THE HYDROCARBONS DEPOSITS PROGNOSTIFICATION ON THE BASIS OF THEGEOPHYSICAL AND GEOCHEMICAL METHODS COMPLEXIFICATION

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The oil and gas deposits direct searches idea with the high – precision devices and the technologies advent has already been real, and it has been focused and concentrated upon the predictive estimate reliability increase tasks of the oil and gas potential, having revealed and having prepared «structures» for the drilling. The presented integrated oil – and – gas presence prognostification field methodology and the diverse and the scalene geophysical and the geochemical data complex interpretation single technology have already been created for the oil – and – gas deposits direct prognostification reliability increasing, and they are included the light geophysical and the geochemical methods of the gravel – and the geomagnetic, the gas – solid, and the thermomagnetic surveys, and also the geoelectochemical probings into the developed rational complex. The fund geological and the geophysical materials, including the seismic – and the electro – prospecting works are being enlisted and involved at the observations results interpretation stage. The oil – and – gas anomalies space distribution regularities on the basis of the one – method maps are being permitted to present the final results in the form of the single cartographical document.

The challenge on the prognostification validity has been come to the foreground at the oil and gas deposits prognostification task solution, by the geophysical methods, when the low amplitude anomalies are being analyzed, which are quite comparable with the observations errors. The fact of the matter is, that even the most «direct» geophysical indices of the section oil – and – gas presence, such as the pressure waves propagation velocity decrease, the seismic energy absorption increase decrement and the specific electrical resistance and the other aspects, are the indirect ones, that is, they are being needed in the geological interpretation, the transformation just in the proper geological indicators, which having had the type of the hydrocarbon saturation coefficients, the porosity ones and the rest ones. This, in its turn, is being resulted in the necessity to solve the inconsistent reverse Geophysics's tasks, and, somehow, to overcome the non – uniqueness challenges and also their solution instability. They usually resort to the methods complexification for the purpose of such overcoming. But even the complex maximum enlargement, at the expense of all the presenting geophysical methods using in the disposal, does not delete the item on the geological interpretations variability of the indirect geophysical anomalies. Therefore, only the methods inclusion in the complex, having permitted to receive the direct information on the oil – and – gas content (e.g. as the formational, and well as the fluidal ones), that is the geochemical and the boundary methods, having combined the indirect geophysical and the direct geochemical indices, is being permitted to be hoped for this item cardinal solution. All these diverse methods combination is quite able to be achieved and the necessary expenses minimization degree for the works production, if such «difficult» and the cost – based geophysical investigations methods to be excluded from the field stage, as the seismo – and the electrical exploration and to be replaced them by the efficient and the inexpensive non – deep and the shallow modifications. At the same time, the seismo – and the electrical and the exploration data are quite able to be claimed just from the fund sources at the materials processing and the interpretation stage. The gravel and magnetic surveys results of the last years are also quite able to be claimed just from the fund sources, which are necessary for the preliminary territory division into the districts by the geophysical fields' peculiarities and also the works results by the oil – and – gas presence regional prognostification. All these materi-

als are the basis for the tectonic and the geological – gas – oil areas division into the districts. Thus, the suggested approach to the task solution of the oil and gas deposits direct prognostification is, now, being structured, as the three – stepped one.

At the first stage, the investigations territories division into the districts is being carried out by the geophysical fields' peculiarities with the following parcellation, which are the most perspective for the field works arrangement by the inexpensive cost – based geophysical, the geochemical and the boundary methods. So, it is quite impossible to achieve the reliable particular tasks solution, having connected with the separate objects without such division into the districts that is at the integral presentation absence on the geophysical fields' distribution regularities and on the studied territory section structure (e.g. of the sedimentary basin, of the perspective – gas – oil region and the rest). All this work, as a whole, is being based on the fund materials usage. Such division into the districts technology the main elements have already been developed by the authors, and they have been covered in the number of the publications [1, 2].

At the second stage, the field observations are being carried out on the singled out and the most perspective parcels. The gravel – and the geomagnetic survey, the geoelectrochemistry, the gaso-geochemistry, the thermo-magnetometry methods are being included into the field complex. So, the above – mentioned and the listed methods are being realized, in the most part, in the authors' technologies [3,4].

The gas survey method is being consisted in the composition study and the hydrocarbon gases distribution on the studied area. All the gas survey varieties are being based on the maximum hydrocarbons micro-concentrations definition: the methane, the ethane, the propane, the butane, the pentane, the hexane, having contained just in the rocks and in the underground waters. It has been suggested to use the oil – and gas structures

exposure thermomagnetic method exposure in the combination with the gas survey [3].

The last one is based on the fine – dispersed authigenic minerals definition (e.g. the pyrite, and the siderite), the concentration and the grains dimensions of which are quite insufficient for their definition, by means of the optical or the X – ray photography and structural methods. Mediately, this task is comparatively and simply being solved, by means of the test heating up to the temperatures range, which is equal to $450 – 500^{\circ}$ C, and it is being directed to the pyrite and the siderite transformation just into the magnetite. Thus, the soils magnetic susceptibility is sharply being increased, at the expense of all these phase transformations that is easily being fixed by the every serial magnetic susceptibility measuring instrument.

The increase size is being defined by the χ_t/χ correlation, where χ – is the soil sample initial magnetic susceptibility, and χ_t – is its quantity after the heating. Hence, the experiment scheme is being followed: the soil magnetic susceptibility measurement up to its heating (χ) $\rightarrow$ the heating $\rightarrow$ the magnetic susceptibility measurement after its heating (χ_t) $\rightarrow$ the thermomagnetic coefficient (TMC) definition $d\chi = \chi_t/\chi$.

