Цель. Предварительная оценка ресурсов метана угольных пластов. Обоснование актуальности развития топливно-энергетического комплекса Республики Казахстан на основе изучения и использования нетрадиционных источников энергетического сырья, среди которых одним из важнейших является метан угольных пластов.

Методика. Методической основой был сбор, анализ и обобщение результатовмирового опыта промышленной добычи метана угольных пластов с определением характеристик коллекторов метана угольных пластов в сравнении с традиционным газом и геолого-технологических параметров перспективности метаноугольных месторождений для промысшленной добычи метана.

Результаты. Представлен анализ мировой и отечественной литературы по вопросам опыта разработки метана угольных пластов. Рассмотрены вопросы технологии извлечения метана, оценки ресурсной базы угольных месторождений Республики Казахстан. Обоснована целесообразность промышленного извлечения метана в Карагандинском бассейне. Проведен сравнительный анализ и сопоставление геологических параметров угольных месторождений Республики Казахстан и друзих стран, где успешно реализуются проекты добычи метана угольных пластов.

Научная новизна. Заключается в следующем:

- установлены различия в условиях нахождения и перемещения природных газов в традиционных поровых и трещинных коллекторах и метана в угольных пластах, предопределяющие различия технологий разведки и разработки традиционных газовых и метаноугольных месторождений;
- определены особенности и критерии промышленной значимости ресурсов метана угольных пластов для промысловой добычи;
- обоснованы объективные условия перспективности развития технологий и добычи метана из угольных пластов в Карагандинском бассейне.

Практическая значимость. Заключается в создании в Республике Казахстан новой газодобывающей отрасли, основанной на комплексном освоении газоносных угольных месторождений, для решения целого ряда социальных, энергетических и экологических проблем Центрального Казахстана.

Ключевые слова: *метан, угольный пласт, дегазация, перспективы добычи, промышленное использование, метанобезопасность, газоотдача*

Рекомедовано до публікації докт. техн. наук Т. К. Ісабеком. Дата надходження рукопису 27.09.15.

UDC 553.981.2:551.735(477.5)

Y. M. Zelenko,
O. V. Dziuba,
O. M. Karpenko, Dr. Sc. (Geol.), Prof.

Taras Shevchenko National University of Kyiv, Educational-scientific institute "Institute of Geology", Kyiv, Ukraine, e-mail: zelenko.yuri@gmail.com; geoinformatic@ukr.net; alexbrig@inbox.ru

ASSESSING THE PROSPECTS OF CARBONIFEROUS ROCKS OF THE SOUTHEASTERN PART OF THE DNIEPER-DONETS BASIN ON GAS DEPOSITS OF UNCONVENTIONAL TYPE

Ю. М. Зеленко,
О. В. Дзюба,
О. М. Карпенко, д-р геол. наук, проф.

Київський національний університет імені Тараса Шевченка, навчально-науковий інститут „Інститут геології", м. Київ, Україна, e-mail: zelenko.yuri@gmail.com; geoinformatic@ukr.net; alexbrig@inbox.ru

ОЦІНКА ПЕРСПЕКТИВНОСТІ КАМ'ЯНОВУГІЛЬНИХ ТОВЩ ПІВДЕННО-СХІДНОЇ ЧАСТИНИ ДНІПРОВСЬКО-ДОНЕЦЬКОЇ ЗАПАДИНИ НА ПОКЛАДИ ГАЗУ НЕТРАДИЦІЙНОГО ТИПУ

Purpose. The study of the thermal maturity of organic matter-rich coal strata of a transition zone between the Dnieper-Donets depression and Donetsk folded structure to assess their gas generation potential and prospects of gas content assessment.

Methodology. The use of mathematical and statistical system for analysis and evaluation of katagenetic and thermal maturity of organic matter. Forecasting oil-gas strata distribution according to contents of organic matter and vitrinite reflectivity of core samples in the study area.

Findings. The thermal maturity of the studied species corresponds to the main phase of gas generation based on application criteria and predictive signs, supplemented by statistical data on vitrinite reflectivity depending on the depth. The most favorable depths for generation and location of unconventional gas reservoirs are defined.

Originality. Relationship between vitrinite reflectivity (R_0) and depth that is described by the logarithmic relationship with the magnitude of the reliability of approximation (R^2) greater than 0.8, was defined and substantiated for the area studied.

