

GEOLOGY OF OIL AND GAS

Prospects of reveal of considerable deposits of gas on big depths in Dnipro and Donetsk cavity

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The new data on the geological structure and gas content of the Visean stage lower section – XIIIa microfaunal horizon (MFH) were provided. In the central near-axial zones of the Dnipro-Donets basin (DDB) on the sides of Sribnensk and Zhdanivsk depressions they were considered as a main reservoir objective to increase proven reserves of hydrocarbons. The lithofacies analysis of sediments of the MFH section XIIIa was given made attempts of back stripping conditions of sedimentation in the zonal plan. The discovery potential of deep reserves of natural gas was shown by the example of the Komysniansk gas condensate reservoir as the primary object for oil reconnaissance.

The results of geologic search works being performed recently proved stable trend in reveal of small and very small deposits. The majority of these deposits are located within the borders of northern board and northern-western borders of Donbas.

Prospects of reveal of big and average deposits are connected with deeply down-dropped coal deposits of axile zone.

As the independent object of reconnaissance there are deposits of microfaunistic horizon of up-Visean sub-layer of low Carbon. The main gas deposits on Rudivska and Chervonozaovodska, Lutsenkivska, Komysnianska deposits, the number of little bit less deposits on Yablunivska, Svyrydivska, Kharkivtsivska and Solokhivska deposits (figure 1) are confined to them.

In general the basin of sedimentation of these deposits can be characterized in the following way. The transgression of sea took place from southern east of axile zone of cavity.

Coastal line of basin of sedimentation of this time line is approximated in form of parabolic curve with the top in the area of western close of Sribnenska depression with passing of northern branch of the curve in the region of Voloshkivske deposit and southern branch in the area of Leliakivska and Ozerianska structures and further to Southern board (according A. O. Bilyk, UkrDGRI). For low-Visean and Tournaisian complex coastal line was dislodged a little bit to east to the region of Northern and Yariivska arch [1].

The most abyssal part of the basin was placed in the region of Solokhivska structure, where in the cuts of mine holes the horizon was presented mainly by clay deposits with few (1–3 m) shallow layers of sandstones. This abyssal zone is spread to rather considerable territory and covers Semerenkivskam Rodnikova, Machukhska structures in southern part of the basin.

Northern part of the basin is characterized with more constrict and less powerful cut (Zahorianska, Pirkivska, Rymarivska areas).

The most interesting for searches of oil and gas are shallow sea facies of coastal streams, avant deltas, alluvial cones, turbidites or other facies of deposits transitional from continent to the sea, which can contain conditional sand layers-collectors. It means that the areas of the basin located respectively not far from the source of location of terrigenous material – southern board of the cavity. One of the relatively studied regions in relation to these deposits is Rudivske-Chervonozaovodske deposit [2].

According to the results of study of kern material (cross-sectional views, electronic microscopy) petrographers and lithographers of “Chernihivnaftogazgeologia” State Economic

Enterprise the sandstones of horizons B-22 top, B-22 bottom, B-23 were referred to shall sea and river facies. Thus, the example of the kern from the depth of 5309,6 m (horizon B-22в) is characterized by porosity of 11,6 %, permeability of 13,1 mD. It is represented by typically shallow sea sandstone formed within the borders of tidal and reflux line.

