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LITHOFACIES CONTROLS ON HYDROCARBON POTENTIAL OF PLIOCENE-QUATERNARY SEDIMENTS IN THE LOWER KURA DEPRESSION (KUROVDAGH-NEFTCHALA ANTICLINE ZONE)

(Представлено членом редакційної колегії д-ром геол. наук, проф. В. В. Огарем)

Background. *The section of the Lower Kura Depression fields mainly consists of the sediments of the Productive series (PS). The thickness of PS sediments is about 4000 m, and consist of molasse formations.*

Based upon the analysis of well and seismic data obtained in the study area, the lithological-facies, reservoir properties and oil and gas potential of the sediments of the Productive series (PS), Absheron and Aghjagil stages were estimated.

Methods. *Using well data and computer programs the lithological composition and distribution of the Baku stage, Quaternary, modern, and Gadim Khazar sediments by area were studied. The thicknesses and lithology of the productive layers, horizons were studied both in the fields and along the study zone, and the regularity of the change in the reservoir properties updip and lateral directions was determined.*

Results. *The results of the analyses show that the change in the composition, thickness and lithology of the reservoirs of the sediments developed in the zone from northwest to southeast along the Kurovdagh-Neftchala anticline uplift zone located in the southwestern part of the Lower Kura depression does not obey a certain regularity, but a decrease in the values of their physical parameters is noted against the general background.*

Conclusions. *The study confirms that the hydrocarbon potential of the Pliocene-Quaternary succession in the Lower Kura Depression is largely governed by lithofacies distribution and depositional heterogeneity within the Kurovdagh–Neftchala anticline zone. Sand-dominated facies formed in channelized and deltaic environments constitute the principal reservoir units, whereas laterally extensive fine-grained intervals perform an effective sealing function.*

The spatial relationship between lithofacies architecture and anticline geometry indicates that hydrocarbon accumulation is controlled by the combined effects of sedimentary processes and structural deformation. This relationship allows the delineation of the most prospective intervals within the studied succession and supports the application of lithofacies-based models in further exploration of the Lower Kura Basin.

Keywords: *seismic data, trap, Lower Kura Depression, lithofacies composition, suites, horizon, analysis of thicknesses, porosity, permeability, sediment succession.*

Background

The Lower Kura oil and gas-bearing region formulate the southeastern part of the Kura intermontane depression located at the junction of the Greater and Lesser Caucasus, Talysh mountain systems. The region is bordered by the Shamakhi-Gobustan oil and gas-bearing regions in the northeast, the Kurdamir-Saatli, Saatli-Lankaran, Ajinohur oil and gas regions in the southwest, and the South Caspian depression in the southeast (Ganbarova, 2022; Ganbarova, & Kerimov, 2022; Ganbarova, & Zeynalova, 2022; Karimov, Ganbarova, & Ismayilova, 2023; Nasibova et al., 2023a; Nasibova et al., 2023b; Pogorelova et al., 2024; Rzayeva, Ganbarova, & Aslanov, 2022; Rzayeva, Guseynov, & Tagiyev, 2023; Salmanov et al., 2023).

Orographically, the region forms the plain parts (Karimov, 2025; Karimov et al., 2025) of the southeastern Shirvan and Mughan plains complicated by small hills (Rzayeva, Abdullayeva, & Tagiyev, 2024). These hills are the geomorphological expression of local anticlinal uplifts discovered in the region on the surface of the earth. The absolute heights expressed throughout the region vary between 20–270 m.

The geological section of this region is represented by the Upper Miocene-Oligocene, Pliocene and Quaternary sediments (Ismayilova, Nasibova, G., & Nasibova, S., 2025; Nasibova, & Zeynalova, 2025; Pogorelova, & Abdulla-zada, 2024). At the same time, rock samples up to the Upper Cretaceous sediments are also found in the eruption products of mud volcanoes developed in the region (Bayraktutan, & Ganbarova, 2024; Nasibova et al., 2024).

The section of the Lower Kura Depression fields is mainly consists of the sediments of the Productive series (PS). The thickness of PS sediments is about 4000 m, and consist of molasse formations (Fig. 1).

The Lower stage of the PS is represented by the Gala, (GaS), Pre-Kirmaki (PK), Kirmaki (KS), Post-Kirmaki sandy (PKS) and Post-Kirmaki clayey (PKC) suites. PK, KS and PKS suites are mostly sandy.

Tectonically, the Lower Kura Depression is a deep-buried depression extending toward the Caucasus with crystalline base of 20–22 km depth (Nasibova et al., 2023a).

The depression limited with Alat-Langabiz mountain range in the northeast and the Mughan monocline in the southwest. The depression is divided into the Kalamaddin-Bandovan and Kurovdagh-Neftchala anticline zones (Ganbarova, Zeynalova, & Zahidova, 2024), the Navai, Kurgala, West-Shirvan synclinal zones, and the Mughan-Salyan depression.

26 local uplifts have been discovered whithin the depression. 4 of them are exploited as oil (Kalamaddin, Mishovdag, Khilli, Neftchala), 5 are exploited as oil-gas and gas-oil (Pirsaat, Kurovdag, Garabaghli, South Kursangi, Kursangi) fields. The Galmaz field is a gas-condensate field and is exploited (Rzayeva, Ganbarova, & Rajabli, 2022).

Due to seismic exploration work carried out in the region, a number of promising structures have been discovered, which are also prepared for deep exploration drilling. These are Sarkhanbeyli, Western Garasu, Govlar, Nasimikend, Azadkend, Mughanli, Arabgubeyli structures. In addition, research work is being carried out in the Kurtalish structure, Rahimli and Navai areas (Fig. 2).