Practical value. According to the evaluation parameters R_0, by the high thermal maturity of the rocks was established, which are located preferably within the main zone of gas generation. Investigation of the distribution of organic matter content and vitrinite reflectivity values made it possible to identify the most favorable time intervals for the gas generation section within the studied areas. These intervals are considered to be favorable for localization of unconventional gas.

Keywords: *Dnieper-Donetsk basin, kerogen, unconventional gas deposits, vitrinite reflectance, thermal maturity of organic matter, katagenesis, oil-and-gas source rock*

Introduction. In recent years, the problem of hydrocarbon output in Ukraine has been becoming highly important. From the mid-seventies of the 20th century the volumes of gas output have decreased from 68.3 to 20 billion cubic meters and continue decreasing, the output of oil has decreased from 11.6 to 3.5 billion tons. The additional exploration of existing hydrocarbon deposits and search of new conventional and unconventional sources of oil and gas are the main objectives in the field of oil and gas geology and engineering. The forming of hydrocarbons is being connected with transformation of organic matter during immersion of sedimentation basins that is accompanied by gradually increasing maturity of organic matter [1, 2].

The study of organic matter in comparison to tectonic processes, that influenced the change of structural architecture of the Dnieper-Donets basin (DDB), gives the possibility to compare the stages of hydrocarbon generation with the periods of forming of oil and gas structures. It conditions the possibility to predict the most prospective oil and gas stratigraphic levels and highlight the perspective areas for search and prospect drilling.

Hydrocarbon deposits of the Dnieper-Donets basin (DDB) known for today are located in a wide range of depths from 300 to 6,750 m and in a stratigraphic range from the Precambrian basement to sediments of the Jurassic period. Among them are deposits of conventional type that are connected with structural forms of sedimentary cover called anticlines, tectonic and lithologic screens; moreover, large-sized gas concentration of central basin type in low-permeability aleurolite-siltstone rocks and shale gas in politic strata are forecast. Thus, important issue is the problem of determining the most promising rock formations with a high content of organic matter, the study of lateral and spatial distribution, the selection of the main maturity criteria of oil and gas generating rocks on the basis of assessment of distribution of the vitrinite reflectance index (R_0) as the main indicator of maturity of gas generating rocks.

Objective of the article is the study of prospective rocks of DDB with a high content of organic matter and its maturity based on the vitrinite reflectivity coefficient (R_0).

Presentation of the main research. Geological assessment of reserves is based on processing the large amounts of data on the structure of the layers (traprocks) and characteristics of rocks and fluids obtained during prospecting and exploitation of oil and gas deposits. It should be noted that almost all the parameters required for determining promising areas for gas deposits of unconventional type can only be estimative, made in the condition of considerable uncertainty. The studies of this problem have been conducted by many national and foreign scholars. Lukin A.E. [1], Vakarchuk S.G. [3], Mykhailov V.A. and Yemets O.V. [4] investigated the formation of unconventional gas resources associated with different low-penetrated ("tight") reservoirs by lithology that are the black shale (shale gas), tight sandstones, siltstones and rhythmites (central basin gas), coal (methane of coal deposits). Yevdoschuk N.I. and Chebanenko I.I. [5] studied the phenomenon of uneven and hydrophobic capillary absorption of methane from different sources, making it possible to clarify the discrepancy of gas capacity of tight reservoirs and actual amount of natural gas produced from them (added to earlier established dependency). Some of the results and established relationships, which are presented in the paper, were partially revealed and confirmed earlier in works by Lukin A.E. [1]. This allows considering the shale, central basin and coal deposit methane as unconventional renewable resources. Many other scientists have been studying the prospects of gas generation from deposits of unconventional type at different sedimentary basins in the world. The analysis of these studies allows distinguishing the main forecast and search criteria and characteristics for assessing the prospects for search, exploration and production of unconventional hydrocarbon resources (Table 1).

The main prospects of opening new hydrocarbon deposits and deposits within the DDB are associated with medium upper coal terrigenous and carbonate formations. The objects of search and exploration works are buried and disrupted brachy-anticlines and hemianticlines with traps of anticline, non-anticline and combined types [4, 6]. In lower coal formations there are two productive systems – Tournasian-Lower-Visean and Upper-Visean-Serpukhovian, each of which has its own oil and gas characteristics. Hydrocarbons were and are the main prospective complexes for further exploration and discovery of new oil and gas formations by the potential of resources. The greatest prospects for gas production from compacted rocks are associated with the territory, which corresponds structurally to the Bahmut and Kalmius-Toretsk basins. Some national researchers distinguish a transition zone between the DDB and Donetsk folded structure (DFS), which also includes the aforementioned basins.