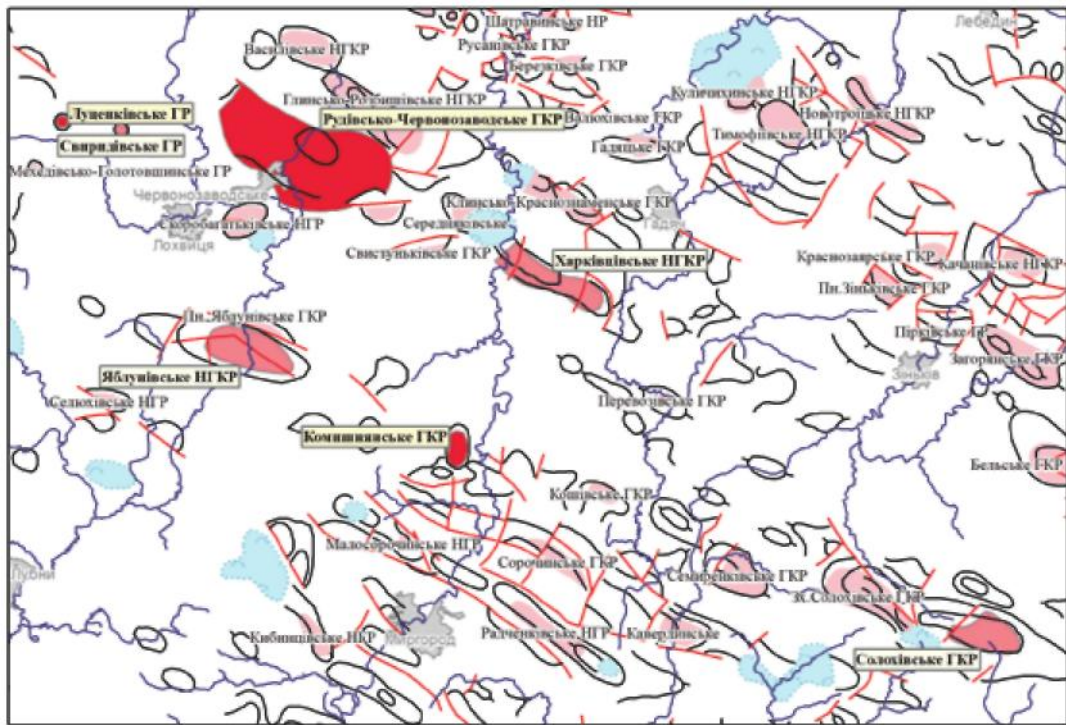


Figure. 1. Review map

The sandstone is moderately and well sorted from alevritic to averagely grainy material, which consists mainly of monocrystalline quartz with little amount of mica and from caolinized to not-changed and plagioclasic feld spars.

Examples of kern from mine hole 3-Chervonozavodska, horizon B-22 в (depth 5337,2 m, porosity 12,2 %, penetration 11 mD), 4-Chervonozavodska, horizon B-22в (depth 5337,2 m, porosity 10 %, penetration 41,9 mD), 1-Rudivska, horizon B-22в (depth 5219,2 m, porosity 14,7 %, penetration 140,2 mD), 2-Rudivska, horizon B-22в (depth 4989 m, porosity 13,4 %, penetration 40,2 mD), 4-Rudivska horizon B-22в, (depth 5064 m, porosity 13 %, penetration 25,3 mD; depth 5088,1 m, porosity 10,5 %, penetration 7,9 mD) are referred to sandstones of avant delta of furcated river.

The examples of kern from mine hole 6-Chervonozavodska, horizon B-22в (depth 5309,6 m, porosity 11,6 %, penetration 13,1 mD), 3 –Rudivska, horizon B -22в (depth 49 4 6,4 m, porosity 14,6 %, penetration 55,5 mD) are referred to shallow sea (zones of tide and reflux) sandstones.

Probably Rudivska and Chervonozavodska structures were formed as the structures of anticline of bodies of sandstones in the process of further sediment genesis.

The characteristic feature of geologic structure is the linear spread of sandstones of the horizons B-22, B-23 to the deposit that completely inherits spread of the tideway of Sula river. The most effective mine holes are located in the deposit within the borders of axile parts of bodies of sandstones of horizons B-22, B-23.

At the result of renewal of reconnaissance drilling of years 2010–2012 on Komysnianska deposit the new data concerning oil and gas bearing of these deposits, the correlation of cuts of

mine holes of low part of Visean layer of low Carbon was considerably changed and adjusted from its reconnaissance at the initial stage of the deposit in 90s of the last century [3].

Thus at the result of drilling of mine hole 23 within the borders of northern part of Komyschnianskyi block manufacturing oil and bearing of low horizon D-22 was defined. During the trial of interval 6059–6057 m the afflux of gas of 338 thousand m³/day on 7 collar. According to the data of manufacturing and geophysical researches (V. V. Nazaryshyn, 2011) effective horizon is presented by consolidate oil and gas sandstones with porosity of 8 %, effective power of 1,6 m. Probably the collectors of effective horizon are characterized by considerable fracture component of penetration that provided for good filtration and capacities characteristics and high gas debit (figure 2).

In 2012 at the result of drilling of estimation and exploitation mine hole 51 development of collectors in low horizon D-22 in central part of Komyschniansky block was proved. During the trial of interval 5995–6050 m influx of gas with debit of 279 thousand m³/day on 8 collar was received. Effective horizon is represented by sandstones with porosity from 7 to 10%, gas saturation of 82–86 % with effective thickness of 3,6 m in upper part and consolidate oil and gas saturated sandstones of different clayiness with porosity of 5–6 and 7–8 % in low part of horizon low B-22. During research of mine hole maximum short-term fixed not-stabilized pressure in crater of mine hole was 720 atmospheres.

Pressures in crater of mine hole close to the above-stated ones were received during trial of mine hole 23.

