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GEOLOGICAL FEATURES AND HYDROCARBON POTENTIAL OF THE SOUTHEASTERN YEVLAKH-AGJABEDI DEPRESSION: A STRATIGRAPHIC AND STRUCTURAL OVERVIEW

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The Southeastern part of Yevlakh-Agjabedi depression, situated within the Lesser Transcaucasian monocline, exhibits intricate geological structures and diverse sedimentary sequences crucial for hydrocarbon exploration. This study utilizes extensive geological mapping, stratigraphic profiling, and seismic exploration to delineate the basin's structural elements and sedimentary formations. Key findings include the presence of Jurassic-Lower Cretaceous volcanogenic terrigenous and Upper Cretaceous volcanogenic carbonate rocks, which exhibit significant variations in thickness and distribution across the basin. The stratigraphic analysis reveals substantial Mesozoic sedimentary sequences that have undergone complex tectonic evolution, with notable implications for hydrocarbon potential. The Upper Cretaceous sediments, in particular, show promising conditions for hydrocarbon accumulation, with favorable paleostructural and lithostratigraphic traps identified. This comprehensive investigation enhances regional geological understanding and provides critical insights into the hydrocarbon exploration prospects within the South Caucasus region.

Keywords: Yevlakh-Agjabedi trough, tectonic structure, Mesozoic sedimentary basin, hydrocarbon potential, paleogeological analysis, structural traps

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Научная статья

ГЕОЛОГИЧЕСКИЕ ОСОБЕННОСТИ И УГЛЕВОДОРОДНЫЙ ПОТЕНЦИАЛ ЮГО-ВОСТОЧНОЙ ЧАСТИ ЕВЛАХ-АГДЖАБЕДИНСКОЙ ВПАДИНЫ: СТРАТИГРАФИЧЕСКИЙ И СТРУКТУРНЫЙ ОБЗОР

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Юго-восточная часть Евлах-Агджабединского прогиба, расположенная в пределах юго-восточного окончания Предмалокавказского прогиба (Азербайджан), представлена разнообразным набором мезокайнозойских осадочно-вулканогенных отложений со сложным геологическим строением, но литологически и петрографически благоприятным для скоплений углеводородов. В статье рассматривается история развития Евлах-Агджабединской впадины на основании результатов комплексного анализа данных геологического картирования, стратиграфического профилирования и интерпретации сейсмических данных с целью определения структурных элементов бассейна

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и его осадочных формаций. Юго-восточная часть Евлах-Агджабединского прогиба геологически представлена чередованием вулканогенно-терригенных пород юрско-нижнемелового возраста и верхнемеловыми вулканогенно-карбонатными породами, характеризующимися значительной вариабельностью мощностей и распределений по всему бассейну. Стратиграфический анализ позволил выделить в строении прогиба отложения мезозойского возраста, имеющие благоприятные условия для скопления углеводородов. Они приурочены к литологическим и структурным (структуры облекания древнего «просвечивающего» фундамента) ловушкам, сформировавшихся в результате длительной тектонической эволюции. В результате проделанных исследований выделены особенности геологического строения Евлах-Агджабединского прогиба, основные перспективные нефтегазоносные зоны, а также предложены направления дальнейших поисково-разведочных работ.

Ключевые слова: Евлах-Агджабединский прогиб, тектоническая структура, мезозойский осадочный бассейн, углеводородный потенциал, палеогеологический анализ, структурные ловушки

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Introduction

The Southeastern part of Yevlakh-Agjabedi depression, nestled within the Lesser Transcaucasian monocline, stands as a pivotal geological feature in Azerbaijan, characterized by intricate structural complexities and diverse sedimentary sequences. This region, spanning the southwestern bank of the depression, presents a mosaic of structural protrusions and hemisynclines, contrasting sharply with the relatively low-pitched monocline on its northeastern counterpart. The basin's geological evolution is marked by the deposition of Mesozoic sediments, prominently featuring Jurassic-Lower Cretaceous volcanogenic terrigenous and Upper Cretaceous volcanogenic carbonate rocks. These sediments not only reveal the basin's stratigraphic diversity but also hold significant implications for hydrocarbon exploration and resource evaluation.