The investigated structures (Artemivsk, Shebelynka, Komyshuvakha, and Sloviansk) are within the men-

Table 1

Forecast and search criteria and characteristics for assessing the prospects for search, exploration and production of unconventional hydrocarbon resources [2]

The main forecast and search criteria and features for assessment of resources of compacted gas rocks and central basin type gas	
1.	Occurrence of compacted rocks of all genetic types of sediments in layers or lensoid forms of migration and deep drainage depending on their current structural and tectonic position in the oil and gas basins presented as secondarily altered sandstones and siltstones with various textural and structural features
2.	Thermal maturity of rocks from 0.7 R_0 to 1.3 R_0 (from the upper zone MK_2 to the lower MK_5) and more
3.	Tectonic conditions of formation of gas deposits of unconventional type determined by the presence of fracturing zones near tectonic faults and areas of rock occurrence with changing angles
4.	The total content of organic carbon (OMC) > 1 %
5.	The filtration capacitive characteristics of rocks: porosity > 3 %, permeability > 0.005 mD
6.	The total thickness of the productive series > 500 m
7.	The depth of prospective rocks occurrence varies from 1 to 5 km

tioned transition zone. The geological information is presented in the form of data on research of core from clefts: Artemivsk – 1, Shebelynka – 800, Komyshuvakha – 4 and Sloviansk – 613. Optical methods for determining thermal maturity of organic matter are based on the study of phenomena of vitrinite reflectance (R_0), fluorescence of liptinite and color and transparency of petrologen. Vitrinite reflectance index is one of the most studied biomarkers which allows evaluating the degree of diagenetic changes of organic matter with depth [2]. In this connection the coefficient of vitrinite reflectance (R_0) and the total content of organic matter in the rock (OMC) have been identified as key factors in mathematical and statistical analysis.

Vitrinite reflectance (R_0) depends on the refractive index (μ) and absorption of light (k) by vitrinite according to widely known equation of Bir

$$R_0 = \frac{(\mu - \mu_0)^2 + \mu k^2}{(\mu - \mu_0)^2 + \mu^2 k^2},$$

where μ_0 is the index of reflection of immersive liquid.

With the increasing level of katagenesis and flavoring of organic matter the vitrinite reflectance increases from 0.15 % (low value) to more than 5.5 % at the level of transformations that corresponds to greenschist metamorphism. With the increasing katagenesis vitrinite becomes more anisotropic and therefore standard deviation reflections are widening. According to statistical data, medium values of arbitrary reflectance (Rr), which was measured during the investigations, correlate well with the values of maximum reflection and do not differ at low levels of maturity of organic matter [5,7]. When measuring vitrinite reflection, one should take into account that there are a number of factors that distort the evaluation of thermal maturity of organic matter of sedimentary rocks:

- vitrinite with different origin can show different reflection at the same level of maturity;
- wrong definition of the type of macerals;
- redisposition of old vitrinite with more reflection in the lower layers;
- souring of vitrinite;
- statistical errors that increase with maturity of vitrinite and growth of its optical anisotropism;
- poorly polished vitrinite.

In the studies conducted, data of the analysis and processing core material fields from seven basins are used, each of which is represented by the cleft (Table 2) [8–10].

As a result of primary statistical data of core studies on four clefts, the dependence is defined between vitrinite reflectance index (R_0) and depth which is described by the logarithmic connection with the magnitude of the reliability of approximation (R^2) in the range of 0.85 to 0.95 (Fig. 1).

Regular change of intensity of gas production and phase condition of hydrocarbon in the process of generation, depending on changes in temperature and pressure and geochemical conditions in oil and gas production rocks at different depths indicates the stages of the process of oil and gas production or vertical zoning. Analysis of the behavior of vitrinite reflectance index (R_0) with depth characterizes the oil and gas production potential of sedimentary strata of researched areas. In the cleft of Artemivsk–1 with the depth interval of 1500–4500 m vitrinite reflectance index (R_0) varies from 0.5 to 1.75 % that corresponds to the main phase of oil production (MK1 – MK2) and ends with methane generation.

