GEODYNAMICS AND GAS BEARINGS OF THE TRANSCARPATHIAN FOREDEEP

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Abstract: The Article presents an issue of geodynamic conditions of forming of the Transcarpathian foredeep from the position of tectonics of the lithospheric plates and proves an existence of a collision zone and a sloppy subdiction of Eurasian plate beneath the microplate of the Panonian depression. Gas field data of the foredeep is given.

Key words: Transcarpathian foredeep, geological development, gas fields.

The Transcarpathian Foredeep, as well as entire Carpathian folded system, to which it belongs, was formed in the epoch of the Alpian folding. In turn the Carpathian system is a member of Mediterranean folded belt, which appeared on a place of the vast Ocean Tethys that at the end of Middle Jurassic partitioned supercontinent Pangea on the Lavrasia and Gondvana.

Early Alpian rifting in the Carpathian region was connected with the formation of large–scale cells and spreading of lithospheric plates. At the beginning of Creaceous age the sea began to reduce. Thus, the Mediterranean folded belt is intercontinental, for the process of its development are characteristic the crust obsorption collision of continents and microcontinents.

The presence of the oceanic crust in this region synonymously is confirmed by the revealed ophiolites, which are known in the Internal Carpathians, Transcarpathian depression and the Pannonian trough. Such placing co-ordinates with the major mechanism of obduction at the closure of ocean type basins. As is known, the ophiolites are always in the allochthonous state and stratigraphic the ophiolites of the Transcarpathian depression and Internal Carpathians are referred to the Triassic, Jurassic and Lower Cretaceous.

The Cretaceous and Paleogene flysch deposits of the Carpathian zone were formed in the boundaries of Pre-Cambrian geostructures: the Czech massif, Volyn-Podillia and Misiya plates and the Pannonian middle massif. The presence of these rigid boundaries and their outlines conditioned appreciably the modern configuration of the Carpathian folded system.

In the Cretaceous and Paleogene in the Carpathian region on the passive outskirts of the East–and– West–European platforms begins to form a powerful accretionary terrigenous wedge

composed with the flysch formation. On the place of the Transcarpathian depression subduction zone is formed above which the volcanic zone appeared and before it the deep–water trough began to develop–forearc trough. In the outskirts sea, which occupied the territory between the Pannonian massif and the modern zone of Pieniny Rocks the deposits of Creataceous and Paleogene were formed – the basis of the Transcarpathian depression.

In the forearc trough, which appeared between a volcanic zone and marginal bar of the platform passive outskirts a melange was formed composed by the unregulated mixture of sediments, which were fetched down both from marginal bar and from volcanic zone. The typical representatives of such sediments are marls, sandstones massive, gravelstones, conglomerates, debris of limestones, granitoids, quartzites of the Cretaceous and Paleogene age of the modern zones of Pieniny and Marmarosh Rocks. The marginal bar of the forearc trough could be limestones, possibly reef limestones of the Jurassic and Cretaceous age. Opposite to the marginal bar shore of the outskirts sea was Pannonian massif. This middle massif is composed with the diabase–phyllites, sandstones and argillites of the Upper Cambrian, Ordovician and Devonian, mollasse-like sediments of the Carboniferous and Permian, Triassic and Jurassic sediments of platform, flysch-like sediments of the Cretaceous and Eocene, on the erosive surface of which the rocks of Miocene were deposited. As it is visible, the Pannonian middle massif was formed on the crust of a continental type. Thus, in the region of the Transcarpathian trough contemporary location in the end of Cretaceous – in the beginning of Paleogene age begins the collision formed on a crust of the continental type of the microcontinent of the Pannonian massif with the continent Eurasia. The area above which the outskirts sea was formed as follows from the presence of ophiolites, undoubtedly, was formed on the oceanic type crust. However on the initial stages of collision development in this region (the end of Lower Cretaceous–Paleogene), when the spreading has ended and has finished the absorption of the oceanic crust into a flat zone of subduction here the conditions of contraction were established.

