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NEW DATA ABOUT THE GEOLOGIC STRUCTURE OF KROSNO ZONE AS A RESULT OF DEEP DRILLING AND ESTIMATION OF ITS GAS AND OIL BEARINGNESS PERSPECTIVES

Krosno cover on the territory of the Ukrainian Carpathians is traced from the river-heads of the Dnister, the Syan, and the Uzh on the north-west to the basin of the Teresva (suburbs of Ust-Chorna village) on the south-east. It borders with Rosluch structural element in the basin of the Dnister and the Stryi (analogue of the Subsilez cover), and further on the south-east with Skole cover. Deposits of Chornohorian and then Klimovo and Duklia covers are partly moved up on Krosno cover from the south-west.

On the surface Krosno cover consists mainly of the Oligocene – Lower Miocene deposits on the basis of which it is considered to be the depression (synclinal structure). However, according to structure searching and deep drilling material, its inside structure is represented by the range of flakes and cobs, which by the structure are similar to Scole cover. The great importance for finding of flake inside structure of cover has a tracing on the area and in the section of striped limestones horizon. The boundary between Oligocene – Lower Miocene is conditionally drawn on it and also separation of massive strata (1300–3800 m) of Menelite-Krosno formations in two non-facies Holovets and Verkhovyna suites.

Krosno cover is divided into Turka (the north) and Bitlia (the south) subzones according to lithology-facial characteristics of Menelite-Krosno formations [1, 2, 5].

Typical characteristic of the first one is large thickness of Oligocene – Lower Miocene formations which twice and somewhere three times exceed the thickness value of the equivalent deposits of the south subzone.

Turka subzone includes such cobs as (from the north to the south): Hroziv, Limna and Ropava (Fig. 1).

Hrosiv consists of Hrosiv and Shumyach-Zavadiv flakes which are traced across the Polish-Ukrainian border to Turka sigmoid. In this direction they are gradually dipping, overlapping each other and tectonically they are wedging out.

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Fig. 1. Geological cross-section on the line Sianky-Turka
Limna cob includes Bystry, Lopushanky-Khashchiv, Besimenna and Charna flakes. Oil seepage in Limna suburb has been known since 1878. The beginning of oil production was started in 1928. Two wells were dug here from which 69 tons were received. Later on the wells were deepened by drilling (1,2 Lysania) to 155m with oil withdrawal of 4 tons.

In 1949–1950 and partly in 1958 structure-searching drilling has been carried out in the area of Lopushanka – Khashchiv – Limna – Vovche, which proved the presence of anticline with the length about 20 km and the width 0,5–1,0 km. Oil and gas seepages have been observed almost in all boreholes during the drilling and in some of them (7-LK) industrial influxes (5,7 t/24 hours with 30% admixtures of water) were observed.

Repeated works on the given area took place at the beginning of 1970–1990 years. The deep boreholes 1, 2–Limna and 10, 21–Khashchiv-Lopusha were bored on this territory.

Combustible gas influx has been got with production rate of 4–5 thousand m³/24 hours in the borehole 21-Rhl from the interval 952–1070 m. Gas horizons were found out in 10 Rhl within the intervals 585–627 m, 720–819 m, and 880–930 m (with visual production rates 2000–7000 m³/24 hours).

Charna, Lipye and Bystry mining have been discovered on the basis of these data and due to the fact that Limna cob includes Charna and Bystrytsa Flakes [4]. We consider all the composition structural elements of cob across the Polish-Ukrainian border to Turka sigmoid perspective for the searching there industrial accumulations of hydrocarbons.

Limna cob has meridian course in the area of Turka sigmoid and it considerably narrows in this crossing. The cob obtains general Carpathian strixe again on the south-east from Smozhe district. It becomes wide and new flakes appear in its composition (Yalynkovata). There is general uplift in this direction and it is proved by exposure of the Eocene formations on the surface.

Ropavska cob is traced on all over the area of subzone and partly covers Limna cob. Narrow Yablonka flake is a part of cob and is located in front of Bitlia subzone from suburbs of Verkhnia Yablonka village on the west to the Tukholka 1 borehole, i.e. the area of Turkivska sigmoid. The width of cob at the border is 3–4 km and it narrows together with Yablonka flake to 1,5 km on the territory of sigmoid and it broadens to 7,5 km on the south-east. New flakes appear (Novoselka, Holiatytn) and its general uplift takes place similarly to the previous cob.