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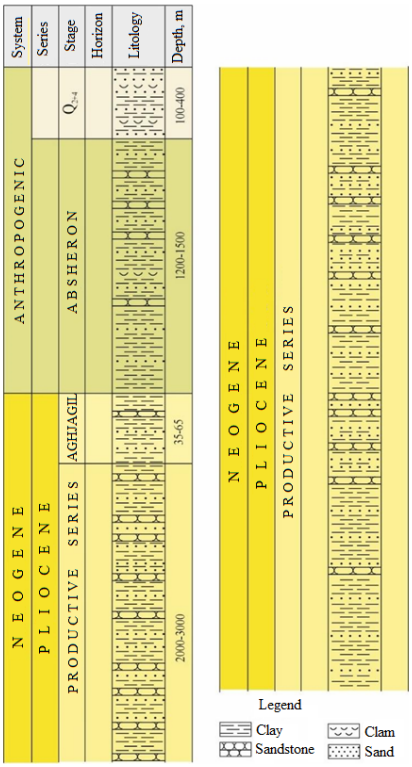


Fig. 1. Generalized stratigraphic section of the Lower Kura Depression:
Q_{2-4}-(Turkan Q_1t, Lower Baku Q_1b_1, Upper Baku Q_1b_2, Lower Caspian $Q_{II}hz$, Upper Caspian $Q_{III}hz$, Lower Khvalin $Q_{III}hv$, Upper Khvalin $Q_{IV}hv$, Modern Caspian $Q_{IV}Yhz$)



Fig. 2. Lower Kura depression
Overview map of local uplifts: 1. Kalamaddin; 1a. Pirsaat; 2. Greater Harami; 3. Lesser Harami; 4. Mishovdagh; 5. Galmaz; 6. Khidirli; 7. Aghzibir-Bandovan; 8. Kursangi; 9. Southern Kursangi; 10. Kurovdagh; 11. Garabaghli; 12. Babazanan-Durovdagh; 13. Khilli; 14. Neftchala; 15. Gizilaghaj; 16. Northern Padar; 17. Southern Padar; 18. Kurtalish; 19. Western Garasu; 20. Govlar; 21. Arabgubeyli; 22. Azadkend; 23. Nasimikend; 24. Azadkend-1; 25. Muganli; 26. Sarkhanbeyli

The research area, the Kurovdagh-Neftchala anticline zone, consists of the Kurovdagh, Garabaghli, Babazanan, Durovdagh, Khilli and Neftchala structures located in the northwest-southeastward. Of these structures, oil and gas accumulations have been discovered in the Kurovdagh, Garabaghli, Khilli and Neftchala structures and have been exploited for a long time. However, the oil and gas content of the lower suites of the PS has not been sufficiently studied. Thus, it is necessary to study the productivity of these suites and the distribution of the physical parameters of their reservoirs along the updip and lateral direction (Bayraktutan, & Ganbarova, 2024; Ganbarova, Zeynalova, & Zahidova, 2024; Nasibova et al., 2024).

The Kurovdagh field is located southwest of the Mishovdagh field and northwest of the Garabaghli field, close to the city of Shirvan. Most of the field area corresponds to the Salyan plain with a hypsometric level of 22–24 m.

The geological structure of the field is represented by the PS, Aghjagil, Absheron, Gadim Khazar and Quaternary sediments (Q_{2+4}) (Gadim Khazar and Quaternary).

In a number of wells (well 426, 401), it is assumed that Pontic sediments are exposed.

The PS succession sediments consist alternation of sandy and clayey layers of various thicknesses. In the upper stage of the PS, 20 sandy horizons and clayey interlayers separating them were discovered. Natural oil and gas seepages were observed in the Kurovdagh field in mud volcanoes and griffons.

The Garabaghli oil-gas field is located 16 km south of the city of Shirvan, on the left bank of the Kura River.

The geological section of the field consists of the Pontic, PS, Aghjagil and Quaternary sediments. The sediments of the Pontic stage (according to data of well 80) consist mainly of clays.

The Khilli field is located 10 km north-northwest of the Neftchala field, 30 km southeast of the city of Salyan, on the right bank of the Kura River.

The Bandovan field is included in the Lower Kura oil and gas-bearing region, located 85–90 km from Baku, 25–30 km south of the Alat railway station, in the junction of Gamma and Aghzibir mud volcanoes. In addition to these volcanoes that form the heights, there are also Aralıg and Bandovan mud volcanoes in the area.

The geological structure of the Bandovan field is build up by the Productive series, Aghjagil and Quaternary (Baku, Gurgan, Khazar and Khvalin stages) sediments (Abdulla-zada, 2022; Salmanov et al., 2023).

The Neftchala field is located in the southeast of the Lower Kura Depression, near the city of the same name and 12 km south of the place where the Kura River flows into the Caspian Sea (Pogorelova, Abdulla-zada, & Namazli, 2024). The territory of the field consists mainly of plains and is covered with numerous salt ponds. The Kura River flows from the northeast of the field. From the northwest to the southeast of the field, there are a number of extinct mud volcanos, the largest of which is the Kichik Pil-Pila volcano. Gas and highly mineralized water are released from these volcanoes, in addition, oil seepages have also been recorded with water.

Exploration work in the field, which began at the end of the 19th century, continued in 1926, and the field was discovered in the same year (according to Absheron sediments).

The geological structure of the field includes the Productive series, Aghjagil and Quaternary sediments.

Methods

Complex geophysical studies conducted in wells in order to determine the petrophysical properties of sediments

forming the geological structure of the deposits located within the Kurovdagh-Neftchala anticline zone of the Lower Kura depression have been analyzed.

These studies include determining the physical parameters of the productive layers of the deposits contrasting the zone, estimating their productivity, analyzing their lithology, distributing the productive layers across the deposits, examining the changes in the vertical and lateral directions of the elements characterizing the saturation, poroperm properties of the reservoir rocks, and investigating the affecting factors.