These conditions naturally have provoked the extension of the trough wings and accordingly decrease of their thickness that has resulted that in the Transcarpathian trough which began to be formed the faults have appeared and the volcanic activity began. As is established, the beginning of intensive volcanic activity is marked in the Late Paleogene. This Paleogene volcanism was the beginning of the collision and origin of the Transcarpathian trough. With the progressing of the collision process and gentle subduction the area of the trough should sag more and more and the intensity of volcanic activity – to increase. Actually this took place in the Transcarpathian trough, where analyzyng the lithological composition of its rocks we see, that in the section beginning from the Lower Badenian and ending with Dakia–Rumania constantly are present volcanogenic deposits:

tuffs, tuffites and tuffaceous sandstones. The thickness and spreading of these deposits testify about the volcanism scale, and the last depend from flexure amplitude and accordingly from the trough tension at the common action of compressing forces and mountain building in the orogenic zone. Such sees the logic scheme of the Transcarpathian trough forming proceeding from the theoretical preconditions of the lithospheric plates tectonics theory (fig. 1).

The beginning of the collision was accompanied by the compression in the very great of accretionary flysch wedge that was formed on the platform outskirts. In result here have begun to be formed cordilleras, which in the Paleogene reached their development that was a reason of different lithologic–facial zones of Cretaceous and Paleogene forming and taking into account which carry out the division of Folded Carpathians.

The different parts of the Transcarpathians trough were sinking with different intensity. In the Badenian more intensively sank south–eastern part of the trough (Solotvyno depresssion), in the Sarmatian – north – western part (Mukachevo depression). In the Solotvyno depression in the Badenian the powerful rock masses of evaporite deposits were formed and in the Mukachevo depression in that time intensively became apparent intrusions of granodiorite–porphyrytes. The most intensive volcanic activity was shown in the Sarmatian, Pannonian and Dakia Rumania. In the same time became apparent and compressing forces, about what testifies more often north–western–south eastern strike of the Transcarpathian depression brachyanticline structures.

Now the territory of the Transcarpathian dapression as well as all Carpathian region are in the end of orogenic stage of development. This territory is characterized now by the great seismic activity.

The earthquakes here are connected with the unloading of stresses provoked by the processes of collision and subduction on gently dipping under the Pannonian trough Beniof zone. The subduction of the Eurasia plate under the Pannonian microplate became a reason of the mantle masses warming-up and appearance of the mantle astenolith, its lifting and decrease of the crust thickness under the Pannonian trough. By this can be explained a high position of Mohorovičic discontinuity under the Transcarpathian depression and Pannonian trough.

On the given time in the Transcarpathian depression are discovered four gas fields (Solotvyno, Rusky-Komarivtsi, Korolevo, Staniv) and Martiv deposit of carbonic acid gas (fig. 2).

Solotvyno gas field is timed to the structure of the same name, which by the top of Badenian undersalt deposits is a brachyanticline of sublatitudinal strike.

By the transverse daslocation with amplitude 630 m, which passes across the crest, the fold is broken into two blocks. The salts of the Upper Tereblya subsuite form a salt stock which goes on the surface in 2 km south-west of the structure crest. The gas – bearing is the more lifted south – western block. Commercial gas presence of the Badenian Novoselytsa suite is established from

which in the well 1 from the interval 1440 – 1530 m gas flow rate was 137 thousand cub.m. per day. The main reservoirs are the tuffs and tuffites, which are characterized by porosity 6 – 13 %. The important meaning has the fracturing, which is caused obviously by the proximity of longitudinal and transverse disturbances. The gas contains 95.6 % of methane, 3.4 % methane homologs, 0.3 % carbon dioxide, 0.66 % nitrogen. Formation pressure at the depth 1485 m is equal 14.73 MPa. The pool is a roof deposit, massive. The cap rock of the pool are the beds of salt and clay of the Tereblya suite.

Rusky Komarivtsi gas field is connected with the brachyanticline fold broken on blocks by the dislocations. The brachyanticline is formed in the result of of gabbro-diabase – basalt intrusion in the Badenian deposits.The presence of seven independent gas pools was established.

Below the intrusion in the Badenian sandstones two bedded roof pools are revealed connected with the sandstones with the effective thickness 7 – 11 m and porosity 14 –18 %. The gas flow rates are 16–67.5 thousand cub. m per day. The major pools are discovered in the Dobrativ suite of Sarmatian. They are timed to the sandstones with thickness from 4 m up to 31 m and porosity 9–21 %. The accumulations are bedded roof pools, which are tectonically screened by the large fault with amplitude up to 600 m and which passes across the central part of the structure. The gas flow rates are 45–72 thousand cub. m per day. In the Lukiv suite of the Sarmatian is revealed the gas pool in the sandstones with the thickness 12 m and porosity 18 %, and gas flow rate – 75 thousand cub. m per day. The accumulation is a roof pool tectonicaly screened. The occurrence depth of pay horizons is from 900 m up to 1650 m. The gas contains 60 – 73 % of methane, 0.1 – 4 % of ethane, 0.3 – 0.9 % of carbon dioxide, 25 – 33 % of nitrogen.