Table 2

Intervals of selection and amounts of sample collections in separate clefts

#	Name of cleft	Interval of sample selection, m	The number of processed samples, pcs.
1	Artemivsk – 1	2015–4120	10
2	Komyshuvakha – 4	1400–4300	15
3	Shebelynka – 800	4600–6050	26
4	Sloviansk – 613	3000–5000	23

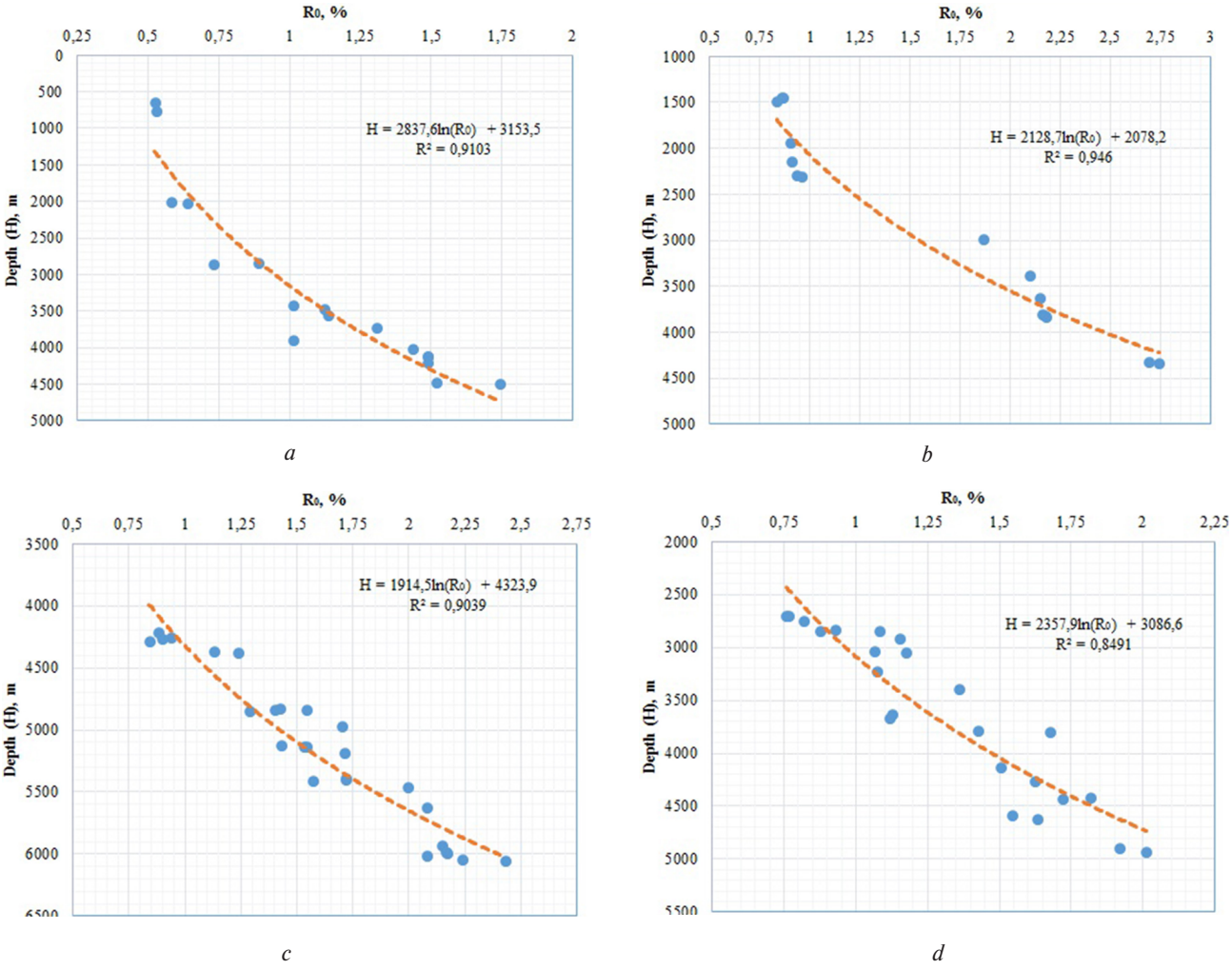

Fig. 1. The connection between vitrinite reflectance index (R_0) and depth of bedding of rocks of clefts of Artemivsk – 1 (a), Komyshuvakha – 4 (b), Shebelynka – 800 (c), Sloviansk – 613 (d). Axis of ordinates is the depth of bedding (h, m), axis of abscissa is the vitrinite reflectance index (R_0, %)

At depths of 1500–5000 meters, thermobaric characteristics of clefts of Komyshuvakha – 4 and Sloviansk – 613 correspond to the second region of mesokatagenesis (MK2) with the transition to the first zone of apokatagenesis (AK1). At this stage, the second maximum of gas production occurs, mainly methane and physicochemical.