For this purpose, complex analyses were conducted along the sections of the wells drilled in separate areas. There is correlated, and analyzed information about the petrographic (granulometric composition) and petrophysical properties of the rock (porosity, permeability). According to analyses, up to 20 (according to some researchers, 22) sandy horizons and clayey layers separating them are distinguished in the Upper stage of the Productive series which are most productive in the study area.

Results

3D model of the Lower Kura Depression (Fig. 3). This image shows a 3D model of the terrain, visualizing the relief features of the Lower Kura depression. The color gradients represent elevation differences: blue and lighter tones indicate lower areas, while yellow and green tones show relatively higher regions. The depression itself appears smoother and lower in elevation, while the surrounding areas gradually rise.

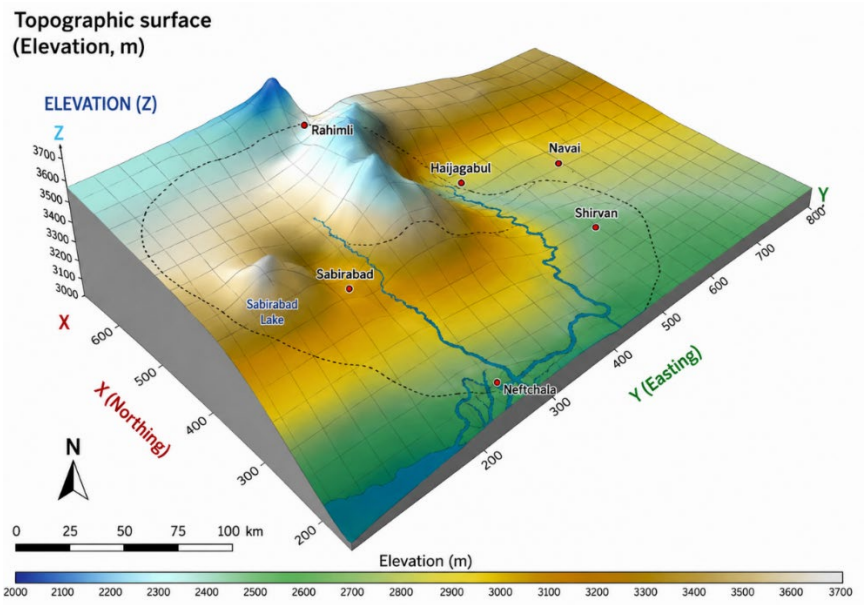


Fig. 3. 3D model of the Lower Kura Depression

The 3D model represents the topographic surface of the Lower Kura Depression and delineates the basin's depth architecture and subsidence pattern, revealing pronounced lateral variations in structural elevation. The surface is not a smooth plain; sharp elevations (peaks/anticlinal uplifts) are clearly visible in the upper-left section, while depressions (synclines) appear toward the center.

A well-defined structural low part occupies the central part of the depression, representing the principal depocenter formed by differential tectonic subsidence. The steep gradients surrounding this low part suggest the presence of fault-bounded zones and flexural margins, which exerted primary control on basin geometry and sediment accommodation. The asymmetric nature of the surface indicates spatially variable subsidence rates, likely associated with syn-depositional tectonic activity.

Marginal areas exhibit a gradual increase in structural elevation, corresponding to relatively stable structural blocks that acted as sediment source and redistribution zones. These uplifted sectors constrained sediment transport pathways and influenced the thickness and facies distribution within the basin.

Overall, the 3D model provides critical insight into the tectono-stratigraphic evolution of the Lower Kura Depression, demonstrating the role of structural inheritance and active deformation in shaping basin architecture. Such geometric relationships are fundamental for evaluating sedimentary infill patterns, reservoir compartmentalization, and hydrocarbon system development.

Thickness Variability and Depocenter Configuration of the Productive Series. Productive series sediments are widespread in the Kurovdagh-Neftchala anticline zone (Fig. 4).

The map illustrates the spatial distribution of thicknesses of the Productive Series sediments using isopach contours and color gradations. Thickness values increase from cooler colors (blue-green) to warmer colors (yellow-red), allowing rapid visual identification of depocenters and thinning zones.

The maximum sediment thickness is concentrated in the central-southern part of the area, particularly around Garabaghli – Southern Kursangi – Kursangi, where values reach about 2900 m. This zone represents a major sedimentary depocenter, likely formed due to enhanced subsidence during deposition and sustained accommodation space. The closely spaced contours here indicate a steep thickness gradient, suggesting rapid sediment accumulation.

Moving outward from this depocenter, sediment thickness gradually decreases toward the northwestern and northern margins, including areas such as Southern Padar, Kalamaddin, Greater Harami, and Lesser Harami, where thicknesses fall to approximately 1400–1800 m. These thinner sections reflect either reduced subsidence, proximity to sediment source areas, or structural uplift during Productive Series deposition.

