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**Myroslav PAVLYUK, Volodymyr SHLAPINSKY,
Olesya SAVCHAK, Myroslav TERNAVSKY**

**PROSPECTS OF THE POTENTIAL FOR OIL AND GAS PRESENCE
IN THE NORTH-WESTERN PART OF INNER FLYSH COVERS
OF THE UKRAINIAN CARPATHIANS**

Here the Cretaceous and Paleogene flysh of the Duklya-Chornohora, Burkut, Magura, Marmarosh and Pieniny covers was studied that in the north-western sector of the Ukrainian Carpathians near the border of Poland and Slovakia (Lemkivsky segment) distinguish themselves by very inclined thrusts. Spatially the given tectonic units are within the limits of so called hydrothermal field unfavourable as a whole, as to the presence of hydrocarbons on a large scale here. But there were distinguished small plots with prevalence of hydrocarbons in the gas composition. Prospects of the potential for gas presence in the region should be connected with the areas that spatially gravitate towards Transcarpathian deep. Studied area consists of several tectonic units of the first order. These are covers located farther south-west of Krosno cover: Duklya-Chornohora, Burkut (Porkulets), Magura, Marmarosh and Pieniny covers, in the south-west the studied terrane is limited by the Transcarpathian deep, and farther west – by the state border of Ukraine and Slovakia, in the south-east – by the Rika River, in the north-east – by the zone of joining of Duklya-Chornohora and Krosno covers. Prospects of the potential for oil and gas presence in the given area, as in the Folded Carpathians on the whole, should be determined by the complex of all accompanying parameters: structural, collecting and covering, hydrochemical and geochemical. For the given area of the Carpathians the geochemical factor is the most important.

Keywords: inner flysh covers, hydrothermal fluid, composition of free gases, oil and gas presence, perspective areas, Transcarpathian deep.

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Ihor NAUMKO

**ON THE LITHOFLUID AND THERMODYNAMIC SYSTEM
IN GEOLOGY AND GEOCHEMISTRY**

The researcher's approaches to the term "fluid systems" as a prototype of the fluid medium of crystallization of minerals, naturally preserved relics – inclusions of fluids reflect the features of the fluid regime of mineralogenesis of rock-ore complexes are analyzed. It is emphasized that the term "fluid" characterizes the main property of the substance of the medium of mineralogenesis, the most important substance of the Earth's crust, its highest mobility, the maximum disorder of structure, fluidity, and covers the liquid or gas state of the lightweight components (gas, aqueous solution), as well as the melt of magmatic (silicate, salt, carbonate) substance. Under the fluid regime, the author understands the physical and chemical nature, the spatial-temporal sequence of manifestation and the variability of the parametric characteristics of the fluids, that is, the entire set of physico-chemical and geological phenomena and processes that determine the regular (discrete, periodic, evolutionary) changes in aggregate state, *PT*-parameters and the composition of the fluid medium of crystallization of minerals and their identified (certain, specific) parageneses. Our long-term studies show that the physico-chemical system of the fluid medium of mineral-ore-narhtidgenesis should cover lithoid (rocky), fluid (genetic) and thermodynamic (temperature, pressure, concentration) components that determine the mass, heat and the energy exchange between the fluid and of its host rock. In view of this, we define this physico-chemical system as a "lithofluid and thermodynamic system" and we believe that this definition takes into account all known phenomena of generation, migration, differentiation and accumulation of fluids, in particular hydrocarbons (hydrocarbon-containing), in the lithosphere of the Earth. An example of such a lithofluid and thermodynamic system in the Earth's bowels – the natural high-energy physicochemical reactor is the hydrocarbon-generating and mineral-ore-forming system of the deep abiogenic high-termobaric fluid.

Keywords: inclusion in minerals, fluid systems, fluids, fluid regime, lithofluid and thermodynamic system, lithosphere of the Earth.

