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Results of reconnaissance studies for hydrocarbon deposits within some districts in Northern Ukraine

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SUMMARY

The results of exploratory studies for hydrocarbons (HC) within five districts of the Chernihiv and Volyn regions of Ukraine are presented. The studies were carried out using mobile technology of integrated assessment of the oil and gas prospects of large blocks and local areas, including methods of frequency- resonance processing of satellite images and vertical scanning of a cross-section in order to determine the depths and thicknesses of forecasted of hydrocarbons accumulations and rocks of cross-section. The results of the work testified to the advisability of conducting the detailed exploration work for hydrocarbons in these areas. On the surveyed areas, the existence of a 57 km border was confirmed, in the area of which the synthesis of oil, condensate, gas and amber takes place. Additional materials have been obtained that testify to the synthesis of water at a depth of 69 km in volcanic complexes of a certain type. The practical application of direct-prospecting technologies will help to accelerate and optimize the search and exploration process for oil and gas.

Introduction. When conducting research in the Ukrainian marine Antarctic Expedition of 2018, a methodology for integrated assessment of the oil and gas prospects of local areas and large blocks was tested, based on the satellite images and photo images processing (Yakymchuk et al., 2019; Yakymchuk and Korchagin, 2019). In 2019-2020 this technology was purposefully used to examine poorly studied areas in Ukraine and in other regions of the world. The report presents the results of its application to assess the oil and gas potential of several districts in the Chernihiv and Volyn regions of Ukraine.

Methods of research. The experimental studies were carried out using the technology of integrated assessment of the oil and gas prospects of large search blocks and local areas, which includes methods of frequency-resonance processing of satellite images and photo images, as well as vertical sounding (scanning) of a cross-section in order to determine the depths and thicknesses of productive horizons and rocks in cross-section. The features of the technology used, as well as the results of its testing and practical application, are described in the articles and materials of the conferences, including (Yakymchuk et al., 2019; Yakymchuk and Korchagin, 2019).

The territory of Borznyansky district of Chernihiv region. When processing a satellite image of the district's territory (Figure 1), signals from oil, condensate, gas, amber, coal, anthracite, hydrogen and water were recorded from the surface. No response from salt was fixed. The presence in the cross-section of 1-8 groups of sedimentary rocks, as well as 6 and 7 groups of igneous were installed.
By fixing responses at various depths (50, 150, 250, 450 km) from the 2nd group of sedimentary rocks, the root of the channel, filled with sedimentary rocks of 1-6 groups, was established at a depth of 470 km. The roots of channels of 7 (carbonates) and 8 (dolomites) groups of sedimentary rock are determined at a depth of 723 km.
The root of the channel of the 7th group of igneous rocks is also set at a depth of 723 km.
The lower edge of 6 group (basalts) of the igneous rock is located at a depth of 95 km.
By scanning the cross-section from the surface with a step of 1 m, the responses from basalts were recorded from a depth of 275 m, and of hydrogen – from 340 m.

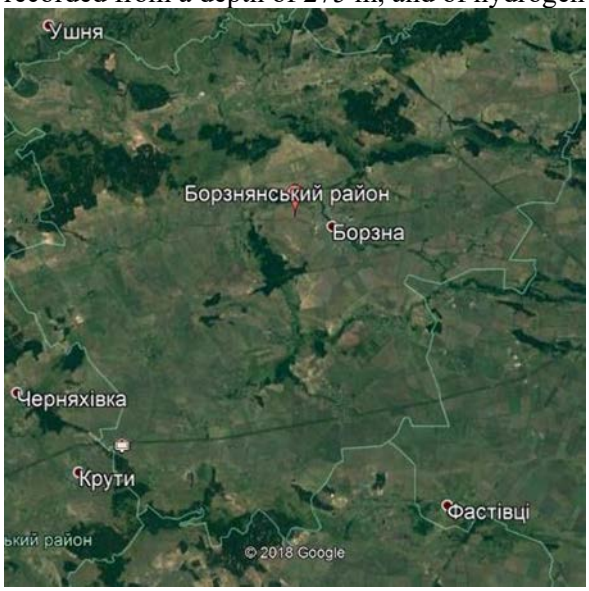

Figure 1 *Satellite image of the Borznyansky district of Chernihiv region.*

Figure 2 *A satellite image of the territory of Ripkinsky district of Chernihiv region.*

Water signals were recorded from the surface, as well as at a depth of 69 km in sedimentary rocks of 1–6 and 8 groups, as well as in the 7th group of igneous rocks; in basalts there were no water responses.
At a surface (depth) of 50 km, responses from oil were recorded in 1–7 groups of sedimentary rocks; in the 8th group (dolomites), no responses were received. Oil responses were also not recorded in 6 and 7 groups of igneous rocks.