Materials and Methods

The study employed extensive geological mapping techniques to delineate the structural elements and sedimentary formations within the Southeastern part of Yevlakh-Agjabedi depression. Detailed stratigraphic profiling was conducted to characterize the lithological composition and thickness variations of Mesozoic sediments across different paleostructural zones. Paleogeological analysis played a pivotal role in reconstructing the evolutionary history of the basin. This involved interpreting sedimentary surfaces, structural evolution, and paleoenvironmental conditions during the Mesozoic and Paleogene periods. Methods included the analysis of sedimentary facies, structural deformation patterns, and paleoclimatic indicators derived from sedimentary records. Seismic exploration data provided crucial insights into subsurface structures, helping to delineate fault systems, anticlines, and synclines within the basin. Core data from exploration and research boreholes, such as CD-1 and Borsunlu borehole No. 1, were analyzed to understand lithological characteristics, sediment thickness, and hydrocarbon potential in specific geological formations. The combination of these methods allowed for a comprehensive investigation into the geological and sedimentary characteristics of the Southeastern part of Yevlakh-Agjabedi depression, elucidating its potential as a hydrocarbon-bearing basin. The findings contribute to both regional geological understanding and the assessment of exploration prospects in the South Caucasus region.

Results

The Southeastern part of Yevlakh-Agjabedi depression consists of the Lesser Transcaucasian monocline, the south-western bank is complicated by poorly reflected structural protrusions and hemisynclines. Structural outcrops are located in the south-eastern extension of the Murovdag and Agdam anticlinoriums, and the hemisynclines are located in the south-eastern extension of the Agjakend and Agdara synclinoriums. The north-eastern bank of the depression is significantly different from the south-western one due to its geological structure (fig. 1). This bank resembles a relatively low-pitched, large-scale monocline [Aslanov, Aslanzade, 2022].

The Mesozoic complex in the Southeastern part of Yevlakh-Agjabedi basin is composed of Jurassic-Lower Cretaceous volcanogenic terrigenous and Upper Cretaceous volcanogenic carbonate rocks.

The Lower Cretaceous and Jurassic sediments were discovered in the CD-1 borehole drilled in the Saatli uplift of the Kurdamir-Saatli buried uplift zone and mainly consist of volcanic formations. In the boreholes drilled in the Beylagan area, which is located in the south-eastern part of the south-western

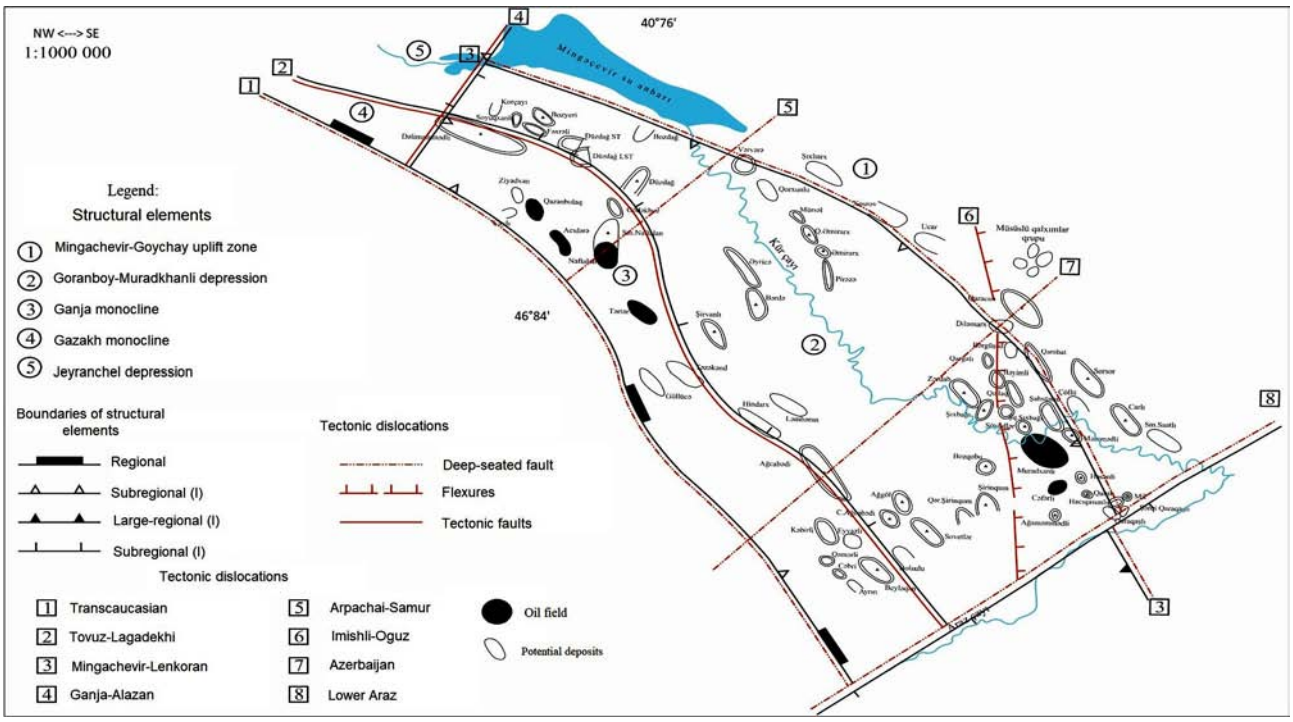

Fig. 1. Tectonic map of the Yevlakh-Agjabedi depression [Aslanov, Aslanzade, 2020]