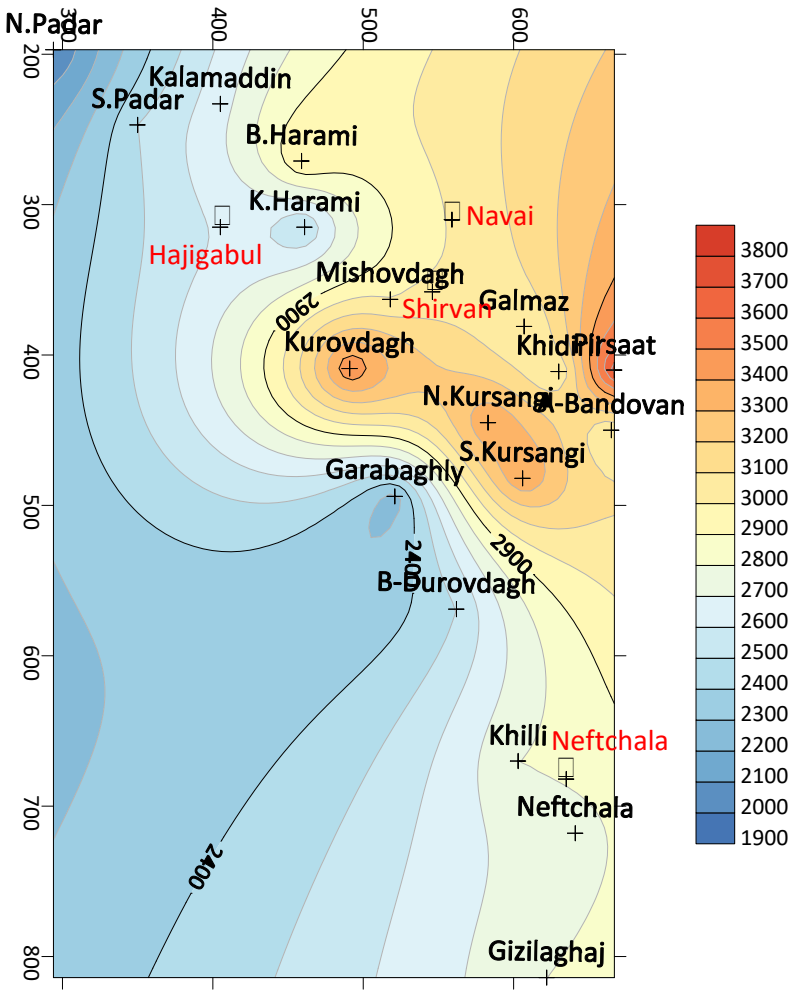


Fig. 4. Spatial distribution of thicknesses of the Productive Series sediments
Legend: + local structures; • settlements

To the eastern and southeastern parts (Galmaz, Khidirli, Bandi, Neftchala, Gizilaghaj), thicknesses remain relatively high but are more uniform, implying stable depositional conditions compared to the central depocenter.

Overall, the thickness distribution is asymmetric, controlled by a combination of tectonic subsidence, basin architecture, and sediment supply. The identified depocenters are of particular importance for hydrocarbon exploration, as increased sediment thickness often correlates with improved reservoir development and hydrocarbon generation potential.

All suites of the Absheron facies (GaS, PK, KS, PKS, PKC) comprise the lower section of the Productive series along the Kurovdagh field section. These suites are more clayey here than in other fields. The total thickness of the lower stage sediments is 390 m.

The upper horizons of the Productive series (horizons I–VI) (see, fig. 1) are characterized by maximum sandiness (30–45 %), the porosity of the reservoir rocks varies between 20–30 %, the sand content of the lower horizons does not exceed 12–25 %, and the porosity of the reservoirs varies between 3–30.7 %. In total along the section 28–33 % is noted. The permeability of the reservoir rocks of the upper and lower horizons is $115–185 \cdot 10^{-15}$ m^2 and $150 \cdot 10^{-15}$ m^2, respectively. The XX horizon, which is the base horizon of the upper stage of the PS, consists of alternating layers of conglomerate, sand and clay. The total thickness of the upper stage sediments is 2850 m.

The deposits associated with the productive horizons appear in different thicknesses. Thus, the thickness of the productive layer in horizons I–VII and XII is 170 m, in horizon IX it is 190 m, and in horizon X it is 200 m (Fig. 5).

The Productive series sediments in the Garabaghli area are the main oil-gas complex, consisting of alternating layers of sand, sandstone and clay of various colors.

As a result of the development of wells drilled to these sediments, the upper 8 horizons (I–VIII) of the PS are productive and the XII–XIII horizons were sporadically oil and gas-bearing. The production of the wells is as follows: oil 10–120 t/day, gas 45–150 thousand m^3/day, condensate 10–15 t/day, water – 10–110 t/day. Oil and gas-bearing in all stratigraphic units was determined in various blocks of the southwest limb of the structure. Oil content was also detected in the northeast limb.

The porosity of the reservoirs noted in the upper horizons of the PS is 22 %, and the porosity of the lower horizons varies between 22–23 %. The permeability of the rocks is much lower compared to the Kurovdagh field, varying in the interval of $15–17 \cdot 10^{-15}$ m^2 in both the upper and lower horizons.

The productive layer sediments in the Khilli area, like in the neighboring Neftchala area, consist of both the upper and lower stages. The upper section consists of up to 20 sand layers and clayey interlayers separating them, and has a thickness of 2800 m. The highest sand content (40–45 %) is observed in the upper horizons I–IV, XII–XIV and XVII–XX horizons. Thin sand layers are also found in clayey

interlayers. The lower stage of the Productive series is relatively poorly studied. The porosity of the reservoirs is 20 %, and the permeability, as in the Garabaghli area, is very low (Fig. 6), is $10–14 \cdot 10^{-15}$ m^2.