The transformation of scattered organic matter begins and ends with methane generation. The second, after a biochemical one, and more significant stage of gas formation occurs at great depths and spacing of the section of sedimentary rock in which it appears, is defined as the main gas generation zone (MGGZ) [1, 7]. Depth displays of MGGZ meet the strictest temperature and pressure conditions. Such conditions are observed and well-illustrated in the chart of Shebelynka-800, where $0.85 < R_0\,(\%) < 2.5$ and $h = 4$–6 km. On the basis of constructions, it can be assumed that there is continuous generation of fluids (hydrocarbons) from deeply embedded horizons.

Logarithmic connection between the parameters h and R_0, depicted in the integrated graph (Fig. 2) allows tracking the behavior of vitrinite reflectance index (R_0) in sedimentary rocks of the researched areas.

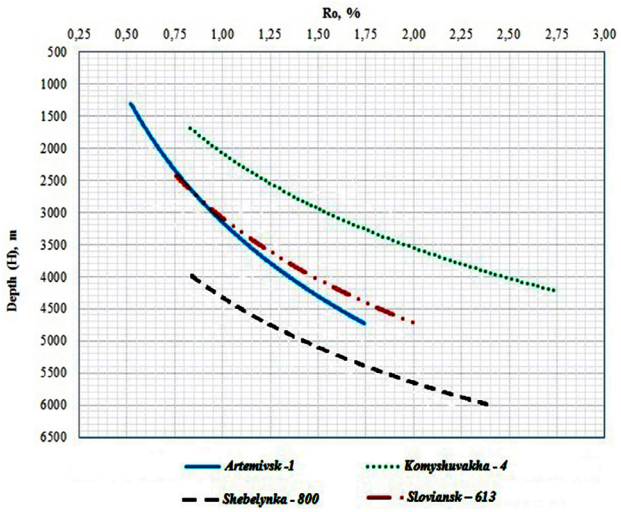

Fig. 2. Summarized graph of dependence of the vitrinite reflection index from the depth of clefts of Artemivsk – 1, Komyshuvakha – 4, Shebelynka – 800, Sloviansk – 613. Axis of ordinates is the depth of bedding (h, m), axis of abscissa is the vitrinite reflectance index (R_0, %)

According to the forecast and search criteria and indicators for assessment of prospects for searching, exploration and production of unconventional deposits of hydrocarbon resources, the vitrinite reflectance index (R_0) and the total content of organic material in the rock (OMC) must fit to the intervals simultaneously, namely $0.8 < R_0(\%) < 3$ and $OMC > 1$ % [4, 6].

Dependences between the vitrinite reflectance index (R_0) and general content of organic carbon in the rock (OMC) with depth are additionally constructed for each cleft (Artemivsk – 1, Shebelynka – 800, Komyshuvakha – 4, Sloviansk – 613) (Fig. 3).

Since the depth of the gas deposits of unconventional type usually ranges from 1 to 5 km, the authors decided to use only these intervals of the vitrinite reflectance index and general content of organic carbon, where the connection between these factors is the most correlative, and the data of these indicators do not exceed the limits specified in Table 2.

The areas highlighted by rectangular zones indicate the most favorable depths to generate gas deposits of unconventional type while hydrocarbon generation of deep horizons can be accepted as space searching criteria of location of gas-containing rocks. All three divisions of the carboniferous system developed throughout the searched site. Regional types serve as various kinds of limestone, dolomite and clay, whereas intercalation of mudstone, sandstone and limestone can be the place of accumulation and formation of hydrocarbons in the future. This ratio of permeable and impermeable rocks substantiated the existence of conditions for regional development of reservoirs of conventional and unconventional types [4, 6].

Despite the variability of conditions sedimentation and sharp fluctuations in thickness, according to lithologic characteristics, the carbon cut keeps the overall look of sandy clay-type rocks formed by the cyclic intercalation of packs and packs with layers of sandstone mudstone, siltstone and limestone. All of the above confirms the possible presence of gas deposits of unconventional type, especially gas of central basin type in the southeastern part of DDB.

