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GEOLOGICAL-GEOPHYSICAL DEEP MODEL ALONG THE TRANSCARPATHIAN SEISMIC GEOTRAVERSE DOBROMYL-KRAKOVETS

With an aim to search oil-and-gas prospective objects in the department of geophysical studies of L'viv branch of Ukrainian State Geological Research Institute in the years 2006–2007 reinterpretation of seismic data with gravimetry and electrometry in wide strip of Dobromyl-Krakovets geotraverse of Transcarpathian stretch was done.

Geotraverse was synthesized on the basis of series seismic profiles worked out by Western-Ukrainian geophysical exploration expedition (WUGEE) "Ukrgeophysika" in 1972–1979.

The work forwards the implementation of Polish-Ukrainian cooperation project "Transboundary investigations of deep geological structures of Carpathians coastal strip for the aspect of studying and discovery of oil and gas pools" [1].

According to results of carried out investigations along the geotraverse deep geological model of Dobromyl-Krakovets geotraverse (Fig. 1) was built, which explains geological cross-section structure of series structurally-tectonic zones.

According to tectonic division [2] geotraverse crosses pre-mountain section of Carpathians within the structure of Sambir nappe, which is thrust over Bilche-Volytsa zone. The Bilche-Volytsa zone includes Krukenychi and Kosiv-Ugerske subzones, made up of molasse autochtonous Neogene deposits. The base of Bilche-Volytsa zone is formed by Mesozoic deposits (Jurassic) in Kosiv-Ugerske subzone and Cambrian Riphean (?) in Krukenychi subzone. Bilche-Volytsa zone divides into subzones by large Krakovets fault with 1.5–2.0 km amplitude.

Geological cross-section of Bilche-Volytsa zone is significantly studied by seismography [3, 4]. Series of hydrocarbon pools were discovered here by drilling. The most productive on gas pools are Sarmatian deposits of Neogene. They were discovered in anticlinal structures of Lower and Upper Dashava subsuites. Gypsumanhydrite horizon of Upper Badenian controls the structural forms of hydrocarbon traps n Bilche-Volytsa zone. Gypsumanhydrite horizon is significantly marked in wave field by high amplitude reflection. The Neogene horizons anticlinal structures inherit paleonoses of eroded relief of Pre-Neogene base, which is covered by gypsumanhydrite horizon.

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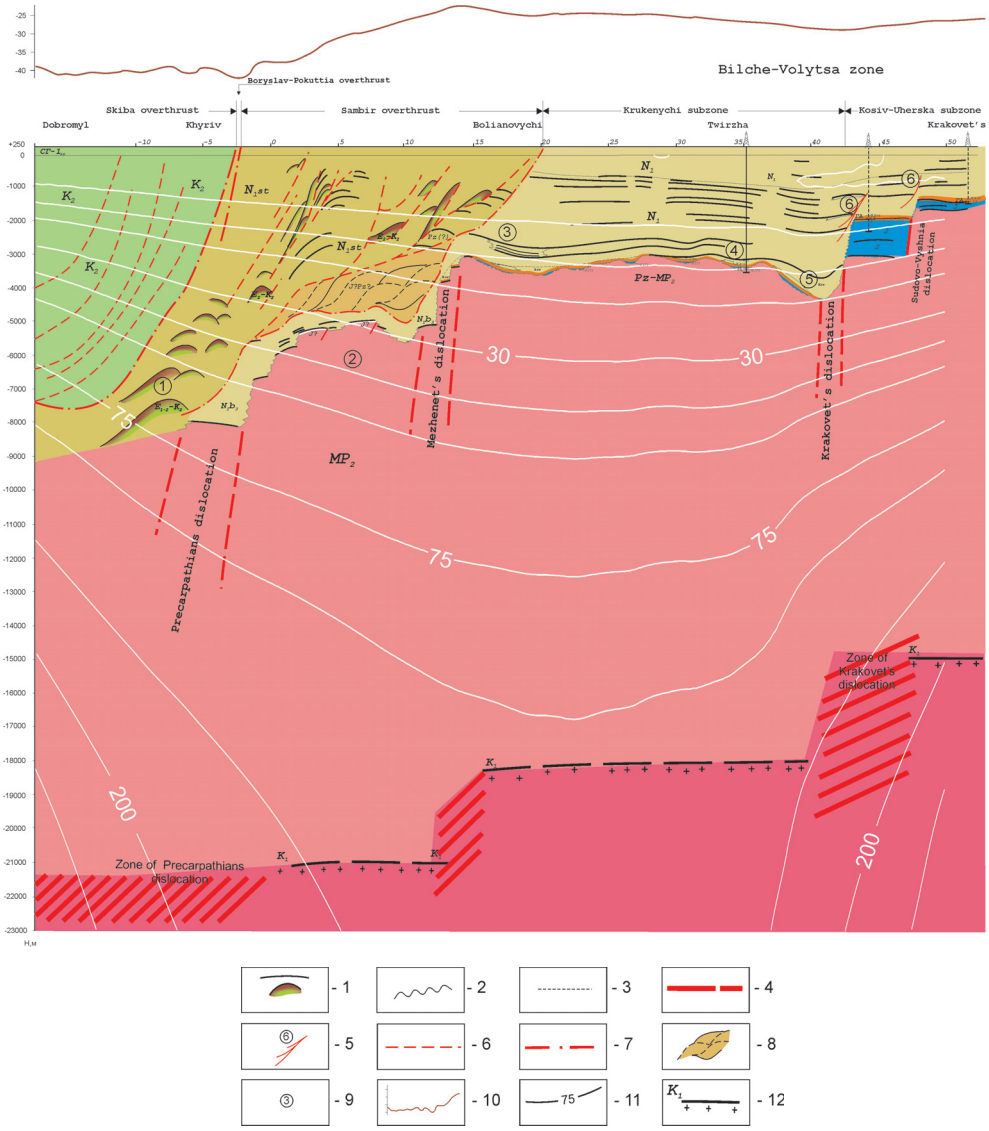