Ropavka and Zahoriv anticline folds were mapped after deposits of Nyzhnoverkovynka (Nyzhnokrosnenka) subsuite within the cob in 1950.

Profile structure-searching drilling was held on Turka area in 1965–1966. However, boreholes did not open project horizons of Eocene because of small depth and as a result industrial accumulations of hydrocarbons were not discovered.

The small volume of seismic and gravimetric works was done on the area of Borynia-Limna in 1960–1970. And as a result, Borynia, Khashchiv and Limna deep folds have been marked by the phantom horizons.

Two arched uplifts have been marked on the top of Holovets suite: the south and the north on the first fold. The last uplift is direct continuation on the depth of surface Ropavka anticline, and the south one – Zahoriv anticline.

Two parametric boreholes were drilled on Borynia deep structure in 1973–1981. Moreover, transitory but intensive gas outburst was got in the first borehole (440–500 thousand m³/24 hours). Ten gas horizons have been got with production rates from 0,7 to 10 thou-
sand m³/24 hours in the second borehole. We recommend to bore in profile with 1, 2-Borynia (in Yablonka block) profile from three holes (5, 6, 7-Borynya). This is the only very important argument of positive estimation of oil and gas bearingness of Oligocene formations of Krosno cover on our area.

Bitlia subzone includes the range of flakes in the south-west part of Krosno cover. Borynia, Nyzhnia and Verkhnoturka flakes are marked in the frontal part (V.V. Hlushko, V.V. Kuzovenko, V.Ye. Shliapinskyi, 1962). They extend across the Polish-Ukrainian border on the west to the borehole 1-Tukholka, where they are locked on Smozka structure. We unite them into one Borynya cob.

The following Yavoriv, Polyana and Syanky-Syglovat flakes are marked in Yavoriv cob, Libokhora and Uzhok flakes are marked in Uzhok cob, and Polonynka (Husnohy), Volosianka, Sukhoro are marked in Bukovets cob.

Yavoriv cob is observed on all over the area of Bitlia subzone and it passes to the territory of Poland, where such fields as Stuposiany, Dvednik, Zatvarnytsia and Polianky have been discovered. Pools are located mainly on depths from 100 to 1500 m and related to sandy horizons of Krosno deposits. The deposits are connected with the narrow anticlassal folds-flakes with sloping, extended, tucked up and cut opposite wings. Traps are lithology-arched and tectonically screened [4].

Yavoriv cob is the most perspective in oil and gas. It has oil yield and oil and gas horizons discovered by boreholes. There are favorable structure conditions for hydrocarbons accumulation. Two boreholes were bored on the place of oil seep in Yavoriv village in 1910–1911. The first borehole is 1-Yavoriv; bottom-hole 920 m opened two oil horizons on depth 300 and 900 m. Twenty-two tones of paraffin petroleum were got from it during research. However, because of war the works have been stopped.

Structure searching drilling was held on Yavoriv and Uzhok cobs in order to find oil and gas pools and confirm Bitlia structure in 1957–1958. The only one cross profile among three planned from nine holes on the line Uzhok-Yavoriv was bored. Oil and gas seepages were observed almost in all boreholes during drilling. The largest among them were Boreholes 7 and 8-Bitlya (M.B. Staroselskyi). Oil seepages of 8-Bitlia borehole have been marked on depths 76 m, 118 m, 172 m, 292 m, 320–365 m, 793–810 m, 864–1003 m. It was observed after drilling in open bottom-hole and as a result oil influx with production rate 1,5 t/24 hours was received. Water has been received together with oil. Six tons of oil and four tons of water have been mined for 7 days. Oil seepage of 7-Bitlia borehole has been marked on depths 90 m, 200 m, 310 m, and 420 m. Oil has different quality here. For example, specific gravity of oil on the depth 310 is 0,824 kg/m³ and on bottom-hole 420 m is 0,850 kg/m³. Light petrol oil has been met in the fractures of clay-sandy formations in 12-Bitlya borehole and gas seepage in 6-Borehole (interval 180–456 m).