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Yuri KHOKHA, Oleksandr LYUBCHAK, Myroslava YAKOVENKO

GIBBS FREE ENERGY OF NATURAL GAS COMPONENTS FORMATION IN SEDIMENTARY STRATA

The main methods of calculating the composition of geochemical systems in the thermodynamic equilibrium state were considered in the article. It was shown that the basis for such calculations was the determination of the Gibbs Free Energy of each system components at given temperatures and pressures. The methods of Gibbs Free Energy calculation at standard pressure and under conditions that are realized within the sedimentary strata were analyzed. The equations of state for natural gas individual components were selected and their Gibbs Free Energies for heat fluxes ranging from 40 to 100 mW/m² and depths of 0–20 km were calculated. The results showed that the pressure significantly affects the value of Gibbs Free Energies formation of natural gas components within the sedimentary strata. Changes of the Gibbs Free Energies of natural gas components formation, as a function of depth, subordinated to the same laws for each compound. This regularity was better expressed in more heated areas.

It was shown that with depth increasing the Gibbs Free Energy of natural gas components formation first rapidly decreases and reaches its minimum ranging from 2 to 6 km. Moreover, as the value of the heat flux increases, the maximum value of the Gibbs Free Energy of formation of natural gas components, expressed in kilometers, decreases. With further immersion/deepening to depths greater than 6 km, the Gibbs Free Energy of the formation of natural gas components gradually increases, and in areas with greater heat flux, a sharp increase was characteristic, and with less, it was slow and weakly expressed.

There is a stability area for hydrocarbon and non-hydrocarbon components of natural gas ranging from 2 to 6 km. With the increase of Carbon number in the hydrocarbon chain, the value of Gibbs Free Energy of the natural gas hydrocarbon components formation decreases, which indicates the presence of a stability zone for heavy natural gas components (it should be expected that oil also) within the depths of 2–6 km.

Keywords: Gibbs Free Energy, heat flow, natural gas, sedimentary strata.

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**GEOHERMAL CONDITIONS
OF THE EASTERN OIL- AND GAS-BEARING REGION OF UKRAINE**

The formation of the temperature regime of the Dnieper-Donets depression is determined by the magnitude of the deep heat flux, the structural and tectonic features of the region, the lithology of the sedimentary complex, the occurrence of a thick complex of chemogenic and volcanic rocks in the region, as well as hydrogeological conditions.

Based on the analysis of factual geothermal material on wells, obtained during geophysical studies, measurements of temperatures and geothermal gradients, measurements of temperatures during testing of productive horizons, as well as from literary sources, the interpolation of factual geothermal material is carried out. The geothermal parameters characterizing the temperature state of rocks and fluids of different tectonic zones of the Eastern oil- and gas-bearing region have been determined. Schemes of temperature distribution at depths of 2000, 8000 m, average geothermal gradient, depths of isotherms 150 °C, 180 °C are given and regularities of distribution of geothermal parameters are analyzed. The lateral zoning of the geothermal parameters distribution of the region is established, the zones of their maximum, middle and low values are distinguished. Taking into account the peculiarities of the tectonic structure of the Dnieper-Donets graben, as the sedimentary complex is submerged, a gradual replacement of oil by oil and gas fields and then by the gas ones occurs from the northwest to the southeast. Geothermal parameters characterize the geothermal activity of the subsurface and allow to determine its zonation, as well as to predict the phase state of hydrocarbon systems at great depths.

Keywords: geothermal parameters, thermobaric conditions, average geothermal gradient, “background” regional temperatures, isothermal surface, hydrocarbon phase state, Eastern oil- and gas-bearing region.

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**MARMAROSH KLIPPEN BELT
IN STRUCTURE OF UKRAINIAN CARPATHIANS**

Article 2. Tectonic-magmatic position and views of the zone structure

The paper describes the tectonic position of Marmarosh zone of rocks and determine its place in the structure of the Ukrainian Carpathians. Shown is the history of the study of igneous rocks. The comparative analysis of the views on the structure and position of the Marmarosh klippen belt in the structure of the Carpathians processed by the literature was carried out. At the end of the article the researchers compared views on the structure of Foreign Affairs, highlighted the main features of the geological structure and tectonic zoning area.

Some similar features of rocks composed of Marmarosh klippen belt, namely formational, to a lesser extent, the morphology of the folded and dislocations with a break of continuity history of even-aged species of complexes the Marmarosh zone of rocks is considered as NW continuation of Marmarosh massif that was torn from its substratum in the tectonic evolution of the region. These tectonic elements of different times and different phases of folding, but the final phase of tectonogenesis was manifested are almost simultaneously during the Miocene. MKB is a special category of tectonic structures associated with faults, of considerable length and long stage of development, is so-called near-fracture or suture structures and delineates two different areas with sharply different geological development history, geodynamic conditions of formation, stratified formations, independent tectonic regime. The structure is characterized by the set of formations – sedimentary, igneous, metamorphic.