The Korolevo gas field is located to the south-east from the town Vynogradovo and is timed to the structure, broken by the longitudinal failures on a number of blocks. The revealed gas pool in the northern longitudinal block, inside of which are localized two small domes. The well 2 – Korolevo which was drilled on the eastern dome to depth 1600 m passed the deposits of Levantin, Pannonian, Sarmatian, Badenian, Carpathian and stopped with drilling in the Jurassic deposits of the depression base. The gas pool which was discovered in the Pannonian sandstones and from which in the interval 710–740 m was obtained gas influx with the production rate up to 125 thousand cub. m per day. The formation pressure at the depth 725 m is 7.7 MPa. The sandstones are characterized by porosity 14–12 %. The gas contains 60.2% of methane, 3.1% of methane homologs, 26.6 of nitrogen, 10.6% of carbon dioxide.

Staniv gas field was discovered in the eastern part of Mukachevo depression. It is timed to the brachyanticline fold of the same name, which is dislocated by the tectonic fractures of sub–meridional and north–eastern direction. The seismic data have shown non–coincidence of the

reflecting horizons structural plans in the Badenian and Sarmatian. In the well–2 commercial gas influxes have been obtained from the sandstones of Sarmatian from the intervals 310–390 m and 238-192 m and production rates 115 thousand cub. m and 15.3 thousand cub. m per day correspondingly. The formation pressures in the pools are close to hydrostatic. The gas contains 95% of methane up to 0.03% of methane homologs 3.5% of nitrogene, 0.2% of carbon dioxide.

Martiv field of the carbonic acid gas (its content reaches 98%) is discovered near the town Mukachevo in the structure of the same name. The reservoir is timed to the Badenian deposits at the deph 900–968 m. The output of carbonic acid gas reaches 12 thousand cub. m per day.

Taking into consideration the presence of discovered and prepared structures it is possible to expect discovery of new fields in the Transcarpathian depression.

