

HYDROCARBONS AND ATMOSPHERIC ELECTRICITY

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1. Introduction

The results of experimental geoelectric investigation within some hydrocarbon fields are considered in the report. The multiple experiments on measuring of the field of atmospheric electricity near the Earth's surface testify that above hydrocarbon deposits higher values of electric field are observed. That allows to search and contour oil and gas fields with help of non-classical geoelectric methods. In the presentation consideration is given to the nature of electric field in the Earth's atmosphere. The data obtained can provide for determining the field outlines and some of its properties.

2. The field of atmospheric electricity

There is a constant electric field in the Earth's atmosphere, which is supported by the influence of various factors and is characterized by certain parameters. It is known that the Earth's surface bears considerable negative charge and the upper atmosphere (the ionosphere) charged relative to the Earth positively. An electric field that occurs between these spheres is approximated to the field of spherical capacitor. Charged particles in the atmosphere are heavy and light ions. They are formed as a result of interaction of cosmic and solar radiation with the ionosphere and the decay of radioactive elements near Earth's surface. There is a constant movement of electric stream along electric field lines towards the Earth in areas of good (calm) weather. During storms the Earth is charged by lightning and precipitations. The electric field strength near the Earth's surface is about 130 volts per metre and significantly decreases with height. During thunderstorms it can reach thousands of volts per metre. Global electric charge of the Earth is about $5.7 \cdot 10^5$ C [1].

The determining of the field of atmospheric electricity by different methods near the Earth's surface shows that various processes lead to the formation of natural, local and constant electric fields in the Earth's crust. They affect the global electric field. Electromagnetic anomalies occur as a result of reduction-oxidation, filtration, diffusion-adsorption processes and other. Anomalous electric effects above hydrocarbon deposits are observed. Results of measurement of electric field above hydrocarbon fields and some prospective areas in Ukraine and Kazakhstan are given in the presentation [2, 3, 4 and 5].

3. Express-technology of "direct" searching and prospecting for hydrocarbon deposits

Oil and gas searching and prospecting were conducted with help of geoelectric method of the forming of short-pulsed electromagnetic field (FSPEF).

The technology of FSPEF allows operatively:

- to reveal and map the "deposit" type anomalies (DTA) [Fig. 1];
- to conduct in compressed time periods the reconnaissance examination of large-scale and difficult of access oil-and-gas-bearing territory;

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- to execute the detailing work within the separate anomalous zones and perspective objects for the reason of the places for the boreholes pawning choice, of possible reserve of HC estimations, of decision making about directions of further geologic-geophysical works and boring;
- to find and map within mine fields zones with raised gas-content in coal layer and containing their rocks;
- to study over-salt and sub-salt (sub-cornice) HC reservoirs;
- to map fractured zone and HC accumulations in the fractured parts of the crystalline basement;
- to conduct the oil and gas prospecting works from the ship board on offshore and etc.

