

*Materials of a Conference***THE GEOPHYSICAL METHODS EFFICIENT  
COMPLEX OF THE HYDROCARBONS  
DEPOSITS DIRECT FORECASTING**Ryskin M.E., Volkova E.N., Frolov E.Yu.,  
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It is usually quite being subjected to the preliminary discussion the two most actual challenges – that is the methods informativeness and the comprehension ones, and also the complexification efficiency, at the geophysical methods complex choice and the validation, having aimed at the one or another practical task and the real – world challenge. The efficiency, one way or another, is being hinged on the costs and expenditures minimization challenge, and also the scheduled time for the works production, that is the complex narrowing challenge, but the informativeness, on the contrary, is being set against its further widening challenge, for the purpose of the indications maximum quantity getting, on the interpretation basis of which it is quite possible to achieve the single value and the unambiguity in the geological nature determination of the studied objects, and also their geometrical characteristics.

The complex widening challenge is being come to the foreground, at the solution so difficult task, as the oil and gas deposits forecasting, and when their presence indications are being revealed themselves in the form of the weak anomalies, which are quite comparable with the observations errors.

But even its maximum widening, at the expense of the geophysics all the methods use, which are available, is not being deleted the challenge from the agenda on the anomalies geological interpretations ambiguity, as the geophysical information is quite capable to characterize the studied object, only by the indirect way in the form of the anomalies in one or another physical field distribution.

Therefore, only the methods inclusion into the complex, having permitted to receive the direct information on the oil and gas presence, that is the geochemical and the bordering methods, having combined, as the indirect geophysical, well as the direct geochemical ones, is being permitted to be hoped for this challenge cardinal solution.

And the costs and the expenditures minimization necessary degree also the scheduled ones for the works production is being achieved by the suggested combination of all these diverse methods, as far as the «heavy» ones and the cost – based geophysical investigations are usually being excluded from the field stage – the seismo – and the electrical exploration, which are able to be changed and to be substituted by the efficient and the inexpensive non – deep and the shallow modifications. At the same time, the seismo –

and the electrical exploration data inevitably would be claimed and be demanded just from the fund and the corresponding fiscal sources at the materials processing and the further interpretation stage.

The gravimagnetic surveys results of the last years will also be claimed and be demanded just from the fund and the corresponding fiscal sources, which are quite necessary for the preliminary territory division into the districts and the fields zoning by the peculiarities and the specific features of all these geophysical fields. All these materials are the main basis for the tectonic lands division into the districts and the fields zoning. So, it is quite impossible to achieve the most reliable the private, the particular, and the specific tasks solution, having connected with the separate objects, without such territory division into the districts and the fields zoning, that is at the integral presentation absence on the geophysical fields distribution regularities and on the studied territory subsurface geological section structure. Thus, the suggested approach to the task solution of the oil and gas deposits direct forecasting is being structured and is being well – defined, as the three – stepped one.

The investigations territory division into the districts and the fields zoning by the geophysical fields peculiarities and the specific features with the further parcellation, which are the most perspective for the field work and the field operation carrying out by means of the low – cost based geophysical, geochemical and the bordering methods is practically being carried out at the first stage. All this work is completely based on the fund materials and the corresponding fiscal sources use. So, the main elements of such territory division into the districts and the fields zoning technology have already been covered in a number of the issued publications [1,2].

The field observations are usually being carried out at the parcellated perspective lots and the plots at the second stage. The gravi – and the geomagnetic reconnaissance, the electrochemistry, the gaso-geochemistry, thermomagnetometry methods are being included into the field complex. So, the above – indicated methods have been included into the field complex by the following considerations.

The minimum gravitational force is usually being observed just over the oil and gas deposit in the anomalous gravitational field, and sometimes with the sharp horizontal gradient at the ends. So, the minimum presence may be the main searching indication, at the oil and gas structures estimation, though such clear and the sharp deposit manifestation in the  $\Delta g$  total field is being observed not always. However, it is succeeded, as a rule, considerably to be increased and to be synergized the effect by the low – exponential trend removal and the frequency transformations use. So, the minimums, as often as not, are being mapped in the magnetic field just over the deposit. In the total, the an-

nular geopotential anomaly is being mapped just over the deposit – and this fact is quite enough well – known from the gravimagnetic methods use practice [3].