By scanning the cross-section from the surface with a step of 1 m, responses from oil were recorded in the following intervals of the cross-section: 1) 540-1185 m; 2) 1660-1960 m; 3) 2485-3050 m; 4) 3435-4260 m; transition to a step of 5 m, 5) 14200-14850 m (up to 15 km traced).

The territory of Ripkinsky district of Chernihiv region. Responses from oil, condensate, gas, amber, oil shale, gas hydrates, ice, coal, anthracite, hydrogen (good) were recorded from the surface in the surveyed area (Figure 2); signals from brown coal and salt were not received.
Signals from 1, 2, 3, 4, 5, 6, 7 and 8 groups of sedimentary rocks and 6 (basalts) and 11 (kimberlites) groups of igneous rocks were recorded; there were no responses from diamonds.
By fixing responses at various depths, the roots of the following deep channels (volcanoes) were determined: 1) 1-8 groups of sedimentary rocks - 470 km; 2) 6 group of igneous rocks (basalts) - 723 km. The lower boundary of the kimberlites is determined in the range of 190-195 km.
On a surface of 50 km, oil responses were received from 1-7 groups of sedimentary rocks, and signals were not received from the 8th group. At the same depth, responses from water were obtained from 1–6 and 8 groups of sedimentary rocks, but not from the 7th group.
By scanning the cross-section from the surface with a step of 1 m, signals from basalts began to be recorded from 120 m and traced to 723 km.
Responses from hydrogen during scanning with step of 1 m were recorded from 230 m and traced to 723 km. The hydrogen signals were also obtained at depths of 724 and 1774 km (outside the basalts)
By scanning the cross-section from the surface with a step of 1 m, the responses from the oil were obtained from the following intervals: 1) 400-(700-strong) (800 very strong)-1180 m; 2) 2190-2780 m; 3) 3315-3580 m; 4) 3820-4110 m; 5) 4620-4820 m; on 5 m step, 6) 7100-7950 m; 7) 11400-13550 m (up to 15 km traced).
Within the surveyed area, responses (weak) from salt were also obtained.
Due to the signals fixation from basalts and hydrogen within the inspection area, a small area of visible hydrogen degassing was taken for additional studies within it (Figure 3).
Within its boundaries, a local zone is additionally distinguished (Figure 3, a rectangular contour). When processing the image in Figure 3 without a local zone, signals from basalts, hydrogen, and water are recorded. The root of the basalt channel (volcano) is set at 470 km.
By scanning the cross-section with a step of 1 m from the surface, responses from basalts were recorded from a depth of 230 m, from hydrogen - at 300 m, and from water - at 280 m. Signals from water were also received at a depth of 10 km.

Figure 3 *A satellite image of the local site of hydrogen degassing in Ripkinsky district of Chernihiv region.*

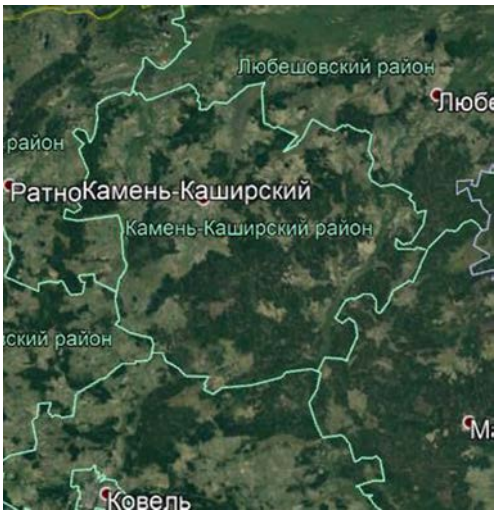

Figure 4 *Satellite image of the Kamin-Kashirsky district of Volyn region.*

When processing the image of the local zone (Figure 3, a rectangular contour), responses from hydrogen and basalts were recorded; signals from salt and 1-10 groups of sedimentary rocks were not received. The root of the basalt channel is determined at a depth of 723 km.
By scanning the cross-section with a step of 1 m from the surface, responses from basalts were recorded from a depth of 90 m, from hydrogen - at 120 m, and from water - at 100 m!