Conclusion. Due to the lack of geological knowledge of the territory, there is considerable uncertainty in the assessment of the possible volume and cost of output. However, the primary information on the characteristics of geological structures and analysis of technological aspects of output provide an opportunity to hold pre-

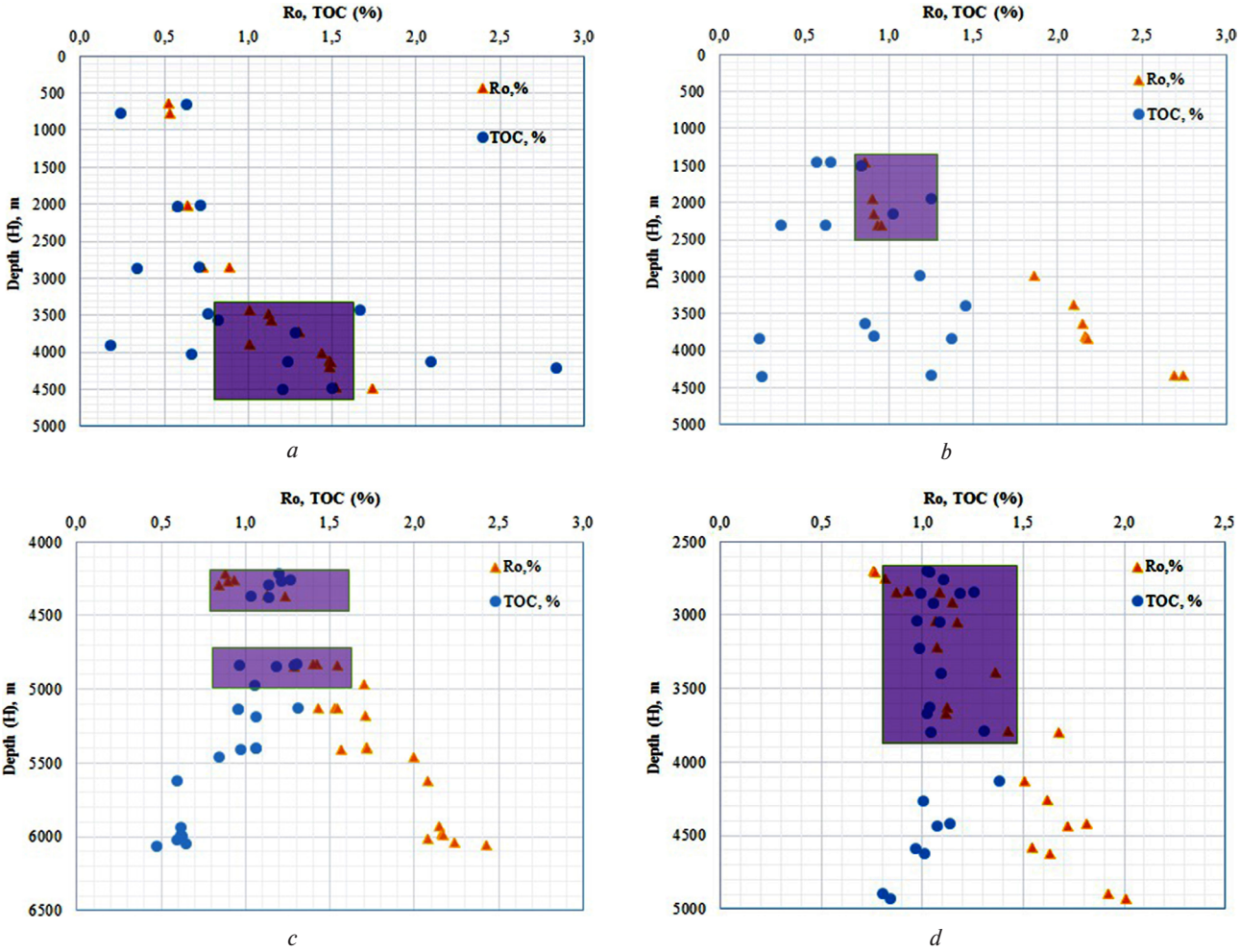

Fig. 3. Distribution of content of TOC and R_0 by the depth of bedding of terrigenous rocks for clefts of Artemivsk – 1(a), Komyshuvakha – 4 (b), Shebelynka – 800 (c) and Sloviansk – 613 (d). Axis of ordinates is the depth of bedding (h, m), axis of abscissa is the vitrinite reflectance index (R_0, %) and general content of organic carbon (TOC, %)

liminary forecasts of prospect of an area for hydrocarbons.