The oil and gas geochemical searching is being included the whole series of the methods, having distinguished, as by the investigations object type, well as by the determinate and the defined geochemical parameters (e.g. the fixed and the retained UV content and the composition, the defined and the specified secondary minerals content and the rest). The gas survey method is being consisted in the hydrocarbon gases composition and the distribution study on the studied and the researched area. All the gas survey varieties are being based on the methane, the ethane, the propane, the butane, the pentane, the hexane micro-concentrations definition, having contained in the rocks and in the groundwater. So, it has been suggested to use the thermomagnetic method of the oil and gas structures exposure with the combination of the gas survey [4]. The last one has been based on the fine – dispersed authigenic minerals definition (e.g. the pyrite and the siderite), the granules concentrations and the dimension of which are quite insufficient just for their definition by means of the optical or the X – ray diffraction methods. Mediatly, this task is being solved simple comparatively, by means of the test heating up to the temperatures 450 – 500 o C, which is being lead just to the pyrite and the siderite transformation into the magnetite. So, the soils magnetic susceptibility is sharply being increased, at the expense of these phase transformations. The increment quantity is being defined by the  $kt/k$  correlation, where  $k$  – is the initial magnetic susceptibility of the soil pattern, but  $kt$  – is its quantity just after the heating. Hence, the experiment scheme is being followed: the soil magnetic susceptibility measurement up to the following heating ( $k$ ) → the heating → the magnetic susceptibility measurement just after the heating ( $kt$ ) → the thermomagnetic coefficient (TMC) definition  $dk = kt/k$ . Thus, it has been empirically determined, that this ratio on the background lots and plots, having placed beyond the deposits UV influence zones, is not being exceeded the 1.1 – 1.5 values, and it seldom is being reached up to the 1.8 – 2 ones. The  $dk$  value is being varied from 3 up to 30 and even the more units over the UV active migration zones just from the oil and gas deposits, depending on the specific geological conditions. It has also been determined at the practical application, that many thermomagnetic and the gas anomalies are being formed the annular or the semi – annular structures over the efficient anticlinal raisings wings. So, the most thermomagnetic effect is being observed at the structure peripheral part, as if, having repeated the oil – and gas content and their drainage boundary presence.

The thermomagnetic minimum is being fixed directly over these deposits. Such annular character of the TMC anomalous values is being explained by the

intensive epigenetic mineral – formation just in the weakest zones, having had the UV migration ways.

The geoelectrochemical method of the oil and gas place – accumulations searching [5] is being based on the mobile forms laid on halos of the heavy metals microelements (such as: Mn, Ni, Cu, Ti and so on and so forth), having formed just in the rock under the migrating hydrocarbons from the deposit influence. The weakly fixed microelements release from the gross content practically is being carried out, at the expense of the geochemical process activization by the electrical current. It is quite possible sequentially to remove the microelements from the weakly fixed up to the syngenetic ones, having changed the current strength and its passing time through the rock samples. The laid on halos distribution study is being carried out by the samples, having selected in the soil by one and the same scheme, that it is being used at the thermomagnetic method realization.

So, the investigations results are being presented in the form of the microelements concentrations distribution schemes.  $C_{init.}$ , and their concentrations just after the current transmission –  $C_{cur.}$  All these values are being permitted to be defined the relative parameter  $U$ , having calculated by the following formula:

$$U = C_{cur.} / C_{init.}$$

The relative parameter, by its meaning, is being reflected the geochemical processes activization degree in the rock samples by the electrical current. In addition, the complex parameter ( $C_p$ ) is being calculated, as on the anode, well as on the cathode for the purpose of the geochemical processes activization degree recording.

$$C_p = U_{a\ av.} \cdot U_{c\ av.},$$

where  $U_{a\ av.}$  – is the average value of the relative parameter by all the elements on the anode part;  $U_{c\ av.}$  – one and the same on the cathode section. Only after this, distribution maps of these parameters are being made by the researched territory. The rocks epigenetic changes zones, having revealed by these maps, are able to be observed, as the inside part of the oil and gas – drainage boundary, well as the outside part of it, having formed the annular anomalies with the minimum just over the deposit. Thus, the similar anomalies distribution pattern is being revealed by all these methods, having included in the field complex.

And the other phenomena are also well – known, which are quite able to be used at the oil – and – gas content section forecasting, for example, the seismic and the electrical emission, the study of which is quite accessible for the seismo – and the electrical exploration and the further prospecting of the small deep and the shallow modifications. All this is being served the basis for these modifications field works

inclusion into the suggested complex.

The complex processing and the materials interpretation of the second stage with the GIS fund data and the other fiscal sources, the seismo – and the electrical exploration and the further prospecting utilization is being carried out at the third stage.

The mentioned similar oil – and – gas anomalies distribution pattern is practically being permitted to be presented the field stage final results in the form of the integrated cartographical document, having received by the directed summation of all the earlier made by the method – like maps, just after their preliminary normalization and, ipso facto, by the dimension removal. Thus, the above – stated document comparison and the further coordination with the having had fund seismo-electro-exploratory constructions is being given the possibility considerably to increase the hydrocarbon place-accumulation forecasting reliability.

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