Water from the distribution interval of basalts and hydrogen can have healing and wellness properties. The same features of the deep structure are recorded in all the examined areas of longevity in various regions of the world. Within this area, it is advisable to conduct additional research, including with the aim of studying the healing properties of water.

Kamin-Kashirsky district of Volyn region. A satellite image of the Kamin-Kashirsky district with adjacent fragments of neighboring regions is shown in Figure 4. During its frequency-resonance processing from the surface, responses were obtained from oil (good), condensate, gas, amber, oil shale, mud breccia, gas hydrates, ice, coal, anthracite (strong), hydrogen, water (deep), salt.
Signals from 1, 2, 3, 4, 5, 6 (weak), 7, 8, 9 groups of sedimentary rocks and the 6th group of igneous (basalts) were also recorded. By fixing responses on various surfaces, the root of the channel (volcano) of 1-6 groups of sedimentary rocks was determined at a depth of 470 km, and 7-9 groups - at 723 km. At a depth of 723 km is also the root of the basalt volcano.
Oil responses were recorded at 57 km. At 56 km, signals from oil were obtained from 1-6 groups of sedimentary rocks, and from gas - from 1-7 groups of sedimentary rocks
Responses from water on a surface of 69 km were obtained from sedimentary rocks 1, 2, 6, 7 groups, as well as from basalts.
By scanning the cross-section from the surface with a step of 1 m, the responses from the oil were obtained from the following intervals: 1) 260-880 m; 2) 1260-(strong)-1830 m; 3) 2070-(strong)(very strong)-2420 m; 4) 2890-(strong)-3100 m; 5) 3655-(strong) (4400 - super strong)-4620 m; 6) 5350-(strong)(5700 - very strong)-5940 m; 7) 6300-6460 m.
Responses from gas were recorded during scanning at the following intervals: 1) 260-(strong) (very strong)-620 m; 2) 1370-(strong)-1660 m; 3) 2470-(good)(2800 - very strong)-3470 m; 4) 4770-(strong) (5300-strong)-5380 m; 5) 5960-(strong)-6770 m.
On the surveyed area, local zones of visible hydrogen degassing were also visually detected. One such zone in Figure 5 is indicated by a rectangular outline. When processing the image of this local zone, responses from hydrogen (very strong) and basalts were obtained.
By scanning the cross-section from the surface with a step of 1 m, responses from basalts were recorded in the interval from 175 m to 723 km, and hydrogen from 260 m to 723 km.
Unfortunately, signals from water (deep) within this local zone have not been received.

Figure 5 *A satellite image of the local site of hydrogen degassing in Kamin-Kashirsky district of Volyn region.*

Figure 6 *Satellite image of a local site of hydrogen degassing in Rozhischensky district of Volyn region.*

Local site in Rozhischensky district of Volyn region. Numerous zones of visible hydrogen degassing can be seen on satellite images in Rozhischensky district of Volyn region. One such area is shown in Figure 6.
During frequency-resonance processing of this image from the surface, responses from oil, condensate, gas, hydrogen, water (deep), as well as from 7-8 groups of sedimentary and 1-6 groups of igneous rocks were recorded.
By fixing responses on various surfaces, the roots of channels (volcanoes) of 7-8 groups of sedimentary and 6th group of igneous rocks were determined at a depth of 723 km.

