

VERTICAL ELECTRICAL SOUNDING (VES) IN AREAS WITH MUD VOLCANOES CASE STUDY: MUDDY VOLCANOES OF PACLELE MARI, ROMANIA

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Introduction

The mud volcanoes at Pâclele Mari is one of the most interesting natural site in Europe. Muddy volcanoes formations are created by natural gas from more than 3.000 meters deep, passing through clayey sedimentary deposits, in combination with groundwater. The water mixed with clay is pushed toward the surface by natural gases usually associated with hydrocarbon accumulations.

The volcanoes display craters up to 6 m tall with permanent or intermittent eruptions, whose intensity is dependent on the amount of gas emergences and infiltrated rainwater.

The most famous mud volcanoes in Romania are placed in the southern part of the Eastern Carpathian belt, in the Buzau County. The phenomenon may be observed on several locations near the Berca locality: Paclele Mari and Paclele Mici (Marunteanu & Ioane, 2010; Brustur et al., 2015).

Geophysical VES investigations

In the Paclelor Mari area were conducted VES (Vertical Electrical Sounding) resistivity geoelectrical measurements for the detection of the muddy volcanoes buried structures and longitudinal faults.

Measurements of apparent resistivity (ρ_a) were performed for a set of distances AB, keeping constant the distance MN and the central position of the measuring array. For each length of AB electric potential difference between the points M and N was measured (injecting electrical current of 10 mA and 20 mA). A resistivimeter IntV3 was operated using the Schlumberger array.

In the Paclelor Mari area three apparent resistivity sections oriented S - N were carried out. The AB/2 for the first profile had a maximum of 50 m, profile 2 was deployed to AB/2 up to 30 m and profile 3 had a maximum AB/2 of 50m.

Data interpretation

The low resistivities showed by the VES results are in good agreement with the high sodium chloride amounts in the groundwater, as well as with the uplifted clay particles by the volcanoes activity.

For the VES geo-electrical apparent resistivity section presented in Figure 1 the depth was evaluated as the semi-distance between the injection electrodes (AB/2), while for the apparent resistivity section presented in Figure 2, the depth was evaluated as AB/3.

Both geo-electrical sections illustrate the deep structure of the investigated muddy volcano, the buried eruption cones below consolidated mud "lavas" being nicely depicted.

