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POLYFACTICITY OF THE PROBLEMS NON-PRODUCTIVITY OF PHANEROZOIC OF THE DNIEPER-DONETS DEPRESSION

The paper presents the results of new trend in geological studies - complex analysis of non-productive Phanerozoic cross-sections problems, discovered by drilling in the Dnieper-Donets Basin. The research was based on the analysis of non-productive oil and gas cross-section complexes, reasons and factors, that caused polyfaktorial problems of lacking commercial hydrocarbon inflows in Phanerozoic cross-sections.
Key words: substantiation of exploration works, resources, well, search, exploration, deposit, unproductive wells, stocks growth.

Inroduction. Improving the process of exploration is important at any stage of studing oil and gas regions, especially in those with complicated stucture such as the Dnieper-Donets basin. Geological exploring the sites is complicated, which makes hydrocarbon exploration and prospecting hydrocarbon deposits difficult [Вакарчук, 1967; Дем'яненко та ін., 2009; Дем'яненко, 2001; Дем'яненко, Клочко, 1991; Демьяненко, 1989; Чебаненко та ін., 2007; Головацкий и др., 1993; Євдощук та ін.., 2001].

In the Dnieper-Donets basin hydrocarbon reservoirs were found and are developed in traps of Jurassic sediments to foundation Archean-Proterozoic formations. Hydrocarbons are located in different types of traps, mainly coincided with deformed brachyanticline and hemianticline. Multilayer fields with different stratigraphic and hypsometric ranges predominate [Дем'яненко, 2001]. Analysis of geological exploration [Дем'яненко, 2004] shows that exploring and prospecting, performed on the sites are not the same effective and timetaking. That caused the necessary investigations of the factors causing negative results of hydrocarbon prospecting and for determining the main criteria of exploring oil and gas reservoirs on region sites.

Methods of investigations. Practical importance of geological criteria on the fields is not the same. It should be noted that the main criterion - discovering commercially productive hydrocarbons, that indicates the beginning of prospecting stage, is achieved not only at the exploration phase (Lypovodolynske, Pivdennopanasivske, Vyshnivske, Pivdennohrakivske fields etc.) and as practical work shows, also during drilling of parametric wells at the stage of regional studies (Voloshkivske, Ostroverhivske, Krasnozayarske fields etc.). In these fields, in some cases it is reasonable to begin exploration stage because of the deep oil and gas sites, small-sized reservoirs and signs of oil and gas determined by parametric drilling. This allows to reduce boring works and to investigate, estimate and prepare pools for developing by exploring wells and make geological exploration process shorter. This will allow to reduce test drilling works and to investigate, estimate and prepare pools for developing by prospecting boreholes and make geological exploration process shorter.

It is known that the methods of exploration, determining the types and the number of works depend on the geological field structure and exploration model. We considered the structural schemes on the investigation sites that made the basis for the placing prospect and exploration wells. The analysis of exploring new fields for many years shows that change of the exploration site structure conceptions caused the necessity of updating exploration process, the types and the number of planned works.

Thus, drilling the well № 11 was proposed [Демьяненко и др.., 1980] in order to open a new reservoir in the horizon B-20 using the improved model that takes into account new drilling and electric prospecting materials on Schurivske field. Generalizating the materials and clarifying the structure of Voloshkivske field by drilling parametric productive well № 314, discovering the field, allowed to determine the further works on the grounds of concrete primary and secondary wells.

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Such transformation of geological structure can also be found on the other hydrocarbon exploration sites. Especially it should be noted that most of fields have productive horizons with complicated structure. Pinching out of collector layers, lithological substitution of sandstones with various tight rocks, the presence of different downthrown faults make oil and gas exploration complicated.

The oil, gas and condensate reservoirs, that have been found in the new fields traps, have complicated structure, different parameters, geological characteristics, stratigraphic position and great depths. Discovering the small-sized pools with small hydrocarbons reserves predominates.

Therefore, the problem of the factors and reasons that caused nonproductive wells cross-sections on the sites of productive Phanerozoic complexes in the Dnieper-Donets basin, is important and needs complex analysis of the geological and geophysical materials, project and actual wells data. The results of these investigations help to determine each well effect on hydrocarbon exploration on the concrete site and enable to correct the geological exploration works, determine the methods effectiveness for prediction of oil and gas presence, and improve exploration methodology.