Taking into account data of drilling of the mine hole, layer pressure of object of the trial was estimated of about 910 atmospheres. In Komyschnianske mine hole in December of 2012 the trial of reconnaissance mine hole 29 located in apical part of the block was completed. The mine hole was drilled with the purpose of reconnaissance of effective horizons of low part of up-Visean sub-layer of low Carbon (B-22-23) up to the depth of 6135 m. Its cut correlates satisfactory with cuts of mine holes 488, 51, 23, 5, 7. Apron of the mine hole is located in carbonate deposits of horizon B-24 of low-Visean sub-layer of low Carbon. With core samples collection of kern 117 meters of driftage was drilled, upon it the removal of kern was 57,5 meters. Kern was selected from horizons B-17, B-18, B-20, B-22_B, B-22_H, B-23-24. The collected samples of sandstones from horizons B-17, B-20, B-22_B, B-22_H, B-23 had the features of hydrocarbon saturation: smell of hydrocarbons on fresh wrecking, characteristic radiance during luminescent and bituminous analysis.

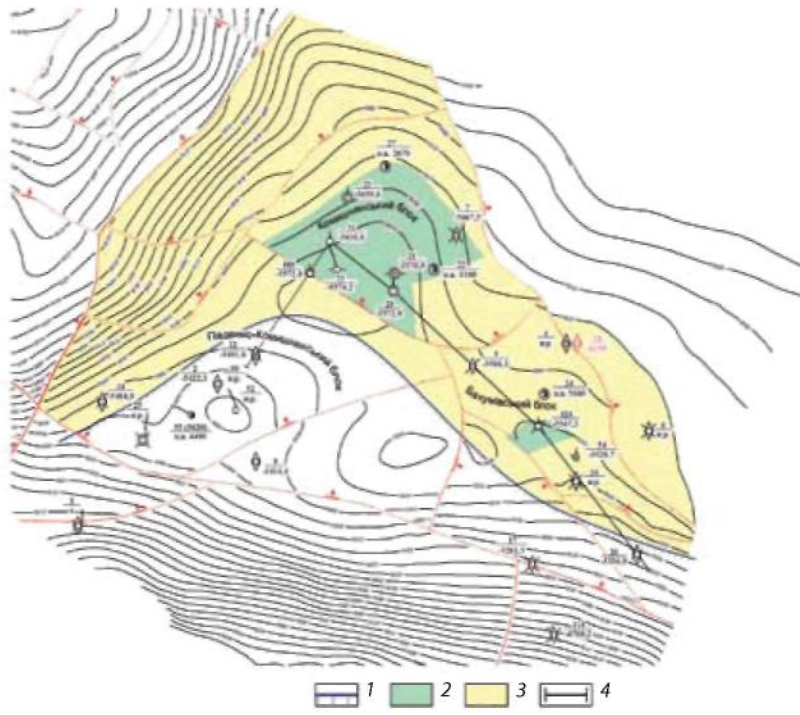


Figure 2. Komyshnianske deposit. Structural map of effective cut of roof of the horizon B-22: 1 – southern border of spread of gas deposits of horizons B-22-23, according to data of drilling; 2 – area of explored deposits of gas of the horizon B-22; 3 – area of prospective resources of gas of the horizons B-22-23; 4 – line of scheme of correlation

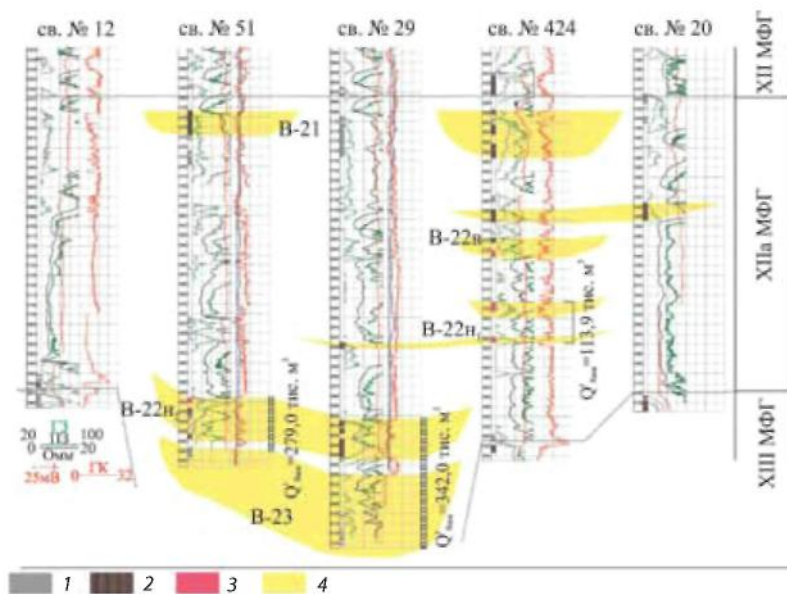


Figure 3. Scheme of correlation of effective horizons in up-Visean deposits. Results of interpretation of geologic research works: 1 – consolidate; 2 – consolidate gas saturated; 3 – gas saturated; 4 – development of gas saturated collectors in effective cut

According to the data of interpretation of complex of geophysical researches in mine hole (V. V. Nazaryshyn, 2012) the number of layer of collectors, namely in horizon B-22 in intervals 6023-6043, 6005-6018 m was emphasized for estimation of their manufacturing effectiveness (consolidate oil and gas saturated sandstones with porosity of 7-9 %). They were tried with the help of filter.