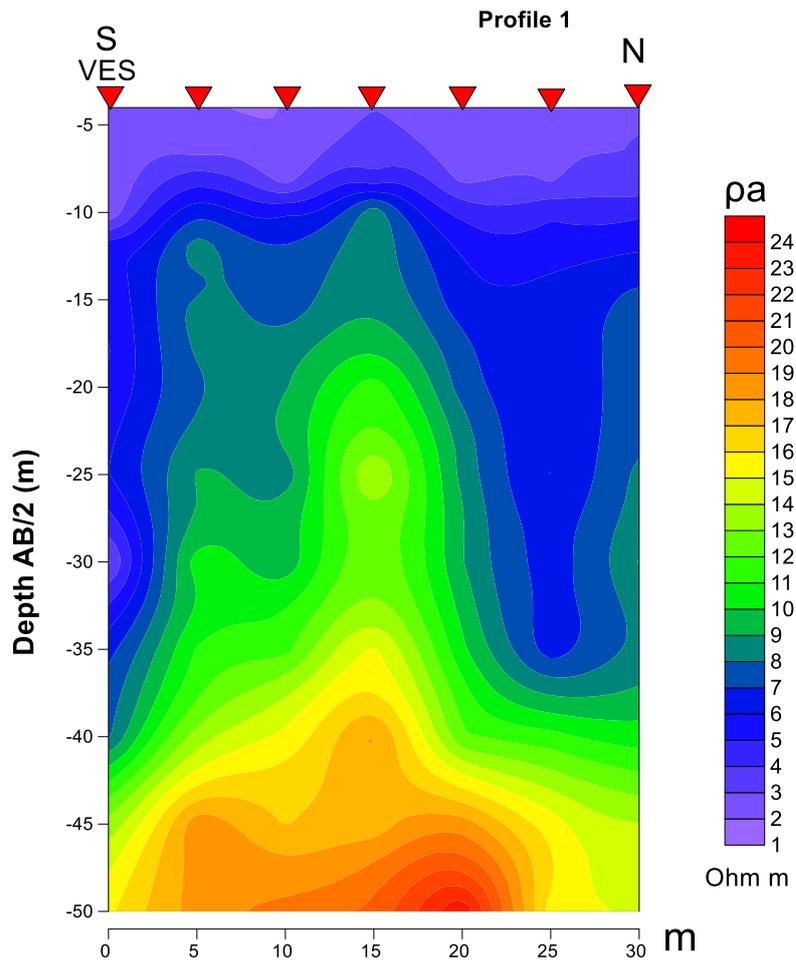


Fig. 1 - Geoelectrical cross-section with AB/2 evaluated depth

The upper part of the faulted anticline structure, including possibly sandstones besides clay layers, may be interpreted at the bottom the section presented in Figure 2, by the upward doming of highest resistivity values.

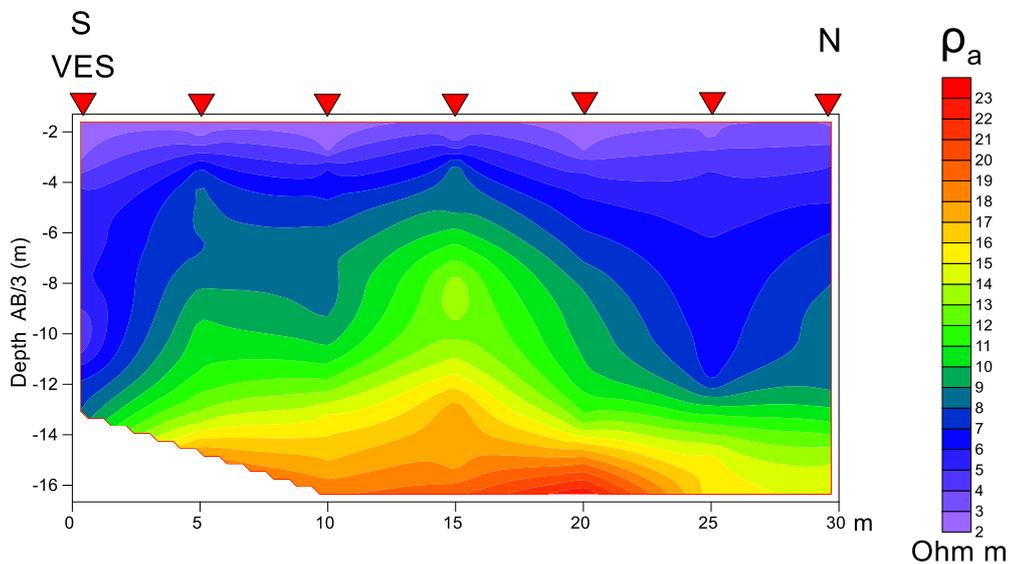


Fig. 2 - Geoelectrical cross-section with AB/3 evaluated depth

Conclusions

VES resistivity measurements were employed to illustrate the buried structure and faulting of the muddy volcanoes in the Paclele Mari area, Buzau county.

The apparent resistivity section computed for AB/3 nicely illustrated the concealed eruption cones beneath recent muddy "lavas".

Faulting of the volcanoes structure could not be shown by the geophysical data at this stage of research, probably due to insufficient resolution of the VES measurements.

References

Brustur T., Stanescu I., Macalet R., Melinte M., 2015. The mud volcanoes from Berca: significant geological patrimony site of the Buzau land geopark (Romania)

Marunteanu C., Ioane D., Muddy volcanoes, 2010, Natural Heritage from East to West, Springer, 79-86 pp.