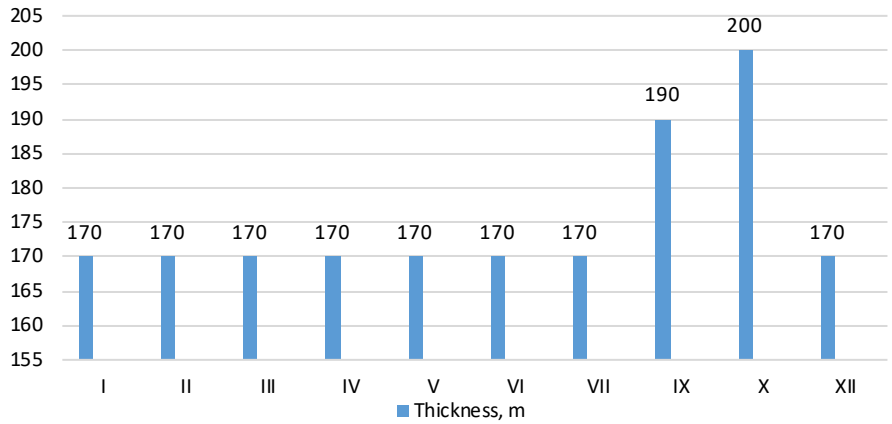


Fig. 5. Histogram of the distribution of productive layers along the Productive series section

Lithologically, the Productive series sediments in the Bandovan area consist mainly of brownish, brown- brownish clays with sand and sandstone interlayers. Along the section, sometimes 3–4 m thick brownish-gray, solid, sandy clayey layers are encountered. The thickness of individual sand layers varies from several cm to 4 m. Sometimes, as a result of a significant increase in sand content in the opening part of the section, the formation of sand series is observed. Such sand series are mainly found in the upper stage of the Productive series. Sometimes clayey and unconsolidated sands are also found in the section (Salmanov et al., 2023).

In the Neftchala area, analogues of the PKC, PKS, KS, PK and GaS suites are traced along the section of the lower stage of the PS. Of these, PKS and PK suites are with highest sand content expressed. The thickness of the lower stage increases to 800 m. PS sediments, as in other areas of the Lower Kura Depression, consist of an alternation of sand, clay and sandstone. 20 sandy horizons have been identified in the upper stage of the PS, of which the upper 6–7 horizons are characterized by the highest sand content, as well as the horizon XX (analogous to the Fasila suite). Individual sandy horizons have a thickness of 95–170 m, and clayey layers have a thickness of 30–90 m. The total thickness of the upper stage of the Productive series is up to 2750 m.

The porosity of the reservoir rocks of the upper horizons of the PS (I–VIII) varies between 16–24 % (Fig. 6). The permeability is high compared to other fields, and is $110–289 \cdot 10^{-15}$ m^2.

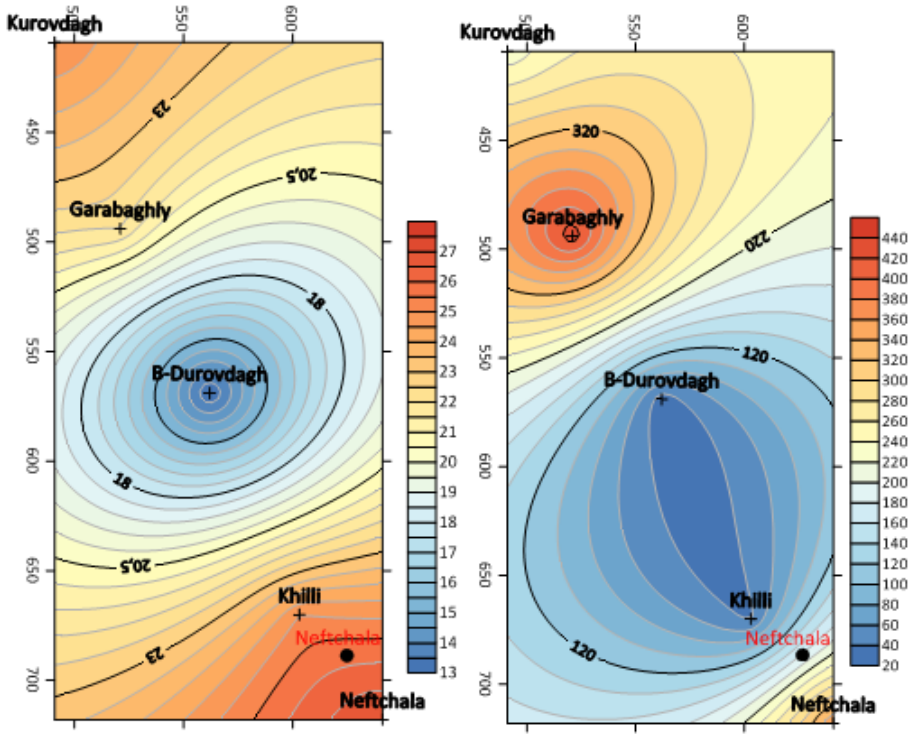


Fig. 6. Distribution of porosity (a) and permeability (b) of reservoirs in the Kurovdagh-Neftchala zone along the PS section
Legend: + local structures; • settlements Porosity ($P_{por.}$)- in %; permeability ($P_{per.}$)– in 10^{-15} m^2

Based on the analyses, it can be noted that the petrophysical properties of the petroleum plays that appear in the Kurovdagh-Neftchala anticline zone are manifested in various character throughout the zone. A decrease in the porosity of the rocks from the northwest to the southeast of the zone, and a relative increase in their permeability, are observed. This is due to the decrease in the sandy facies that make up the section from the northwest to the southeast and the increase in the clayey facies. The increase in the permeability of the rocks can be said to increase due to derivative cracks and tectonic faults.

The sediments of the Aghjagil stage consist of dark-gray clays and sands along the Kurovdagh field section. The sand layers are mainly located in the middle part of the section. Their thickness is 60–260 m. The thickness of the bed associated with this layer is 110 m. The porosity of the reservoirs varies in the interval of 26–29 %. The permeability is relatively high, and is $115–185 \cdot 10^{-15}$ m^2 (Fig. 7).

The sediments of the Aghjagil stage have been tested in 28 wells located in different blocks of the Garabaghli field, and oil was obtained in only 2 wells with a flow of 3–7 t/day. Lithologically, it consists of marl, siltstone and clayey sands. According to well data, the porosity of the rocks is 21 %, and the permeability is very low and is $15 \cdot 10^{-15}$ m^2.