The main material. Factors and causes of nonproductive deep wells are determined by analyzing the results of exploration in the western sub-region that is the territory [Дем'яненко, 2009] of northwest and central parts of the Dnieper-Donets Basin. In the subregion exploration works were investigated on the fields, that are mainly coincided with deformed hemibrachyanticlines. Among them there are monoclinal slopes (Zimnitske, Karpylivske, Chervonozavodske, Svystunkivske, Pivnichnoyablunivske), structural noses (Mekhedivske, Holotovschynske) semi-brachyanticlines (Svyrydivske, Selyuhivske) and terrace (Chervonolutske). A number of fields (Volodymyrivske, Rudivske, Skorobahatkivske, Lutsenkivske) are located in brachyanticlines. Most of these structures types are complicated with productive sediments disturbances. The hydrocarbon pools are located in hemianticline and anticline traps and they are lithologically and tectonically screened. The Visean complex is the main productive one. On Skorobahatkivske field hydrocarbons have also been found in the mid-carboniferous traps, and on Rudivske and Svyrydivske fields, those of turnei sediments. Four fields (Volodymyrivske, Zimnitske, Karpylivske, Pivnichnoyablunivske) are single-layer fields and the rest are multilayer ones.

The first reason of nonproductiveness is the lack of collector rocks with the necessary filtration and capacitive properties that were predicted in the perspective cross-section part wich resulted in seven wells abandones (41%). This happened because of lithological substitution of permeable rocks by clay rocks, pinching-out or compecting collector rocks.

The second reason is that structural imaging was not confirmed by drilling, therefore sediments were drilled in the areas of water saturation or compaction productive horizons, wich did not provide the optimal conditions for hydrocarbon traps. That is why, six wells (35%) were abandoned. In particular, in Zimnitska area the prospect well did not find gas-saturated layers in horizon B-21, that was the perspective one according to analogy with Voloshkivske field.

The third reason is lack of confirmation as for perspective traps prediction. As a result, four wells were abandoned (24%). Zimnitska prospect well 2 found no hydrocarbons in non-anticlinal traps of horizon B-22, Karpylivska № 1 did not find any in anticlinal traps of horizon B-20 and B-21.

The latter indicates that these polifactorial reasons of nonproductive wells mostly concern searching fields and less their exploring: among seventeen liquidated wells there are twelve (71%) searching wells that did not found hydrocarbons, and five (29%) exploration wells, that were beyond the oil and gas area of exloring pools.

The main polifactorial problems affecting Phanerozoic sections productivity are the following:

1. Transformation of structural imaging during prospecting and estimating oil and gas fields.

Two uplifts complicated by three disturbances were idenified (by means of reflection horizon Vв3) during prospecting works in Sophia Square. Futher prospect and exploration

stages allowed to find six multidirectional disturbances in the Lower Carboniferous sediments that caused the presence of tectonic blocks, where the North and West Sofiyivske elevations and Sophia hemianticline are located. Changing ideas as for the number of objects led to failure of some wells that were used for determining structural and geological features of the area and its structural elements.

2. Low probability to confirm geological models of prospect and exploration sites with anticlinal structure.

Many oil and gas bearing structures, identified in the drilled Phanerozoic cross-section of the Dnieper-Donets basin, have anticlinal structure.

Though the fund of anticlinal structures in the region is considerably developed, they remain to some extent the exploration objects, and over 30 oil-and-gas promising cross formations with different structure are predicted in lower visean-tournai productive complex [Дем'яненко, 1986].

Through productive brachyanticline structures in many cases keep their closure in Mesozoic shallow sediments, and some of them are also indicated in Cenozoicas counter mapping as small uplifts.

Most through anticlinal structures are deeply drilled on the basis of seismic structural constructions. Reservoir delineation is mostly associated with arch and tectonically screened traps in different stratigraphic complexes, among those lower Permian, mid- and lower Carboniferous sediments and Devonian rocks that were considered as oil-and-gas perspective. Vast stratigraphic interval of oil-and-gas perspective rocks, sometimes inadequate preparing structures for prospect drilling and its technical facilities often did not allow to solve the project problems completely and in some areas they were stopped prematurely. Re-drilling was substantiated by updated structural constructions and specifying the prospect sites.

3. The model grounds of perspective productive sites with hemianticline structure.

The results of current oil and gas exploration in the Dnieper-Donets Basin show that a lot of new fields are related to hemianticlines.

