Innovative interaction between oil and gas enterprises and financial institutions on the financial services market

The introduction of innovations anticipates the formation of a systemic strategy and tactics and permanent response to the volatility of the market in the long- and the short-terms. This factor creates the conditions for comprehensive analysis and consistency in approaches to innovations, which touch the interaction between financial institutions and oil and gas sector on the financial services market at present.

In the article the theoretical aspects of the interaction between financial institutions and enterprises of the oil and gas sector on the financial services market in the transformation process of long-term investment resources in the production capital are investigated. The author’s own vision of the science categories as "innovative cooperation", "cluster" and "cluster capital" is presented. The necessity of financial-industrial cluster formation for the integration of financial capital, reduction of transaction costs in the process of innovative interaction between oil and gas sector and financial institutions on the financial services market is explained.

The article proves that clustering develops the processes of the transformation of the traditional cooperation in the innovative economic activities by methods that maximize revenues due to penetration of their capitals on the different levels, in various forms and spheres of the financial and economic activities. For the oil and gas sector the effective mechanism of innovative interaction between entities will provide the raise of the competitiveness of products on the domestic and foreign markets, help expand it’s exports, implementation of the advanced innovative technologies, creation and development of new industries, modernization of fixed assets and increase jobs.

Key words: innovation, innovative cooperation, cluster, cluster capital, oil and gas sector, the financial services market, the financial institution
Geological oil and gas zoning of Pre-Carpathian Foredeep

Present article deals with the history of research of the geological structure and zoning of the pre-Carpathian foredeep by the different authors since 1949 and until the present time. The underlying concept of the article is the plate tectonics theory on the sedimentation and formation of flysch beds and the influence of erosion processes in the geological development and the zoning of molasses beds. Based on the research studied, it is proposed to distinguish the autochthonous foredeep base and the thrusted deposit block, allochton within the pre-Carpathian foredeep.

In the foredeep platform base the northeastern and the depressed northwestern parts are differentiated. Within the northwestern part to the southeast of the foredeep a Lopushniansk subzone is also distinguished. It is suggested that the autochthonous flysch deposits exist to the southwest of the pre-Carpathian foredeep toward the Uzhgorod foredeep approximately up to the mountain pass part of the Carpathians. It is further recommended to discriminate a zone of the thrusted molasses and a zone of thrusted flysch and molasses structures within a thrusted rock complex extending from northeast to southwest.

To the southwest from these zones lie the known allochtonous areas of Carpathian flysch (Skybova, Krosnenska etc.). Due to the research undertaken, it is suggested that in the present time hydrocarbon exploration is more effective and economically efficient on the little depths in the autochthonous molasses zone that wedges out on top of the platform to the northeast and in the Mesozoic eorsional buttes of the zone.

Key words: Pre-Carpathian foredeep, oil and gas geological zoning, autochton, allochton, flysch and molasse deposits, the perspectives of oil- and gas- potential bearing.
The article investigates the potential of oil and gas in West Ukraine oil and gas region. It shows the oil and gas potential prospects of Neogene and Mesozoic sediments Outer zone, and flysch rocks Inner zone of the Precarpathian foredeep. Author determined the prospects of oil and gas potential in Folded Carpathians and gas content in Transcarpathian foredeep and Volyno-Podilska plate.

Main prospects of opening new objects in the Outer zone are associated with multiple fundament elevations. Due to our research the largest number of uplifts can be found in the north-western and central part. In particular, 19 such uplift is set within the submerged part of the Outer Zone. Priorities have advanced folds lying shallow and bent wings of structures already open in the Inner zone. In the Folded Carpathians are great prospects opening of gas accumulations in the Krosno zone and unconventional gas in compacted Cretaceous sediments. We estimate the resources of such clusters only within Dolyna oilfield area are about 100 billion m3. The most promising deposits in the Transcarpathian basin are Miocene within folds in the central zone where the undiscovered resources are estimated at over 70 billion m3.

Highlight the basic problems of oil and gas production in the region and proposed solutions for it determining.

Key words: oil, gas, prospects, production.