In the section of the Khilli field, the sediments of the Aghjagil stage consist of clays with a thickness of 90–105 m. The sediments of the Aghjagil stage have been tested in 28 wells located in different blocks, and oil was obtained in only 2 wells with a flow of 3–7 t/day.

In the Bandovan area, the Aghjagil sediments were studied mainly based on the data of structural-prospecting and exploration wells drilled in the top parts of the structures. Lithologically, they consist mainly of carbonate clays and thin, fine-grained, hard gray clayey sand interlayers. Fine-grained, hard sandstone layers are also found in the section. From the limb of the structure to the crest, a decrease in the Aghjagil sediments is observed (from 60 m to 35 m). The Aghjagil sediments do not have high oil and gas characteristics in the Bandovan area. A total of 12.84 million m^3 of gas flow was obtained from these sediments (Salmanov et al., 2023).

The sediments of the Aghjagil stage along the section of the Neftchala field consist mainly of clays and are 70 m thick.

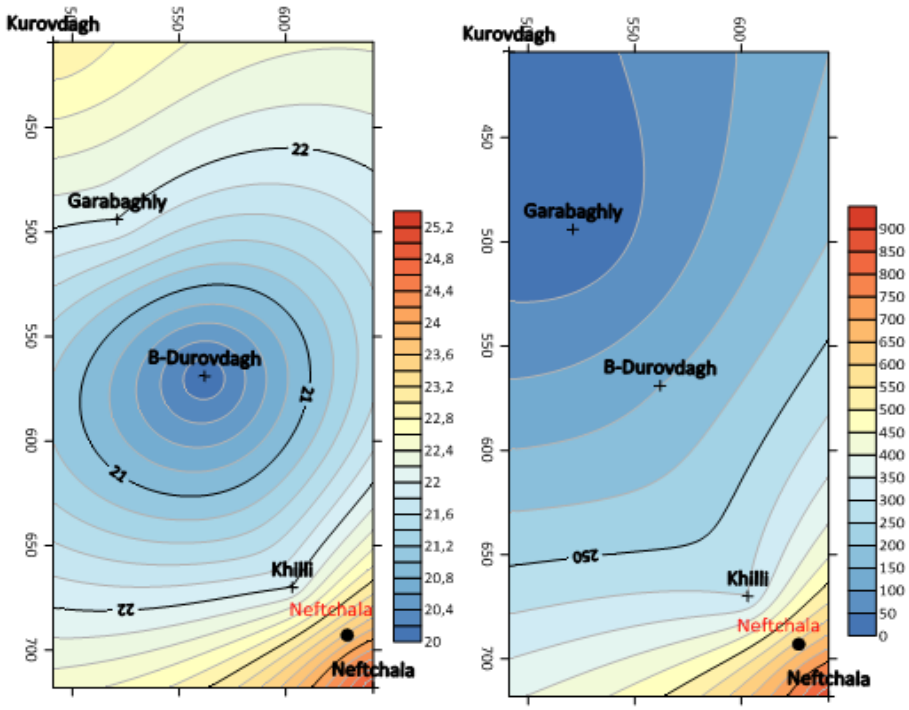


Fig. 7. Distribution of porosity (a) and permeability (b) of reservoirs in the Kurovdagh-Neftchala zone along the Aghjagil stage section

Legend: + local structures; • settlements Porosity ($P_{por.}$)- in %; permeability ($P_{per.}$) – in 10^{-15} m^2 (see Fig. 1)

The decrease in both properties of the Aghjagil stage reservoirs (porosity and permeability) is observed northwest-southeastward. The same picture is observed in the Absheron stage reservoirs (see Fig. 8).

Along the Kurovdagh field section, the Absheron stage sediments consist of an alternation of sand, sandstone and clay. The highest sand content is noted in the middle half-stage (middle Absheron, 2–3 sandy-oil horizons are distinguished), the highest clay content is noted in the lower half-stage (Lower Absheron). The total thickness of the Absheron sediments is up to 2000 m.

The porosity and permeability of the noted reservoir rocks along the section were determined to be 28–33 % and $17–52 \cdot 10^{-15}$ m^2, respectively.

Along the Garabagh field section, the Absheron stage sediments are represented by all three half-stages: Upper, Middle and Lower. The Upper Absheron sediments consist of alternating sands and clays in the upper part of the section, and clays with thin sandy interlayers in the lower part. Their thickness is 690 m. The Middle Absheron sediments consist of alternating sands, clays and siltstones, having a thickness of 780 m. The sandiness increases towards the bottom of the section, but there is decrease in porosity and permeability in this direction, due to filling of pore spaces of sand grains with tiny particles. The sediments of the Lower Absheron sub-stage consist of clays with rare sandy interlayers. Their thickness is 400 m.

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The porosity of the rocks exposed in the section is 20 %. The permeability is very low, $13 \cdot 10^{-15}$ m^2. The thickness of the productive layer associated with these sediments is 63 m. Oil and gas deposits are morphologically associated with stratigraphic and tectonic screened traps.

In the Khilli area, Absheron stage sediments are represented by the Middle and Lower sub-stage. The oil and gas-bearing of the sediments of the Middle and Lower Absheron sub-stages was determined by the drilled structural-prospecting and deep exploration wells. The Middle Absheron sediments are represented by three sandy horizons (I–N_2; II–N_2 ap_2; III– N_2 ap_2) separated by clayey interlayers. Horizon III is characterized by greater sandiness. Its thickness is 580 m. The sediments of the Lower Absheron sub-stage consist of clays with rare sandy interlayers. Its thickness is 235 m. The thickness of the sand layers reaches 5–12 m.