Рис. 1. Тектоническая карта Евлах-Агджабединской впадины [Асланов, Асланзаде, 2020]

Условные обозначения: Структурные элементы: 1. Зона Мингячевир-Гёйчайского поднятия, 2. Геранбой-Мурадханлинская впадина, 3. Гянджинская моноклиналь, 4. Газахская моноклиналь, 5. Джейранчельская впадина; Границы структурных элементов: Региональные, Субрегиональные (I), Крупно-региональные (I), Субрегиональные (I); Тектонические нарушения: 1 — Закавказское, 2 — Товуз-Лагадехское, 3 — Мингячевир-Ленкоранское, 4 — Гянджа-Алазаньское, 5 — Арпачай-Самурское, 6 — Имишли-Огузское, 7 — Азербайджанское, 8 — Нижнеаразское, Нефтяное месторождение, Потенциальные месторождения.

wing of the Southeastern part of Yevlakh-Agjabedi depression, the lower Cretaceous sediments consist of volcanic rocks [Huseynov B. B. et al., 2015].

Volcanic rocks also dominate the Upper Cretaceous section (up to Santonian). The upper Santonian-Maastrichtian interval is mainly composed of carbonate rocks.

The thickness of carbonate sediments, which are more favourable for the formation and accumulation of hydrocarbons, reaches 750 m in the north-western part of the basin (Borsunlu borehole No. 1), and 800 m in the south-western part (Agjabedi region). The minimum thickness of Upper Cretaceous carbonate sediments (50–200 m) was recorded in the Muradkhanli-Zardab anticline zone and in the Amirarch uplift located northwest of them [Guseynov, Atamov, 2008].

The Southeastern part of Yevlakh-Agjabedi depression is separated from the Gabirri-Acinohur depression by the north-eastern inclination of the Shamkir uplift, which is represented by volcanic sediments, and in the southeast from the Talishgarshi depression by the Bilasuvar uplift.

At the end of the Mesozoic era and at the beginning of the Paleogene, the Upper Cretaceous carbonate sediments were partially corroded in the outer parts of the basin and uplift zones, and completely corroded in the dome parts of the Muradkhanli, Gullujeh, and Delimammadli structures.

The paleostructural factor of the Upper Cretaceous sedimentary surface at the end of the Eocene shows that the Mesozoic oil-gas complex underwent significant changes during the first and middle Paleogene (fig. 2A). During this period, the meridional Naftalan-Godekboz uplift is formed in the north-western part of the Southeastern part of Yevlakh-Agjabedi depression.

This uplift zone of Cretaceous sediments, located at depths of 400–600 m, separates the Borsunlu depression, which still exist in the Late Cretaceous, and the Barda depression, where the paleogeology of Azerbaijan's oil and gas regions is located in the east. In the depressions, Upper Cretaceous sediments are underlined at a depth of 1400 and 1800 m, respectively.

It is assumed that the Cretaceous sediments in the larger Agjabadi basin were subjected to the same level of subsidence. In the southeast, the depression closed