In the study region hemianticlines iclude semi-brachyanticlines i.e. not closed brachyanticlines, monoclinal slopes, terraces, blocks and structural noses, which in most cases are deformed by downthrown faults. Placing prospect wells on Phanerozoic hemianticlines are based on the seismic horizons maps that show the structure of investigating complex. Exploration works are performed using the updated structural maps of reflecting horizons and similar productive horizons maps that were made on the basis of drilling and seismic data. The complicated hemianticline structure often makes hydrocarbon exploration difficult. Increasing exploration efficiency depends on reservoirs prediction and prospecting on hemiamticlinal and non-anticlinal sites with various types of traps, in general improving exploration methodology and timely specifying the models and the works progress on each site.

Productive areas distribution mainly depends on lithological factor in the upper Visean and the Serpukhovian sediments interval in a number of fields with hemianticlinal structure. The fact that hydrocarbons accumulation dependence on lithologic factor stresses the necessity of similar conditions predicting throughout the Dnieper-Donets basin territory. The possibilities of reservoir delineation in conditions of stratigraphic cutting lower Permian-upper Carboniferous rocks by lower Triassic (upper Permian) rocks are estimated to be low. The presence of exclusively massive-layered hydrocarbon accumulatios in the complex structures makes the lower screen presence doubtful in stratigraphic trap. Regional hydrocarbon saturation of these rocks in the Dnieper-Donets basin, the importance of lithological substitution factor in oil and gas bearing capacity on the structures, the explored fields in lithological traps and the presence of areas with entire clay cross-section indicate high probability of lithologic reservoirs formation in Serpukhovian sediment traps.

Paleogeologic profiles (before Bashkir time) [Абражевич и др.., 1983] show that the maximum Serpukhovian collectors thicknesses were accumulated on the consediment structures flanks and local paleo-depressions slopes in conditions of their large reduction (until total pinching out) in arches and paleo-depressions peripheral areas. Within the structural lines

the higher-grade collectors develop as zones of mainly transversal extension with respect to structure longitudinal axis.

Making the paleogeologic profiles using the fund materials of previously drilled wells allows to determine the possible pinching out areas of collectors, where the areas of lithological reservoirs prospecting (possibly lithologically- and tectonically screened) should be traps associated with hemianticlines: structural noses, terraces, slopes, blocks, faults etc.

Conclusions. Solving the problem of nonproductive well cross-sections, implementing the proposals for the sites, reaching the project depths in wells and opening the project horizons and also better indicating perspective intervals by interpreting geophysical surveys and their confirming by formation testing will reduce the number of nonproductive well cross-sections, discover new hydrocarbon reservoirs and increase exploring efficiency in Phanerozoic oil and gas complexes of the Dnieper-Donets basin.

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ПОЛІФАКТОРНІСТЬ ПРОБЛЕМ НЕПРОДУКТИВНОСТІ ФАНЕРОЗОЮ ДНІПРОВСЬКО-ДОНЕЦЬКОЇ ЗАПАДИНИ

Викладені результати нового напряму геологічних досліджень – комплексного аналізу проблем непродуктивних розрізів фанерозою, розкритих бурінням у Дніпровсько-Донецькій западині. В основі досліджень лежать результати аналізу непродуктивних розрізів нафтогазоносних комплексів. Виявлені причини і фактори, що обумовили поліфакторність проблем відсутності промислових припливів вуглеводнів у розрізах фанерозою.

Ключові слова: обґрунтування напрямів геологорозвідувальних робіт, ресурси, свердловина, пошук, розвідка, поклад, непродуктивність свердловин, приріст запасів.

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ПОЛИФАКТОРНОСТЬ ПРОБЛЕМ НЕПРОДУКТИВНОСТИ ФАНЕРОЗОЯ ДНЕПРОВСКО-ДОНЕЦКОЙ ВПАДИНЫ

Изложены результаты нового направления геологических исследований — комплексного анализа проблем непродуктивных разрезов фанерозоя, раскрытых бурением в Днепровско-Донецкой впадине. В основе исследований лежат результаты анализа непродуктивных разрезов нефтегазоносных комплексов. Выявлены причины и факторы, обусловившие полифакторность проблем отсутствия промышленных притоков углеводородов в разрезах фанерозоя.

Ключевые слова: обоснование направлений геологоразведочных работ, ресурсы, скважина, поиск, разведка, залежь, непродуктивность скважин, прирост запасов.

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