At the result of trial of the mine hole the influx of has with debit of 342 thousands m^3/day on 8 mm fitting was received. Layer pressure is 980 atmospheres, mean of layer pressure in comparison with data received during researches of mine hole 51. It is explained by connection of layers of horizon B-23 tried by filter together with low horizon B-22 to work.

In mine hole 488 effective low horizon B-22 is excepted because of violation. Mine holes 7 and 5 were not drilled up to low horizon B-22.

So within the borders of Komysnianske deposit the manufacturing oil and gas deposit of Komysnianskyi and Bakumivskyi blocks on horizons B-22H, B-23 is determined.

Estimation of reserves and prospective resources of horizon B-22, B-23 of Komysnianske deposit is about 10 millions of conventional fuel. Low border of oil and gas bearing of deposits (gas and water contact) was not defined and can exceed in the north the borders of structural brow. Because of this the priority direction of reconnaissance is the drilling of reconnaissance mine holes 27, 28 and mine hole in the area of connection of Komysnianska and Bakumivska blocks.

Analysis of the received data gives opportunity to make such conclusions.

Sediments of XIIa microfaunistic horizon are confined to the part of structure down-dropped on trap-down of sub-longitude spread. Within the borders of elevated Southern Komysnianskyi block and elevated blocks of mine holes 17 and 20 they were not accumulated (figure 3).

Cuts of XIIa microfaunistic horizon revealed by mine holes on Komysnianska area correlate with cuts of mine holes of Rudivska-Chervonozavodska, Svyrydivska, Lutsenkivska and Yablunivska deposits. They are presented by shallow sea facies or maybe the facies of turbidites [4].

The availability of such facial conditions can be forecasted within the borders of Zhdanivska depression on Zviazivska, Western Komysnianska, Kliushnykivska, Koshevoiska, maybe Lysivska and Perevozivska structures. The above-stated structures are considered as the most prospective objects for performance of search works for sediments of XIIa micro-faunistic horizon, with which the prospects of reveal of gas deposits with considerable reserves on big depths.

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Candidate of technical sciences, corresponding member of Ukrainian National Geologic Academy, Specialist on development of oil and gas bearing deposits. Ivan Andriiovych Pylypets was born on April 12, 1934 in Stoyaniv village of Radekhiv district of Lviv region. In 1957 he graduated from mining faculty of Lviv Polytechnic Institute and began to work as operator (then assistance of foreman on oil extraction) in Dolynska Oil Manufacturing Administration. In 1962 he became the head of scientific and research laboratory on support of pressure in oil deposits with watering, and in 1970–2006 he headed manufacturing and technical (then the technical) department of administration. In 1980–1981 Ivan Pylypets was a consultant on extraction of oil in Bulgaria. pp. From 1972 to 1976 he studied in graduate center at I. M. Hubkin Moscow Institute of Oil Chemistry and Gas Industry, after graduation from which he defended a candidate dissertation on topic “Use of thermal measurements for control and regulation of development of many-layer oil and gas deposits”. Thermal measurement and hydrodynamic methods of control and regulation of the processes of development of oil deposits offered by Ivan Andriiovych Pylypets were applied on practice and gave opportunity to increase the rate of cover of the layer by watering and their oil removal. Under his active participation together with the traditional ways of intensifying of oil extraction the new technologies and technical devices for processing of mine holes by micellar solution, impulse and wave effect on layer, directed influence to tidal zone of mine holes with blocking of highly watered layers, acid processings with use of various sets and solvents, and also their modifications were implemented. He developed technologic and constructive innovations that cover the process of extraction and preparation of oil. He created for the first time and implemented new way of development of screened zones of oil deposits. I. A. Pylypets is the author of 57 scientific publications, 43 patents and author certificates for inventions, over 150 rationalizing offers. During 1958–1980 he was the head of primary organization of All-Union Association of Inventors and Rationalizers he was elected two times a delegate of all-Union meetings of All-Union Association of Inventors and Rationalizers. He got an honor rank of the “Honored Rationalizer of Ukrainian SSR”, awarded with bronze medals of exhibitions of achievements of national economy.

I. A. Pylypets died on June 4, 2013.

Cherished memory about Ivan Andriiovych Pylypets will remain in our heart for ever.

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