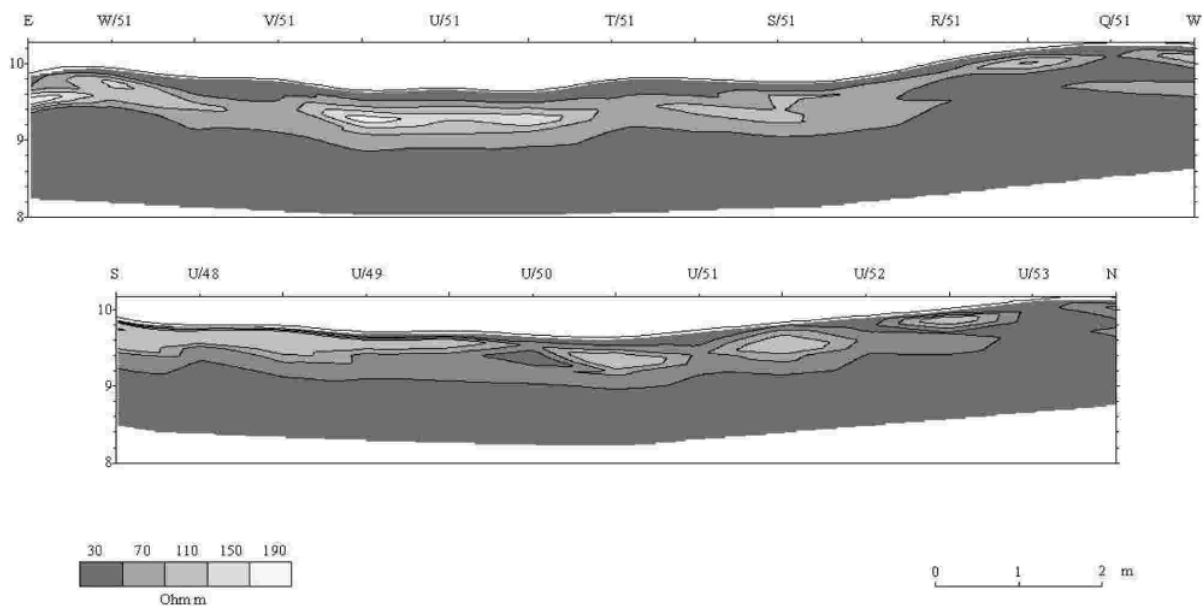


Figure 2

grades of specific resistivity between 30 and 200 Ohm·m. Loamy soil and sod has higher permeability and looks darker than building fillups.

After interpretation of above shown sections, the profiles has been excavated. Below, on figure 3 the resulting stratigraphic section shown. Numbers on figure 3 shows:

1. Sod;
2. Dark brown loam;
3. Black clay sand;
4. Burnt ground;
5. Grey clay sand with fine calcinities
6. Yellow-grey clay sand with fine calcinities
7. Black loamy sand with yellow clay impregnation
8. Black sooty clay sand

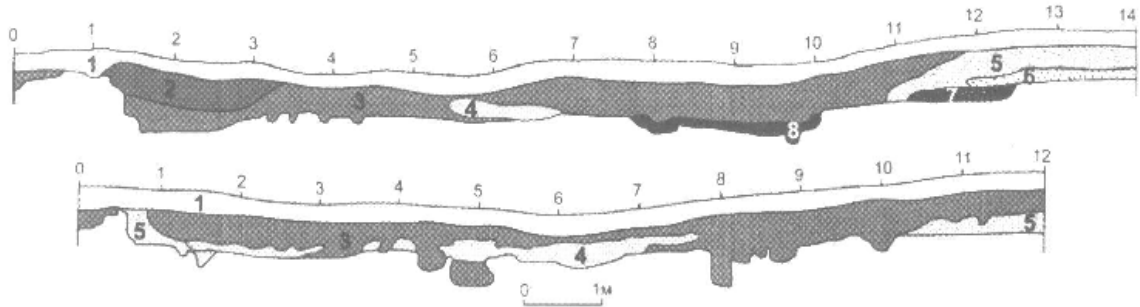


Figure 3

A good correlation between electromagnetic cross-section and excavation results can be seen.