Empirically, it has been determined, that this correlation on the background parcels, having located out of the deposits UV influence zones, is not being exceeded the range of the 1.1 – 1.5 values, and it is seldom being reached the range of the 1.8 – 2. The DK is being varied in the range from 3 up to 30 and more units over the UV active migration zones from the oil and the gas deposits, depending on from the specific geological conditions.

It has been also determined at the practical application, that many thermomagnetic and the gas anomalies are being formed the annular or the semi – annular structures over the wings of the productive and the efficient anticline highs. So, the largest thermomagnetic effect is being observed at the structure peripheral part, as if, having repeated the oil – and – gas presence contours. The thermo-

magnetic minimum is being fixed directly over the deposits. So, such the thermomagnetic coefficient (TMC) anomalous values annular character is being explained by the intensive epigenetic mineral – formation in the most weaken zones, having been the UV migration ways.

The oil and gas accumulations place search geoelectrochemical method has been based on the overlaid in haloes exposure of the heavy metals microelements of the mobile forms (such as, Mn, Ni,Cu,Ti and so on and so forth), having formed in the rock under the migrating from the hydrocarbons deposits influence [4].

The weakly – fixed microelements exposure from the gross content is being carried out, at the expense of the geochemical process activization by the electrical current. So, it is being succeeded in sequentially to be extracted the microelements from the weakly – fixed ones up to the syngeneitical ones, having changed the current intensity and the passing its time through the mountain rocks patterns.

For all this, the overlaid in haloes distribution examination is quite able to be carried out by the patterns, having selected in the soil by the same scheme, that is being used at the thermomagnetic method realization.

Thus, the investigations results are being presented in the form of the C_{out} microelements initial concentrations distribution schemes, and also their concentrations after the current passing – the Flowing. All these quantities are being permitted to be defined the U relative parameter, having calculated by the U = Flowing/C_{out} formula and having reflected the geochemical processes activization degree in the mountain rocks patterns by the electrical current, and also, so called, the complex parameter:

$$C_p = Ua_{mean} \cdot Uk_{mean},$$

where Ua_{mean} – is the relative parameter mean value by all the elements at the anode parcel; $Uк_{mean}$ – is the same at the cathode parcel. Only after this, all these parameters distribu-

tion maps by the investigated territory are being made up. The rocks epigenetic changes zones, having revealed by these maps, are quite able to be observed, as inside the oil – and – gas presence contour, well as outside of it, having formed the annular anomalies with the minimum over the deposit.

As it is also known, that the annular anomaly with its minimum in the center is the most universal geophysical oil – and – gas content indication in the gravitational and the magnetic fields, sufficient reliably having worked in the various situations [5]. Such conclusion has already been confirmed by the multileveled modeling results and also the by the numerous experimental data [6].

Thus, the similar anomalies distribution drawing, having diagnosed the deposit, has been discovered, by all the above – mentioned methods, having included into the field complex. The noted the similar oil – and – gas anomalies distribution drawing is being permitted to be presented the field stage results in the form of the single cartographical document, having received by the directed all the earlier made up one – methoded maps summing up after their preliminary normalization and, ipso facto, the dimension removal.

The large role from the point of view of the hydrocarbons deposits new diagnostic indications determination, the endogeneous micro – seismic waves, for the designation of which the «nano – earthquake» term has been suggested, are quite able to be played the passing through the deposit and the registering on the day time surface ones [7].

In general case, such micro – seismic waves have to be formed under the well – known phenomena and the processes influence: the reflections, the refractions, the dispersions, the diffractions, the polarizations and the others. Therefore, after the dissimilar geological medium passing, the wind noise and the ground unrest, having registered on the surface, are being borne the information on the physical and the geometrical section dissimilarities, in particular on the oil and the gas deposits. So, this circumstance is being

confirmed by the observations factual data on a number of the hydrocarbonic raw material deposits [8].

And the other phenomena are also well – known, which are able to be used at the section oil – and – gas presence prognostification, for example, the seismic and the electrical emission, the examination of which is being quite accessible by the small – deep and the shallow modifications of the seismo – and the electrical exploration and the prospecting. All this is being served the basis for these modifications field works inclusion into this suggested complex.

At the third stage, the comparison and the above – mentioned cartographical document coordination and the small – deep and the shallow seismo – electrical – exploratory investigation results is being carried out with the having fund geological and geophysical constructions, that is being given the possibility considerably to increase the hydrocarbonic accumulation places prognostification validity. Thus, the final stage of all the received materials complex interpretation is the coordinated physical and the geological models construction (e.g. PHGM) in the two – and the three – dimensional space.

The complexification considered model innovation potential is being defined by the large – scale diverse and the scalene information coverage, its receiving and the processing methods, having constructed in the single technological scheme. This is permitted maximum to narrow the freedom degrees number at the only correct solution choice from the great number of the equal rights in the mathematical relation, with what the geophysicists are constantly coming across at the inverse task solution. The conjugation in the framework of the oil and gas deposits prognostification indirect (e.g. geophysical) and direct (e.g. geochemical) meth-

ods single complex is also the innovative aspect, in essence. And at last, the suggested complex, in the full, is being met the rationality requirements, as far as the most efficient and the economical methods are usually being used at the most cost – based works field stage.

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