All the boreholes are “hovered” in deposits of Krosno strata. As a result Bitlia fold with Menilite deposits in the core of the structure has not been approved.

Nothing was done about geology structure of this region after repeated deep structure drilling with depths 710–1887 m in 1963–1964. Flake structure of this region was approved. A few horizons (4–5) of acid sinters have been discovered for the first time among Krosno layers. They are deposited below the striped limestones (Boreholes 12 and 18 Yavoriv). The conclusion has been done that the most important oil and gas pools should be connected with more deep bedding Paleocene – Eocene and Cretaceous deposits. For this reason parametric
borehole 1-Bitlia with planned depth 3600 m has been started to drill. At this moment the borehole is in conservation with bottom-hole 3205 m in deposits of Verkhnogolovets sub-suite. It opened two gas horizons during drilling at interval 1866–1933 m and on bottom-hole. It should be added that important gas seepage was in 18-Bitlia borehole (structure searching, interval 1850–1860 m) which is situated in 1.5 km on the south-east from 1-Bitlya borehole on the same hypsometric level and it is widely spread in Yavoriv cob.

Eight deep boreholes: 1, 2-Limna, 10–Lopushanka-Khashchiv, 1, 2-Borynia, 1-Tukholka, 1-Mizhhirya, 1-Liuta have already been bored for oil and gas perspectives estimation of the Cretaceous and Paleocene – Eocene deposits on the territory of Krosno zone. For the first time the only 1-Tukholka among them opened full section of Paleocene – Eocene below the Menilite-Krosno formation and stopped in the Cretaceous deposits. After lithological deposits characteristics the borehole log is correlated with Istebnianskyi and Tsienzhkovitskyi beds on the territory of Poland.

We took the materials of deep drilling and also geology maps and natural sections (flaking-off) of some flakes and cobs for clarification of bedding conditions of the Paleocene – Eocene and Cretaceous deposits of Krosno cover across the Polish-Ukrainian border [2, 4, 6].

According to these data longitudinal strips comparatively to shallow and considerably dipped bedding of given formations are traced on transversal crossing of Krosno cover. The first strip is traced in front of Duklia cover. These deposits were opened by boreholes within absolute marks 2000–3000 m in the region of Vyetlina (Poland).

Bukovetska cob (Luzka, North Luzka or Sukhy flakes) gets into this strip on the area of Ukraine where the Eocene deposits get out on surface and Cretaceous deposits are forecasted to be on the depth 1500 m.

The second strip comparatively to shallow bedding of these deposits passes in Zatvarnytsia and Dvernyk regions, where it was opened by boreholes on the depth 2000–3000 m. Lybokhorska and Yavoriv cobs belong to this strip, too. Borynska cob should be referred to this strip. Borynya cob is locked on Smozka fold in upper stream of the Stryi River.

There is great dipping of the cover of the Eocene and Cretaceous deposits on the north-east. Such holes bored here as 1-Smolnyk (bottom-hole 4520 m), 1-Lutovysko (bottom-hole 4634 m), 1-Borynia (bottom-hole 4873 m) and 2-Borynia (bottom-hole 5232 m) have not come out from the Krosno deposits.

The far north strip of shallow bedding of the Eocene and Cretaceous deposits is situated in front part of Krosno cover and includes structural elements of Rostoky-Krosno (Poto ka anticline). The formations here are exposed on depths from 100 to 3000 m.

Given data give the possibility to do oil and gas zoning of Krosno cover more differentiated and also mark favorable territory for geology searching. Limna and Ropava cobs in Turka subzone and Yavoriv, partly Lebokhoriv, Bukovets cobs in Bitlia subzone have the greatest interest in oil and gas searching.

Parametric borehole 1-Luta (bottom-hole 3400) has been bored within Bukovets cob (Luha and Sukhy flakes) in recent years. It has opened Stavnya, Lubni and Luha flakes of Duklia cover, in the interval 875–3400 m Sukhy, Volosianka, Polonynka (Husny) Bukovets and Uzhok cobs and did not come out from the Oligocene formation. Combustible gas influx has been got during drilling on the intervals 1150–1154 and 2404–2455 m. The borehole is on the testing nowadays.
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