On a surface of 57 km, responses were received from oil, condensate, gas and water; signals from water were also received at the surface of 69 km. At a depth of 68 km, responses from water were obtained from sedimentary rocks of 7–8 groups, as well as from the 6th group of igneous rocks.
Water in basalts began to be recorded from 120 m, responses were traced up to 69 km.
When scanning from the surface, a step of 1 m, responses from basalts were obtained from 120 m, and from hydrogen - at 260 m and traced to 723 km.
The recording of oil responses on various surfaces showed that the predicted reservoirs can be located in the depth range of 4–9 km. By scanning a cross-section from 4000 m, a step of 1 m, signals from oil were obtained from the intervals: 1) 4215-5010 m; 2) 5325-(strong) (6000-strong) (very strong)-6910 m; 3) 7080- (strong) (8000-strong)-8570 m (up to 9 km traced).
Responses from gas when scanning from the surface, step 1 m were recorded at intervals: 1) 470-(1000 - strong)-1280 m; 2) 1600-1700 m; 3) 2660-(strong) (3000 – strong)-3220 m; 4) 5010-(strong 5600)-5730 m; 5) 6835-(7200-strong) (7500-strong) (strong)-8400 m.

The territory of Nosovsky district of Chernihiv region. During the frequency-resonance processing of a satellite image of the area (Figure 7), signals from oil (good), condensate, gas (good), amber, coal, anthracite, water and dead water were recorded from the surface; responses from oil shale, argillite breccia, gas hydrates, ice, hydrogen and salt were not recorded. Signals were received from 1, 2 (good), 3, 4, 5, and 6 groups of sedimentary rocks; no responses were recorded from igneous rocks.

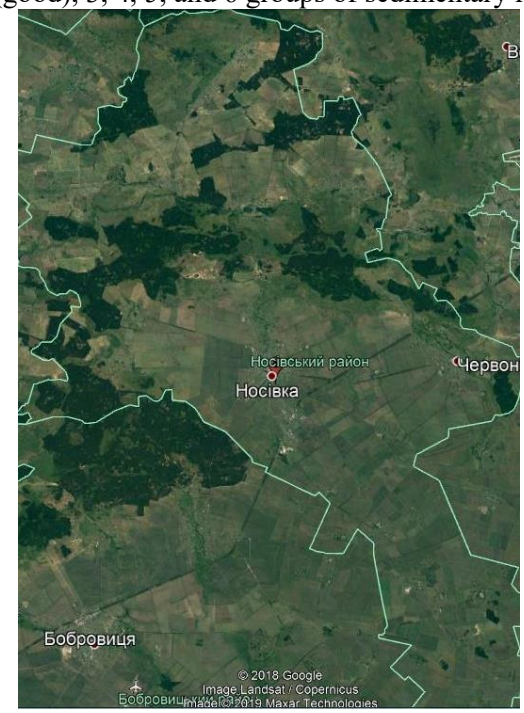

Figure 7 *Satellite image of the territory of the Nosovsky district (Chernihiv region).*

By fixing responses from the 2nd group of sedimentary rocks at various depths (50, 150, 250, 350, 450, 550, 470 km), the root of the channel (volcano) of sedimentary rocks was determined at a depth of 470 km.
On the surface (depth) of 57 km, signals from oil, condensate and gas are recorded!
Responses from water were obtained on the surfaces of 57 km and 69 km. There were no responses from dead water on surface 69, and signals were recorded on surface 59 km.
By scanning the cross-section from the surface, with step of 1 m, the responses at the oil frequencies were obtained from the following intervals: 1) 1090-1240 m; 2) 2410-2800 m; 3) 3730-3860 m; at a step of 5 m from 5 km, 4) 8000-(strong)-9600 m; 5) 11800-(good) (13500-very strong)-14100 m, (up to 15 km traced).

Conclusions. The results of reconnaissance studies within 5 districts of the Chernihiv and Volyn regions of Ukraine testified to the advisability of conducting detailed exploration for hydrocarbons in these regions. On the surveyed areas, the existence of a 57 km boundary was confirmed, in the region of which there is a synthesis of oil, condensate, gas and amber from hydrogen and carbon migrating from below. Additional materials have been obtained that testify to the synthesis of water at a depth of 69 km in volcanic complexes of a certain type.
The practical application of direct-prospecting technologies will help accelerate and optimize the search and exploration process for oil and gas in Ukraine.

References

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