The sandy object of the Lower Absheron (N_2 $ab_{1"a+b'}$) was uncovered in more than 30 wells, and oil (together with water) was obtained in 13 of them. The flow rate of the wells was 2–18 t/day. Gas was also obtained in some wells from this object.

The Lower Absheron N_2 $ab_{1"c"}$ object has been tested in more than 35 wells, 7 of which yielded gas and 12 produced oil.

The Lower Absheron sediments in the Bandovan area consist of gray and light gray clays, with a thickness ranging from 250 to 400 m (Salmanov et al., 2023). Only the upper part of the Lower Absheron has been uncovered in structural-prospecting wells 8, 9 and 57 located in the northeast part of the fold. In the structural-prospecting wells located in the southeast of them, the thickness of the stage is 100–130 m, but in wells 15, 16, 25, 28 the thickness varies between 446–494 m. Lithologically, the section is mainly composed of carbonate, occasionally weak sandy hard clays and sometimes fine-grained clayey sand interlayers.

In the section of the Neftchala field, the Absheron stage is represented by the Lower and Middle half-stages. The Lower Absheron sediments consist of clays with thin layers of sand and volcanic ash. The total thickness of the Absheron stage sediments is up to 750 m. The upper part of the Middle Absheron consists of clays, and the lower part consists of alternations of sand and clays. Sandy horizons I, II, III are oil and gas-bearing. The open porosity of the reservoir rocks is associated with the productive horizons is 18–20 %, and their permeability is unknown. Deposits are associated with tectonic screened traps.

The Neftchala field has been included in the development since 1931. Currently, there are 15 objects in development. The well fund is 190.

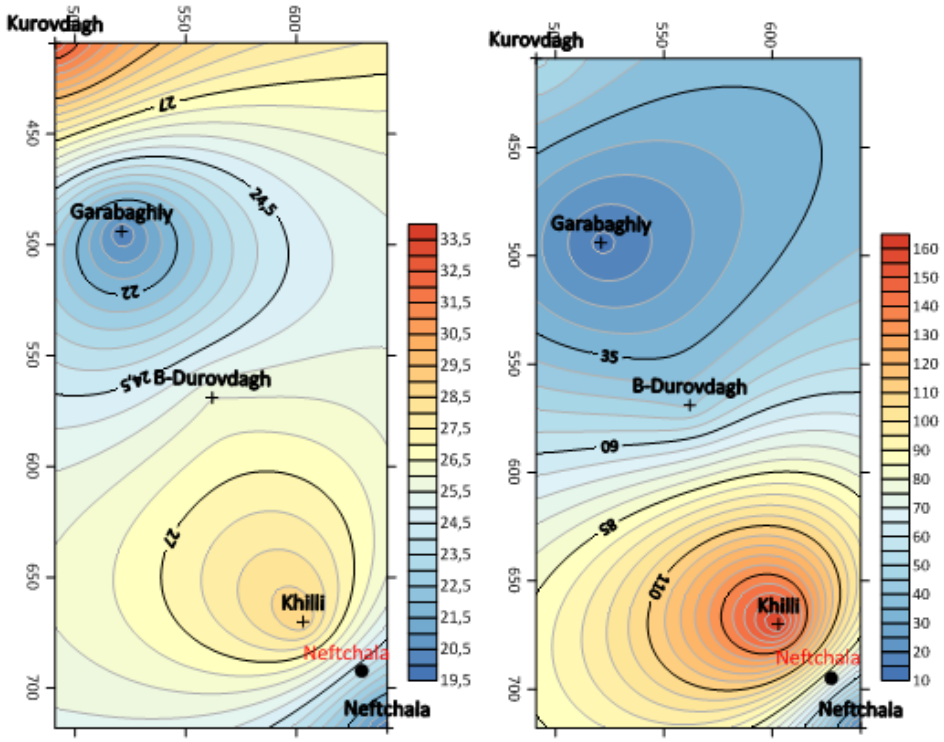


Fig. 8. Distribution of porosity (a) and permeability (b) of reservoirs in the Kurovdagh-Neftchala zone along the Absheron stage section

Legend: + local structures; • settlements Porosity ($P_{por.}$) – in %; permeability ($P_{per.}$) – in 10^{-15} m^2

Within the Neftchala field, Quaternary sediments are distributed in the limbs of the fold, covering Modern and Gadim Khazar formations, as well as Baku stage sediments.

Modern and Gadim Khazar sediments consist of lagoon and delta-type clastic rocks, poorly sorted sands and clays. Their thickness is 100–250 m.

The sediments of the Baku stage (85 m) consist of clays in the upper part of the section, and sand-clay alternations in the lower part. Sandy intervals are associated with a weakly oil-saturated horizon.

Quaternary sediments of the Khilli field are present in the limbs of the field and consist of sands and clays in lithology. Continental sediments, clays and sandstones are also found along the section. The maximum thickness is 670 m, which is recorded in the southwest limb.

The Baku stage sediments consist of clays with sparse sandy interlayers along the Garabaghli area and are 115 m thick.

Modern and Gadim Khazar sediments are widely distributed in the area and consist of alternations of clayey and fine-grained sandy rocks. Their thickness is 475 m.

Compared to other fields, the sediments of the Gadim Khazar and Baku stages within the Kurovdagh field consist of grayish-brown clays with clayey and volcanic ash interlayers. Their thickness is 150 m.

Here, the Quaternary sediments are of continental and marine origin and are of alluvial, diluvial and field formations. The alluvials mainly consists of clays. The sediments of this period are sometimes covered with large (up to 600 m) thick mud volcano breccias.