S. Vakarchuk

Evaluation of petroleum potential in consolidated rocks of Devonian sequence of Dnipro-Donets depression

The paper features results of prospecting potential assessment for the Devonian tight carbonate and arenaceous sedimentary rocks in the Dnieper-Donets basin. 460 analyses of rock pertrophysical properties, 156 analyses for rock thermal maturity, 96 of TOC measurements, 76 XRD analyses and 640 thin sections and cores descriptions from 250 deep wells have been for this study. According to this research it was recognized six main stratigraphic levels of tight unconventional hydrocarbon reservoirs development, namely tight arenaceous reservoir rocks: of Givetian stage (Starooskolsky horizon), lower part of the Lower Frasnian sub-stage (Pashiysky and
Timansky horizons), upper part of the Lower Famennian sub-stage (Yeletsky horizons sediments) and upper part of Famennian stage; tight carbonate reservoir rocks: upper part of the Lower Frasnian sub-stage (Sargaevsky and Semiluksky horizons) and lower part of the Lower Famennian sub-stage (Zadonsky horizon). Eight prospect areas favorable for unconventional hydrocarbons have been recognized in this study. Upon the assessment made the geological resources of unconventional gas in the Devonian tight calcareous and arenaceous reservoir rocks in the DDB are totaled to 1332 BCm (recoverable ones are as much as 467 BCm). The geological resources of unconventional oil are totaled to 1409 MMt (and 106 MMt to recoverable ones). The Grybova Rudnya-Sedniv lead is the most promising area to search for unconventional oil, and the Zachepylivka-Kremenivka lead is the top prospecting area for unconventional gas.

Key words: Devonian sequence, tight reservoirs, unconventional hydrocarbons, prospect areas, resource assessment.

V. Lebid

On favourable preconditions of petroleum potential of the basis-and-genesis complex in Dnipro-Donets sliding. Predictable mechanism of petroleum accumulation and immersion of the basal complex

The necessity of selection in the Dnieper-Donets sliding basisgenesis new oil and gas complex, which consists of a lower (superficial incision Precambrian basement) and upper (Precambrian weathering crust, roofing layers of sedimentary rock) sub. Considered a predictable mechanism for its diving and accumulation of oil and gas. It is shown that immersion mechanism is closely related to the terms basis genesis complex. It is shown that the lower and upper traps under paragenetic complexes linked.

Key words: basis genesis oil and gas complex, unconventional traps, slopes performances crystalline basement.

Ya. Pylyp, M. Bahniuk, M. Nesterenko, O. Dmyshko, L. Kozak

Research of gas permeability of rocks in various gas filtration regimes
A series of experiments to measure the permeability of porous samples of low
terrigenous rocks to steady gas filtration at different extremes and medium pressures. Based on the results established that to determine the permeability linearly filtering the gas do not enter an amendment to slip its molecules. In a wide range of pressures recorded the existence of laminar and turbulent gas filtration with clear traceability between them for mutual sandstone with absolute gas permeability $1.54 \cdot 10^{-15} \text{ m}^2$. Experimentally proved absence of turbulent gas filtration for absolute gas permeability siltstone with less than $0.1 \cdot 10^{-15} \text{ m}^2$ and its priority habitat for species of these settings over $10 \cdot 10^{-15} \text{ m}^2$. The values of permeability must be considered beyond the transition from laminar to turbulent filtration.

Key words: rock formation, porosity, gas permeability, gas filtration, medium pressure, the effect of Klinkenberh, Darcy law, the laminar mode, the turbulent mode.

WELL DRILLING

M. Myslyuk, R. Dolyk

Selection of stabilised bottom-hole assemblies for well drilling

The model for selection of the stabilized bottom-hole assemblies (BHA) with the account of the information uncertainty concerning the contact of the centralizing and supporting elements (CSE) and some other factors (zenith angle, drilling parameters, availability of local caverns) is suggested

$$
\begin{align*}
R(p^v, a^v) \rightarrow \min, v \in \Theta, p^v \in D^v; \\
\varphi(p^v) \leq 0,
\end{align*}
$$

where $R(p^v, a^v)$ – risk of the $v$– BHA from the class of alternatives $\Theta; p^v=(p_1^v, p_2^v, K, p_n^v)^\top$ – vector of variables parameters of the $v$–BHA with the domain of definition $D^v; a^v=(a_1^v, a_2^v, K, a_n^v)^\top$ – vector of the known parameters; $\varphi(p^v)$ – limitation system for the BHA parameters.