Fig. 1. Deep geological-geophysical model of cross-section along Dobromyl-Krakovets geotraverse. Compiled by Kh. Zayats, R. Moroshan. 1 – Reflecting horizons according to CDP data and their fragments, 2 – Paleorelief erosional surface of Premiocene surface, 3 – Conventional stratigraphic boundaries, 4 – Autochthonous tectonic faults, 5 – Gravitational shifts, 6 – The limits of allochthonous complex scales, 7 – Nappes fronts, 8 – Conglomerates in allochthonous, 9 – Prospective objects: ① – in Cretaceous- Paleogene folds of Sambir nappe, ② – on paleonoses of autochthonous surface, ③ – bolianovychi, ④ – in undergypsum rock mass, ⑤ – in Badenian deposits, ⑥ – over the bench of Krakovets and Sudova-Vyshnia fault; 10 – Graph of gravity Δg, 11 – Isolines of interval resistance in ohm.m, 12 – Surface of Pre Riphean crystalline basement

Within the area of Kosiv-Ugerske zone gas pools were discovered in Neogene (Svidnytsia, Vyshnia, Vyzhomlia and other fields). In Jurassic deposits oil pools were discovered (Kokhanivka, Orkhovychi fields) in anticlinal type of traps.

In Krukenychi zone gas fields are connected with anticlinal forms of Neogene horizon, which are located along Sambir nappe front.

The carried-out investigations in geotraverse Dobromyl-Krakovets strip indicate the possibility of new types of hydrocarbon traps discovering in geological cross-section.

We prognose lithologically-screened traps in horizons of Lower Dashava subsuite in Bilche-Volytsa zone, which are formed by groups of sandstones on the slopes of anticlinal uplifts. The isolated groups of dynamically expressed reflections of horizons in Sarmatian, which appear on time sections of geotraverse Dobromyl-Krakovets in Bolianovychi-region (Fig. 1) correspond to lithologically screened traps in wave field.

To prospective strata we include also undergypsum part of deposits, which is concentrated in paleobreaches of Pre-Neogene surface of Krukenychi subzone on the area Bolianovychi-Lypnyky (Fig. 1). As the well Tvirzh-1 shows, undergypsum strata can contain rests of Jurassic oil-and-gas-prospective formations. The indicated paleobreaches on the eroded surface of Riphean are not very wide, but, as paleobeds they can have longer stretch and area.

Not less prospective for the presence of lithologically limited traps we can name rock mass of Badenian deposits, which fills the areas of gypsum-anhydrite horizon downwarping of Tyrrassian suite on the area Bolianovychi-Oselia.

Special attention should be put to adjacent area in the bottom of Krakovets break, where thickness of Badenian deposits is the largest (600–700 m), and to the areas of Badenian deposits wedging-out on the north-east slopes of paleonoses.

Despite of seismic surveys and drilling, in Kosiv-Ugerske subzone we discovered a new type of structures, the development of which we prognose over the fractures along the stretch of benches of Krakovets and Sudova-Vyshnia faults. These half-anticlinal structures on Sarmatian horizons are located above the lifted faults wings. So, the idea is expressed about the formation of half-anticlinal structures of Sarmatian horizons, which in the process of sedimentation rise of fault amplitude and rock mass of Neogene fell off under the gravity force in the direction of it's lowered wing.

According to prognosed mechanism of formation, separated from each other and adjacent to planes of gravitational shifts, half anticlinal structures stretch like chain along the bench of Krakovets fault in the direction Oselia-Hlynychi (near Poland border). In this strip along the horizon of Sarmatian Lower Dashava subsuite, series of gravitational shifts structures were discovered. Nearby is located Niklovychi gas field.

Similar chain of half-anticlinal structures of gravitational shifts was discovered in the strip of Sudova-Vyshnia break bench and these structures border with Vyzhomlia gas field.

The described half-anticlinal structures in Sarmatian deposits over the zone of Krakovets and Sudova-Vyshnia breaks can be studied as independent hydrocarbon traps and can be recommended for further geological-research works as oil and-gas-prospective objects of new research type.

The deep model of geological cross-section along Dobromyl-Krakovets illustrates the character of sedimentary nappe formation in corelation with peculiarities of Pre-Neogene platform base bedding (Fig. 1).

Its step like sinking in the south-west direction by the system of large Precarpathians, Mezhenets, Krakovets, and Sudova-Vyshnia faults causes the formation of structurally-tectonic zones of sedimentary nappe and provides the formation of sedimentation Neogene basin of autochthonous Bilche-Volytsa zone and frontal nappes of Carpathians (Sambir and Skyb).

So, Bilche-Volytsa zone showed that it was rich in oil and gas pools, but hydrocarbon prospects of Sambir nappe remain not yet researched. They can be linked with Cretaceous-Paleogene folds of Boryslav-Pokuttia nappe, which dissipated in it under the influence of lateral forces from the side of Carpathians and resistance from the side of large benches of Mezhenets and Precarpathians high amplitude benches.

The deep geotraverse model Dobromyl-Krakovets is coordinated with the observed curve of gravity acceleration and distribution of differential electric resistance according to magnetotelluric sounding data (Fig. 1) which are changed synchronically with deep of boundarys bedding.

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