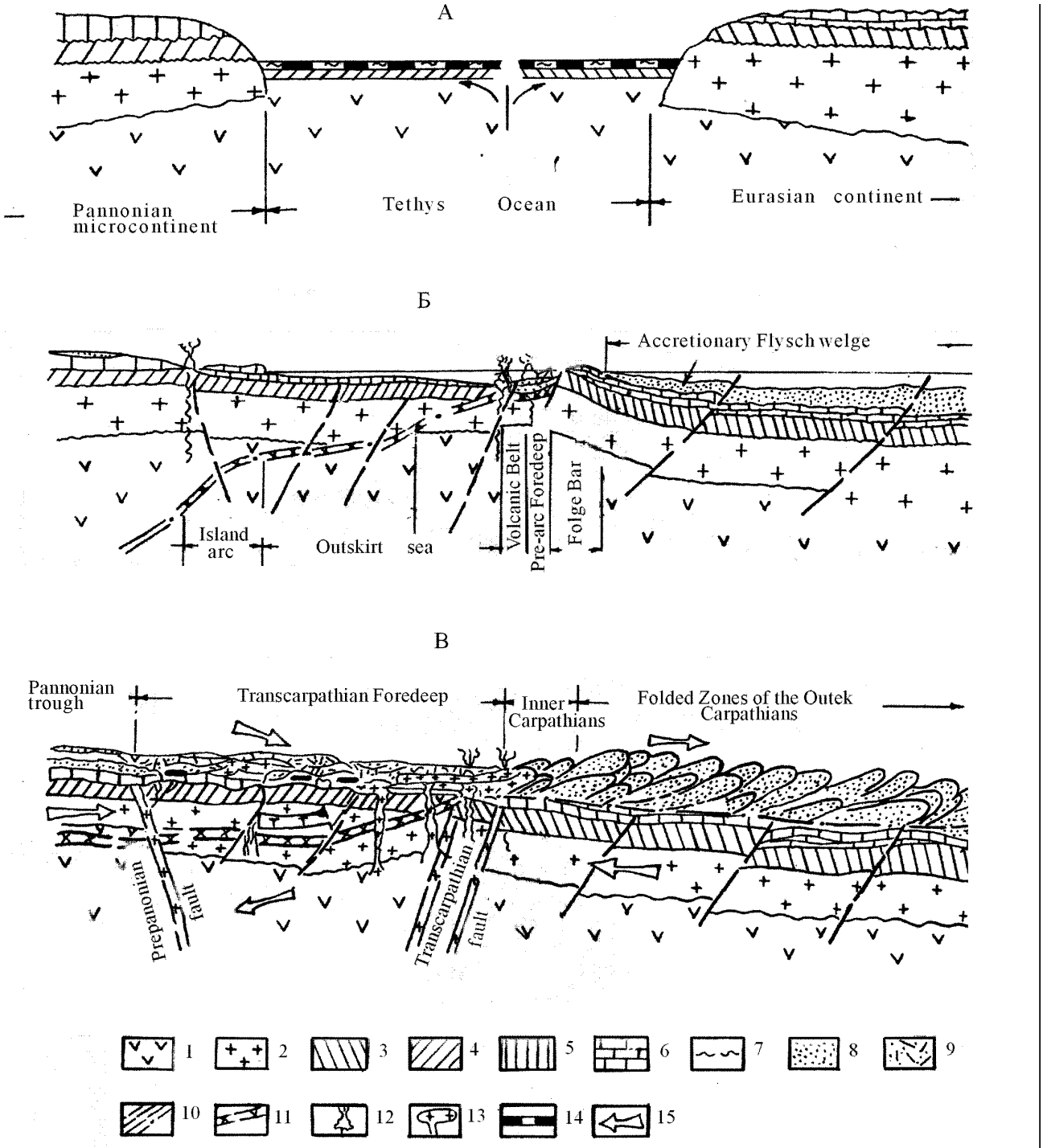

Fig.1. Scheme of the Transcarpathian depression geodynamic development
A- Jurassic - early Cretaceous; Б - late Cretaceous - early Paleogene; B - Pannonian;
1 - oceanic lithosphere; 2 - continental lithosphere; 3 - Paleozoic - Proterozoic deposits of the Pannonian microcontinent;
4 - Paleozoic - Proterozoic deposits of the Eurasia continent; 5 - Mesozoic covers of the Pannonian masiff;
6 - Mesozoic deposits of the cover of the passive platform margin; 7 - Mesozoic deposits of the ophiolite zone;
8 - flysch deposits of the Cretaceous - Paleogene; 9 - molasse deposits of the Neogene;
10 - faults, tectonic dislocation (thrusts, nappes); 11 - Beniof zone; 12 - volcanos; 13 - intrusions; 14 - ophiolites;
15 - directions of the tectonic forces.

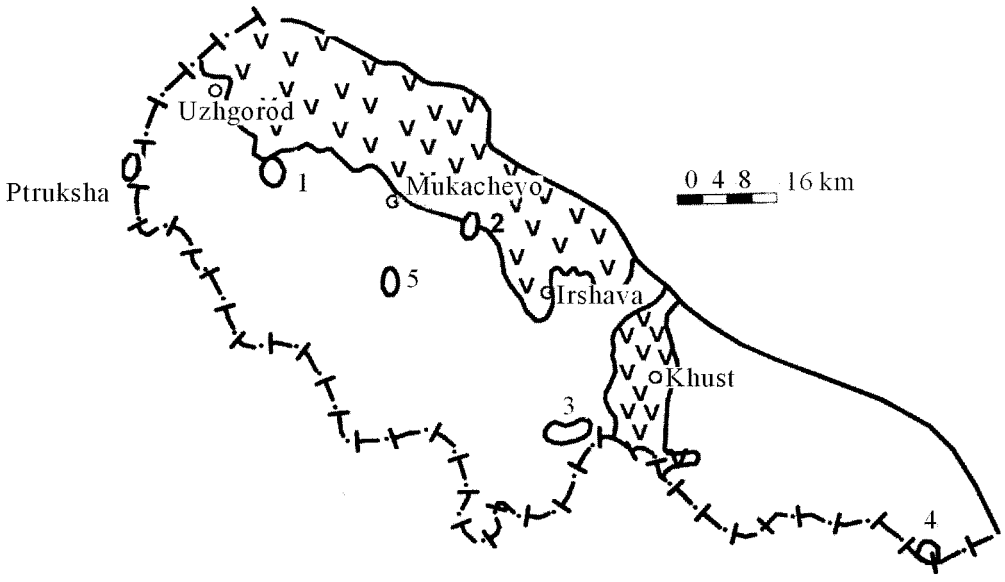

Fig.2 Transcarpathian foredeep. Gas field.
1 - Rusco-Komarivske; 2 - Stanivske; 3 - Korolivske;
4 - Solotvinske; 5 - Martivske.