Figure 4 represent in his right part quazi-3d building consists of four maps. The maps shows

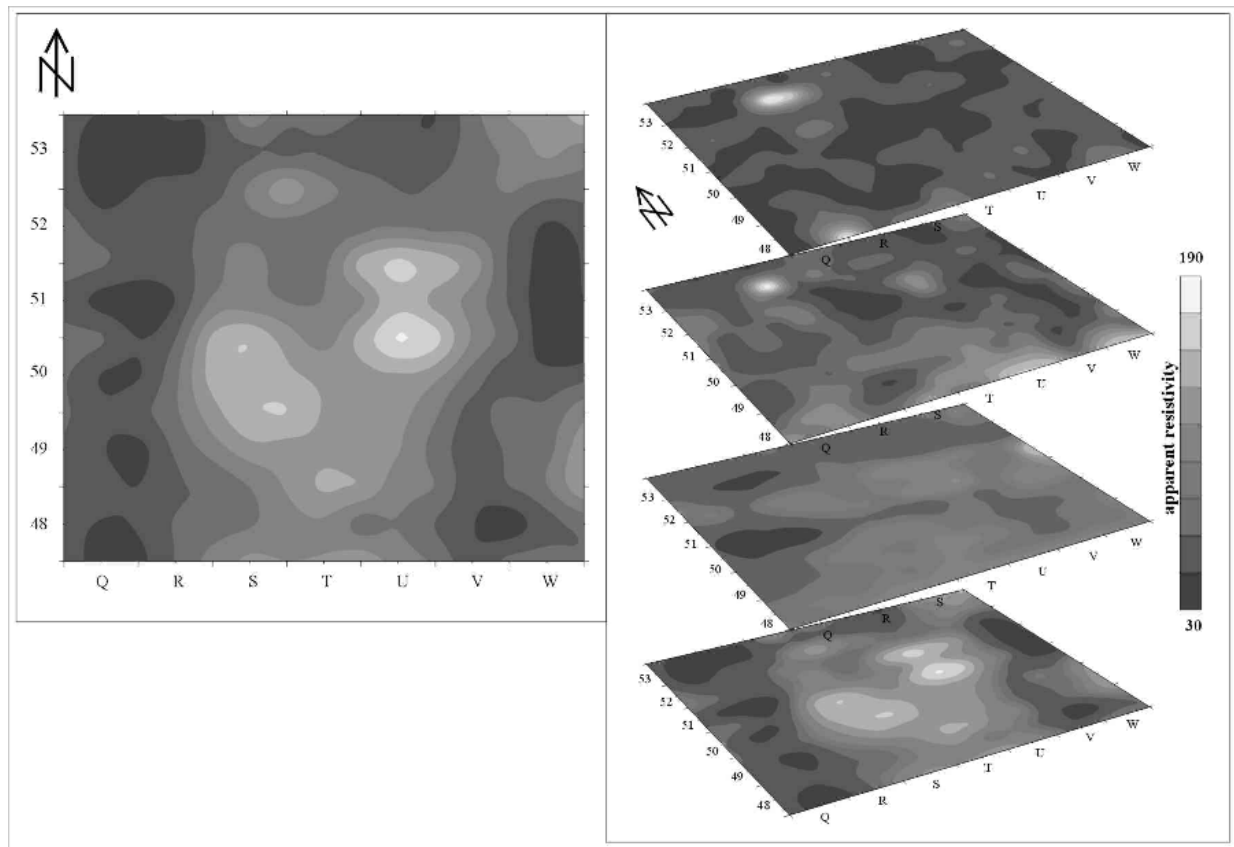


Figure 4

distribution of apparent resistivity on depths 0.4, 0.6, 0.8 and 1.2 m. The lower map with clearly seen on depth 1.2 m shape of building shown enlarged in the left part of the figure. The site includes the profile of section mentioned above. The direction of shown profile can be seen on the map.

The net of points here is also 1x1 meter. In the figure presented a site 6x7 meters.

Following excavation proved that the target present on the shown site.

The complex of geophysical works was extended by usage of metal detector UMI able to identify ferrous and non-ferrous metals. This tool allows to find metal artefacts and calcined ground in the former fireplaces.

CONCLUSIONS

Archaeological targets in Western Siberia met all the requirements to be a good matter for study by electromagnetic induction frequency sounding. Specific resistivity of the ground there can not exceed 400 Ohm·m, maximal depth of the targets location 5 m.

Application of magnetometry in complex with EM-methods drastically reduce the scope of excavation work and make possible to schedule them knowing location, shapes and dimensions of targets.