Class $\Theta$ of the alternative BHA variants is formed based on structural features, sizes and placement of their elements. System $\varphi(p^v)$ determines the limitation for the drilling parameters, geometrical parameters and stiffness of the BHA elements, their
static and dynamic characteristics. The risk function $R(p^*, a^*)$ defines the probability of violation of the problem solution conditions for BHA characteristics due to the inadequate information of the decision making model.

Stabilized BHA for drilling vertical and inclined well sections of Melekhivka gas-condensate field are substantiated based on the field data analysis with the help of the suggested model. Their static and dynamic (when drilling with the help of the three-cone and PDC bits) characteristics are shown in comparison with the BHAs that were used during well drilling. The risks were evaluated with the help of the statistical modeling when solving the problem of the BHA selection.

Key words: dynamic characteristics, multi-supported BHA, information uncertainty, inclined well, risks, constraint system, static characteristics.

I. Voievidko, I. Chudyk

Analysis of stress state of drill collars when drilling a lateral hole in a well’s casing string

The analysis of the early stage of the lateral hole of well has been done. It has been proved that on the first stage of lateral hole drilling the form of drilling string lower parties close to arc, the radiuses of which arc between 17.5 and 92 m. The recommendations regarding the applying of drill collars of defined stamp and strength groups.

Key words: hole, casing string, diverter, well bore, grade of steel, production string.

P. Ohorodnikov, V. Svitlytskyi, O. Ivankiv, A. Poliovyi

Drill string modelling in borehole drilling where deviation of the hole path is possible

Consider the drill string vibrations with linear axis AC or the length of sectional curvature in terms of its trajectory. It is shown that the amplitude of the bending vibrations amplified by centrifugal force while rotating column (rotary drilling).
Key words: modeling, the drillstem, wellboring, borehole, deviation of the hole path.

OIL AND GAS EXTRACTION

V. Nahornyi, I. Denysiuk

Research of stress intensity factors in tensile cracks under pulse-and-wave loads on petroleum formations

The cracks of normal rupture with strained state in their tops characterized by intensity coefficient $K_1$ have been considered in the paper. Two kinds of loading on the cracks have been considered – impulse and harmonic ones. Analytic representations have been obtained for $K_1$ coefficients and their investigation has been conducted. Examples of loadings interactions with a crack situated in sandstone have been considered. It has been found that in case of impulse action ($\dot{\Omega}=0,1$ s) $K_1$ coefficient firstly increases up to its maximal value at $t=0,1$ s and decreases later up to its static value $K_1=1$ at $t=9,0$ s. In case of harmonic wave action $\sigma(t)=\sigma_0 \cos \omega t$ upon the crack $K_1$ coefficient has an oscillatory character. Graphic dependences of $K_1(\omega)$ coefficient have been given for duration of loadings $t_1=3,93 \cdot 10^{-5}$ and $t_1=3,93 \cdot 10^{-3}$ s. It has been found that $K_1(\omega)$ coefficient in case of $t_1$ has an exponentially decaying character and exceeds static value within the range of frequencies $\omega=(10...1500)$ Hz. For $t_2$ $K_1(\omega)$ coefficient has an oscillatory character and exceeds static value within the range $\omega=(750...1200)$ Hz and $\omega=(1650...1750)$ Hz, and with further increase of frequency attenuates gradually.

Therefore, as a result of theoretical studies conducted tension intensities coefficients $\hat{E}_1$ around the crack of normal rupture have been found for different regimes of its impulse-wave loading. When we know $\hat{E}_1$ coefficients, we can determine the strain field within the rock around the top of the crack. It is known that there is a relation between the intensity of energy release by the crack and the strain field near its top. The results obtained might be used for elaboration of new impulse-
wave methods of oil-gas layers processing based on the release of internal energy by structural elements of layers geo-medium.

Key words: impulse, intensity coefficient, stress, layer, crack, frequency.