According to the results of the studies, it was established that organic matter of the researched area is thermally mature and sufficiently katagenetic converted to form gas deposits of unconventional type. This is proved by the dependence between the vitrinite reflectance indexes (R_0) and depth which is described by the logarithmic connection with the magnitude of the reliability of approximation (R^2) over 0.8. Based on the evaluation of indicators of the vitrinite reflectance (R_0) and the content of organic matter in the rock (OMC), zones of spreading gas-generating rocks which are prospective for hydrocarbon were discovered and outlined. The research results indicate that the southwestern part of DDB is prospective for conducting geological prospecting works for searching gas deposits of unconventional type.

References / Список літератури

1. Lukin, A. E., 2011. On the nature and prospects of low-permeability gas-bearing rocks of the sedimentary shell of the Earth. *National Academy of Sciences of Ukraine*, No. 3, pp. 114–123.

О природе и перспективах газоносности низкопроницаемых пород осадочной оболочки Земли / А. Е. Лукин; Доп. НАН України. – 2011. – № 3. – С. 114–123.

2. Kryshtal, A. M., 2015. *Geological conditions of forming and forecasting unconventional hydrocarbon deposits in Dnieper-Donetsk depression*. Institute of Geological Sciences of NAS of Ukraine.

Кришталь А. М. Геологічні умови формування та прогнозування нетрадиційних вуглеводневих покладів у Дніпровсько-Донецькій западині: автореф. дисерт. на здобуття наук. ступеня кандидата геол. наук за спеціальністю 04.00.17 / Кришталь А. М.; Інститут геологічних наук НАН України. – Київ, 2015. – 21 с.

3. Vakarchuk, S. G. and Ischenko, I. I., 2010. Problems of oil and gas industry. *Collection of scientific works*, No. 8, pp. 77–84.

Вакарчук С. Г. Проблеми нафтогазової промисловості / Вакарчук С. Г., Іщенко І. І.; Зб. наук. праць. Вип. 8. – Київ, 2010. – С .77–84.

4. Mikhailov, V. A. and Yemets, O. V., 2014. The level of maturity of organic matter deposits of Dnieper-Donets basin at the prospect of the discovery of unconventional gas", *Visnyk of Taras Shevchenko National University of Kyiv: Geology,* No. 1(64), pp. 48–53.

Михайлов В. А. Рівень дозрілості органічної речовини відкладів Дніпровсько-Донецької западини у зв'язку з перспективою відкриття родовищ нетрадиційного газу / В. А. Михайлов, О. В. Ємець; Вісник Київського національного університету імені Тараса Шевченка. Геологія. – 2014. – № 1(64). – С. 48–53.

5. Chebanenko, I. I., Demianenko, I. I., Yevdoshchuk, M. I., Hladun, V. V., Klochko, V. P., Karpenko, I. V., Polivtsev, A. V. and Halko, V. P., 2007. Search for hydrocarbon oil and gas in the Eastern region of Ukraine. *Reports of the National Academy of Sciences of Ukraine,* No. 3, pp. 133–136.

Пошук вуглеводнів у Східному нафтогазоносному регіоні України / Чебаненко І. І., Дем'яненко І. І., Євдощук М. І. [та ін.]; Доповіді Національної академії наук України. – 2007. – № 3. – С. 133–136.

6. Zelenko, Y. M. and Karpenko, O. M., 2015. Spatial prediction of gas-generating sequences in the Dnieper-Donets Basin based on assessment vitrinite reflectivity Theoretical and applied aspects of Geoinformatics. *Collection of scientific works*, No. 12, pp. 43–51.

Зеленко Ю. М. Просторове прогнозування газогенеруючих товщ у Дніпровсько-Донецькій западині на основі оцінки відбивної здатності вітриніту / Ю. М. Зеленко, О. М. Карпенко; Теоретичні та прикладні аспекти геоінформатики. – 2015. – Вип. 12. – С. 43–51.

7. Zelenko, Y. M., 2016. Spatial distribution of types of kerogen based on data processing method of pyrolysis of samples within Dniper–Donetsk depression. *Geoinformatika*, No. 3(59), pp. 20–24.

Зеленко Ю. М. Просторове поширення типів керогену на основі обробки даних методу піролізу зразків в межах ДДз. / Ю. М. Зеленко, О. М. Карпенко, О. В. Дзюб; Геоінформатика. – 2016. – № 3(59). – С. 20–24.