As a result of structural and tectonic studies the Marmarosh klippen belt is a consequence of Albian movements where appeared blocky dislocation and Post-Oligocene folding and formation of small intrusive bodies. Modern look of the band was formed in Oligocene time at neotectonic stage of development of the Carpathians. MKB is not correlated with any of the Carpathians area, although it has similarities with some elements, such as Marmarosh massif, but it different by a character of section and especially by peculiarity of the section of the Lower Cretaceous.

One of the conditions for further study of Marmarosh klippen belt is integrated research, including the study of facies changes of the nature of the thickness, more mapping

of folded and discontinuous structures, further development of stratigraphic scheme of the area, the analogy of even-aged sediments and similar genesis formations of adjoining the territories both on the – territory and abroad of Ukraine. In this comprehensive analysis the Marmarosh klippen belt may get a proper understanding of its nature and place in the structure of folded Carpathians.

Keywords: Marmarosh klippen belt, tectonics, overthrust, landslide, nappe, olistostrome, horst-anticlinorium, magmatism, ophiolite complexes.

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**PALEO- AND EXISTENT HYDROGEOLOGICAL CONDITIONS
OF THE BILCHE-VOLYTSYA ZONE
OF THE CARPATHIAN OIL- AND GAS-BEARING PROVINCE**

On the basis of paleo- and modern hydrogeological signs it was possible to establish a space-time mechanism of formation and reservation of gas and oil deposits in the Bilche-Volytsya zone of the Carpathian oil- and gas-bearing province.

The time interval of their forming applies on the last cycle of the hydrogeological time. Geodynamic and secondary geostatic loadings, that manifested themselves during the dynamo-elision stage (Late Badenian – up to the present) the development of which was caused by thrust motions of the covers, turned out to be the factors of migration of aqueo-hydrocarbon mixtures deep underthrust structures of the Inner zone. Time calculations for reservation of deposits of gas fields have determined their age which does not exceed 6 million years.

The south-western trend of motion of paleo- and modern infiltration waters in combination with reversed dynamo-elision have caused here the existence hydrodynamically balanced system squeezed between them which differs by favourable conditions for the formation and reservation of hydrocarbon deposits.

We have ascertained the connection between piezomaxima and areas of tectonic dislocation, mainly transverse, that points out the ways of transference of hydrocarbon mixtures from deep-seated horizons. Discharge areas (perspective on a plane of searching for new deposits) are limited by local piezomaxima on the background of regional fields. Areas of paleopiezominima in the near-fault part of the Ugerske-Kosiv blocks at the boundary with the East European Platform are favourable for localization of hydrocarbon deposits.

Results of the barosmotic analysis of hydrogeological conditions of gas and oil fields have revealed barosmotic flows of waters molecules in the thickness of clay rocks, their intensity and directions of motion and connections with deposits.

Keywords: Bilche-Volytsya oil- and gas-bearing zone, paleohydrodynamics, hydrogeochemistry, elision, infiltration, barosmose.

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Yosyp SVOREN

**ON NEW APPROACH TO DETERMINING HEAT-PRODUCING
OF NATURAL GAS SUPPLIED TO CONSUMERS
AND ITS CUBIC METROBAROMETRY**

It is shown that with the change in pressure and temperature of natural gases in storages gas-holders, different installations one can separate water in necessary concentration from hydrates of hydrocarbon gases in their composition that forms its increased admixture in pipes and in the long run it influences the final heat-producing of the fuel. New approach was proposed as to the determining of heat-producing of natural gas supplied to consumers by the way of substantiation of the necessity to introduce such a unit as cubic metrobar ($\text{m}^3 \text{bar}$). This would be conducive to determination of the correlation between heat-producing of produced natural gas and gas supplied to consumers, that is to say, determination of quality of consumed gas.

Keywords: cubic metrobarometry, natural gas, gas hydrates, water steam, process of burning.

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NAUMKO Ihor. VII International Scientific Conference “Geophysics and Geodynamics: prediction and monitory of geological environment”

PAVLYUK Myroslav, NAUMKO Ihor, POBEREZHSKY Andriy. Sparkling 90th anniversary of professor Orest Illiarovych Matkovsky