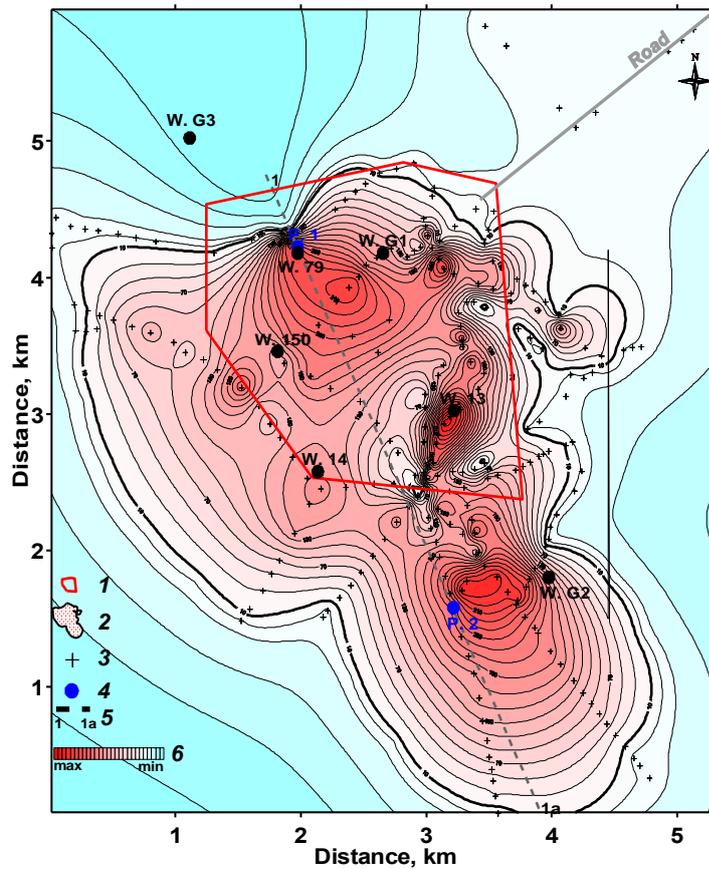


Figure 1. Botakhan oilfield (Western Kazakhstan) DTA map. 1 –oil-mine zone contours; 2 –deposit contour for two structural stratum; 3 – points of survey; 4 –VERS points; 5 –cross-section; 6 –scale.

The FSPEF method allows to determine places with higher values of the intensity of electric field. Such positive anomalies correspond to oil- or gas-bearing of structures. Negative anomalies don't contain hydrocarbons [Fig. 2] [6].

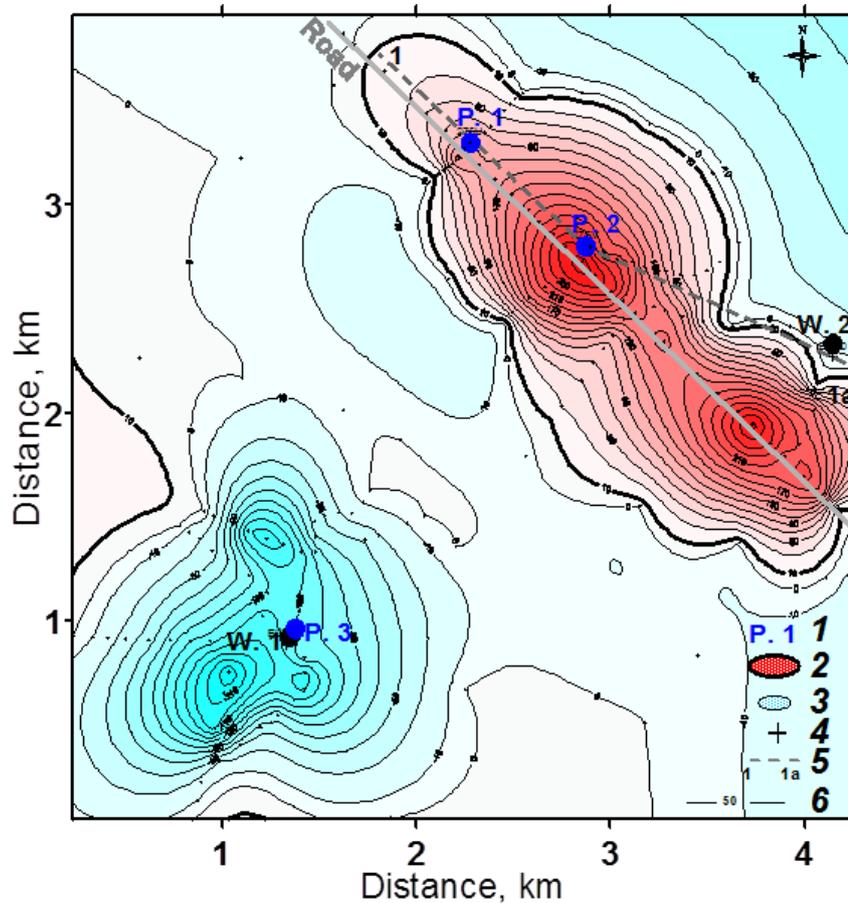


Figure 2. Satybaldy-Korsak structure (Western Kazakhstan) DTA map. 1 – VERS station; 2 – sub-cornice deposit zone; 3 – zone of watered layers; 4 – survey points; 5 – cross-section line.

3. Conclusions

Experimental data of the measuring of the field of atmospheric electricity shows that anomalous electric effects above hydrocarbon deposits are observed. The ground-based survey by FSPEF method can be effectively used for the determining of outlines of oil-bearing or gas-bearing structures, operative choice of the optimum places for the degassing, parametric, exploratory and producing wells location and etc.

References

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