Quaternary sediments in the Bandovan area have been studied on the basis of surface outcrops in the limb and plunge parts of the folds. Quaternary sediments lie on the Upper Absheron sediments with an angular unconformity. In the Bandovan area, the Baku stage, Gadim Khazar and Modern sediments are involved in the Quaternary stage section. Modern sediments consist mainly of alluvial, diluvial rocks and volcanic deposits with thicknesses ranging from 0–350 m. Alluvial and diluvial sediments are mainly composed of eroded materials of the Productive series, Aghjagil and Absheron sediments (Salmanov et al., 2023).

Baku stage sediments have reached the surface in the northeast limb of the structure and were observed in all wells drilled in the southwest limb. The section consists of sandy, carbonate clays. At its base is two volcanic ash layers with a thickness of 1–1.5 m. From the limb toward the crest of the structure, the thickness of the Baku stage decreases from 125 m to 60 m.

Discussion and conclusions

The study confirms that the hydrocarbon potential of the Pliocene-Quaternary succession in the Lower Kura Depression is largely governed by lithofacies distribution and depositional heterogeneity within the Kurovdagh-Neftchala anticline zone. Sand-dominated facies formed in channelized and deltaic environments constitute the principal reservoir units, whereas laterally extensive fine-grained intervals perform an effective sealing function.

The thickness distribution is asymmetric, controlled by a combination of tectonic subsidence, basin architecture, and sediment supply. The identified depocenters are of particular importance for hydrocarbon exploration, as increased sediment thickness often correlates with improved reservoir development and hydrocarbon generation potential.

The spatial relationship between lithofacies architecture and anticline geometry indicates that hydrocarbon accumulation is controlled by the combined effects of sedimentary processes and structural deformation. This relationship allows the delineation of the most prospective intervals within the studied succession and supports the application of lithofacies-based models in further exploration of the Lower Kura Basin.

The 3D model provides critical insight into the tectono-stratigraphic evolution of the Lower Kura Depression, demonstrating the role of structural inheritance and active deformation in shaping basin architecture. Such geometric relationships are fundamental for evaluating sedimentary infill patterns, reservoir compartmentalization, and hydrocarbon system development.

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ЛІТОФАЦІАЛЬНИЙ КОНТРОЛЬ НАФТОГАЗОНОСНОГО ПОТЕНЦІАЛУ ПЛІОЦЕН-ЧЕТВЕРТИННИХ ВІДКЛАДІВ НИЖНЬОКУРИНСЬКОЇ ЗАПАДИНИ (ЗОНА КУРОВДАГ-НЕФТЧАЛИНСЬКИХ АНТИКЛІНАЛЕЙ)

Вступ. *Геологічний розріз родовищ Нижньокуринської западини сформовано переважно з відкладів продуктивної товщі (ПТ). Потужність відкладів ПТ становить близько 4000 м і представлена моласовими формаціями. На основі аналізу свердловинних і сейсмічних даних, отриманих у районі досліджень, було оцінено літолого-фаціальні, колекторські властивості та нафтогазоносність відкладів ПТ, апшеронського й агджагільського ярусів.*

Методи. *З використанням аналізу свердловинних даних та методу моделювання досліджено літологічний склад і площинне поширення відкладів бакинського ярусу, четвертинної системи, сучасних та давньохазарських відкладів. Вивчено потужності та літологію продуктивних пластів і горизонтів як на родовищах, так й уздовж зони досліджень, а також визначено закономірність зміни колекторських властивостей за підняттям та у латеральному напрямках.*

Результати. *Результати аналізів свідчать, що зміна складу, потужності та літології колекторів, розвинених у зоні з північного заходу на південний схід уздовж Куровдаг-Нефтчалинської зони антиклінальних піднять, розташованої в південно-західній частині Нижньокуринської западини, не підпорядковується чіткій закономірності, однак на загальному тлі відбувається зменшення значень їхніх фізичних параметрів.*

Висновки. *Дослідження підтверджує, що нафтогазоносний потенціал пліоцен-четвертинного розрізу в Нижньокуринській западині значною мірою зумовлений літофаціальним розподілом і седиментаційною гетерогенністю в межах Куровдаг-Нефтчалинської антиклінальної зони. Переважно піщані фації, сформовані в руслових та дельтоподібних умовах, утворюють основні колекторські товщі, тоді як латерально витримані дрібнозернисті інтервали виконують ефективну флюїдоупорну (екранувальну) функцію. Просторове співвідношення між архітектурою літофацій і геометрією антикліналі свідчить про те, що накопичення вуглеводнів контролюється сукупним впливом осадових процесів і структурної деформації. Це співвідношення дає змогу виділити найбільш перспективні інтервали в межах досліджуваного розрізу та підтверджує доцільність застосування літофаціальних моделей у подальшій розвідці Нижньокуринського басейну.*

Ключові слова: *сейсмічні дані, пастка, Нижньокуринська западина, літофаціальний склад, свити, горизонт, аналіз потужностей, пористість, проникність, осадовий розріз.*

Декларація про генеративний штучний інтелект та технології, що використовують штучний інтелект. Під час підготовки цієї статті автор не використовував інструменти штучного інтелекту.

Declaration of Generative AI and AI-Assisted Technologies. During the preparation of this work, the author did not use artificial intelligence tools.

Етична декларація. Дослідження є теоретичним аналізом відкритих джерел і не передбачає безпосередньої взаємодії з людьми чи тваринами. Відповідно, отримання спеціального етичного висновку для такого типу дослідження не потрібно.

Ethical Statement. This study is a theoretical analysis of public sources and does not involve direct interaction with humans or animals. Accordingly, formal ethical approval was not required for this type of research.

Автор заявляє про відсутність конфлікту інтересів. Спонсори не брали участі в розробленні дослідження; у зборі, аналізі чи інтерпретації даних; у написанні рукопису; в рішенні про публікацію результатів.

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