8. Bechtel, A., Gratzer, R., Makogon, V., Misch, D., Prigarina, T. and Sachsenhofer, R. F., 2015. Oil/gas–source rock correlations in the Dniepr-Donets Basin (Ukraine): New insights into the petroleum system. *Marine and Petroleum Geology*, Vol. 67, pp. 720–742.

9. Sachsenhofer, R. F., Shymanovskyy, V. A., Bechtel, A., Gratzer, R., Horsfield, B. and Reischenbacher, D., 2010. Palaeozoic source rocks in the Dniepr-Donets Basin, Ukraine. *Petroleum Geoscience*, No. 16, pp. 377–399.

10. Sachsenhofer, R. F. and Koltun, Y. V., 2012. Black shales in Ukraine – A review. *Marine and Petroleum Geology*, Vol. 31.1, pp. 125–136.

Мета. Вивчення та визначення найбільш перспективних глибин залягання кам'яновугільних товщ перехідної зони між Дніпровсько-Донецькою западиною й Донецькою складчастою структурою з метою оцінки їх газогенераційного потенціалу та оцінки перспектив газоносності.

Методика. Використання математично-статистичного апарату для аналізу та оцінки катагенетичної та термічної зрілості органічної речовини. Прогнозування поширення нафтогазоперспективних товщ за даними вмісту органічної речовини та показника відбиття вітриніту у зразках керну досліджуваної території.

Результати. На підставі застосування прогнозно-пошукових критеріїв та ознак, доповнених статистичними даними щодо залежності показника відбиття вітриніту від глибини занурення, показано, що термічна зрілість досліджених порід відповідає головній фазі газоутворення. Виділені найсприятливіші глибини для генерації та локалізації покладів газу нетрадиційного типу.

Наукова новизна. Для дослідженого району встановлена та підтверджена залежність між показником відбиття вітриніту (R_0) та глибиною, що описується логарифмічним зв'язком з величиною достовірності апроксимації (R^2) більшою, ніж 0,8.

Практична значимість. За результатами оцінки показників R_0 встановлена висока термічна зрілість порід, що розміщуються переважно в межах головної зони газоутворення. Дослідження розподілу вмісту органічної речовини та значень показника відбиття вітриніту дозволили виділити найсприятливіші для газогенерації інтервали розрізу в межах вивчених площ. Ці інтервали розглядаються як сприятливі для локалізації покладів газу нетрадиційного типу.

Ключові слова: *Дніпровсько-Донецька западина, кероген, поклади газу нетрадиційного типу, показник відбиття вітриніту, термальна зрілість органічної речовини, катагенез, нафтогазоматеринські породи*

Цель. Изучение и определение наиболее перспективных глубин залегания каменноугольных толщ переходной зоны между Днепровско-Донецкой впадиной и Донецкой складчатой структурой с целью оценки их газогенерационного потенциала и оценки перспектив газоносности.

Методика. Использование математически-статистического аппарата для анализа и оценки катагенетической и термической зрелости органического вещества. Прогнозирование распространения нефтегазоперспективных толщ по данным содержания органического вещества и показателя отражения витринита в образцах керна исследуемой территории.

Результаты. На основании применения прогнозно-поисковых критериев и признаков, дополненных статистическими данными о зависимости показателя отражения витринита от глубины погружения, показано, что термическая зрелость исследованных пород соответствует главной фазе газообразования. Выделенные благоприятные глубины для генерации и локализации залежей газа нетрадиционного типа.

Научная новизна. Для исследованного района установлена и подтверждена зависимость между показателем отражения витринита (R_0) и глубиной, которая описывается логарифмическим связи с величиной достоверности аппроксимации (R^2) больше чем 0,8 позволило уточнить оптимальные глубины генерации углеводородов.

Практическая значимость. По результатам оценки показателей R_0 установлена высокая термическая зрелость пород, размещаются преимущественно в пределах главной зоны газообразования. Исследование распределения содержания органического вещества и значений показателя отражения витринита позволило выделить благоприятные для газогенерации интервалы разреза в пределах изученных площадей. Эти интервалы рассматриваются как благоприятные для локализации залежей газа нетрадиционного типа.

Ключевые слова: *Днепровско-Донецкая впадина, кероген, залежи газа нетрадиционного типа, показатель отражения витринита, термальная зрелость органического вещества, катагенез, нефтегазоматеринские породы*

Рекомендовано до публікації докт. геол. наук В. В. Огаром. Дата надходження рукопису 27.02.16.