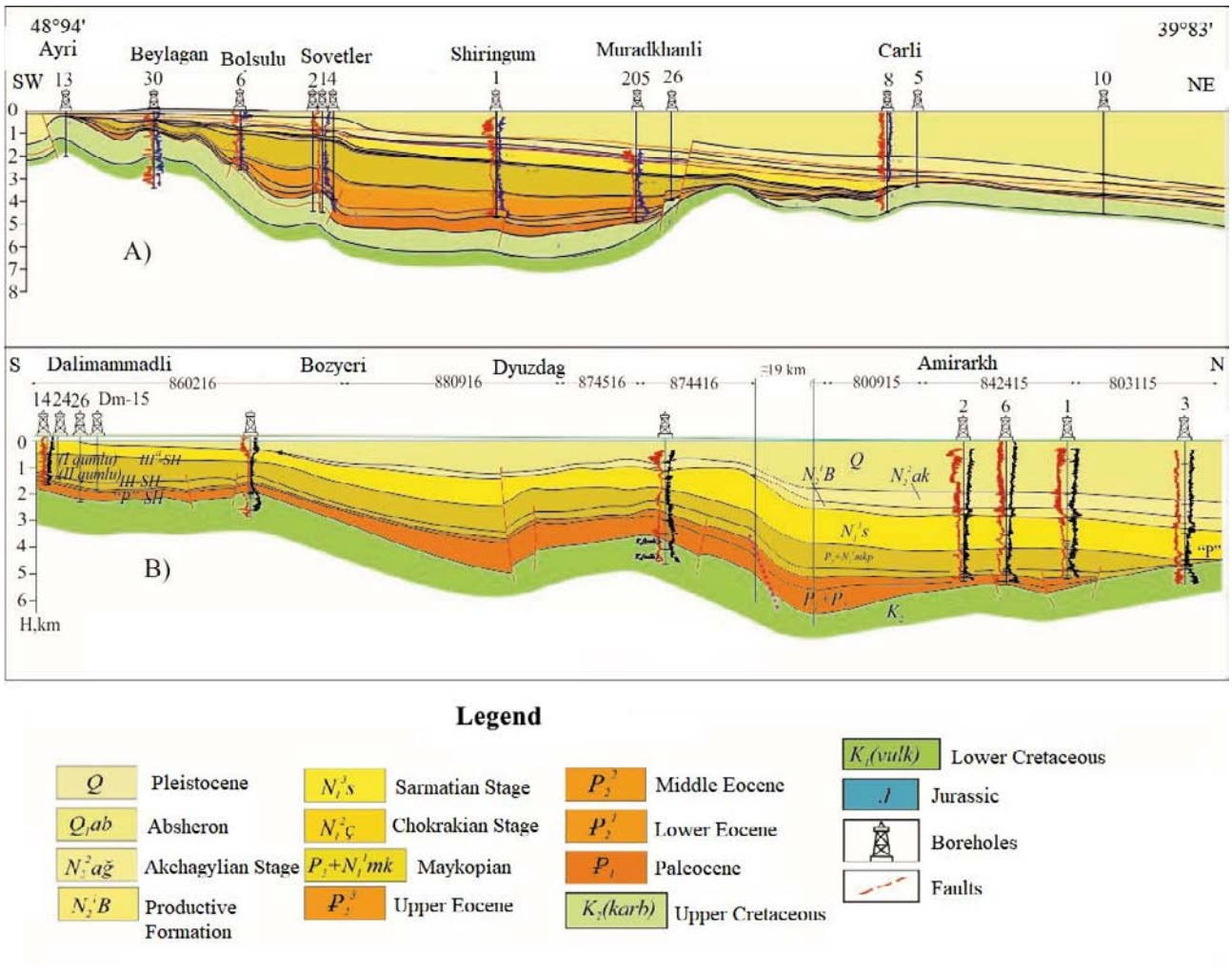

Fig. 2. Geological profile in Ayri-Muradkhanli-Carli direction [Aslanov, Aslanzade, 2022]

Рис. 2. Геологический профиль в направлении Айры-Мурадханлы-Джарлы [Асланов, Асланзаде, 2022]

Условные обозначения: Q — Плейстоцен; Q_1ab — Апшерон; $N_2^2ağ$ — Акчагыльский этап; N_2^1B — Продуктивная формация; N_1^3s — Сарматский этап; $N_1^2ç$ — Чокракский ярус; $Ꝑ_3$+N_1^1mk — Майкопский; $Ꝑ_2^3$ — Вверхний Ээоцен; $Ꝑ_2^2$ — средний эоцен; $Ꝑ_2^1$ — нижний эоцен; $Ꝑ_1$ — Палеоцен палеоцен; K_2 (*karb*) — верхний мел; K_1 (*vulk*) — Нижний Мел нижний мел; J — Юрский; Скважины; Разрывы.

in the Araz river valley forms gulf-side depressions in Jafarli and Khudafarin-Bahmanli regions. In the bays, the Upper Cretaceous sediments underline at a depth of 400–1000 m [Aslanov, Aslanzade, 2022].

The dome part of the Muradkhanli uplift, which is highly developed on the north-eastern bank of the depression, was a washing area during the first and middle Paleogene. Here, the volcanic rocks of the upper Cretaceous come to the surface and are exposed to erosion. In the neighbouring Zardab anticline, thin carbonate, thick tuffogenic and volcanic sediments of the Upper Cretaceous are buried to a depth of 200 m (see fig. 2A).

Both Muradkhanli and Zardab anticlines have a sharp asymmetric structure in the width direction. At the end of the Eocene, the narrow northeastern wings of these structures are separated from the south-western wing of the Kurdamir-Saatli uplift zone by very shallow depressions (see fig. 2A).

This structure is replaced by monoclinal subsidence of Upper Cretaceous Eocene sediments up to 1000–1200 m southwest of the baulk zone in a 28–30 km long area located between the Zardab and Amirarch structures. In the Amirarch field itself, the paleostructure, characterized by a 300 m closed contour, is separated from the baulk area by a shallow and wide synclinal depression, as in the Duzdag field (see fig 2B).

Beylagan, Sovetler, Agjabedi, Gullujeh, Gazanbulag, Delimammadli, etc., which are the main paleostructural elements of the Upper Cretaceous

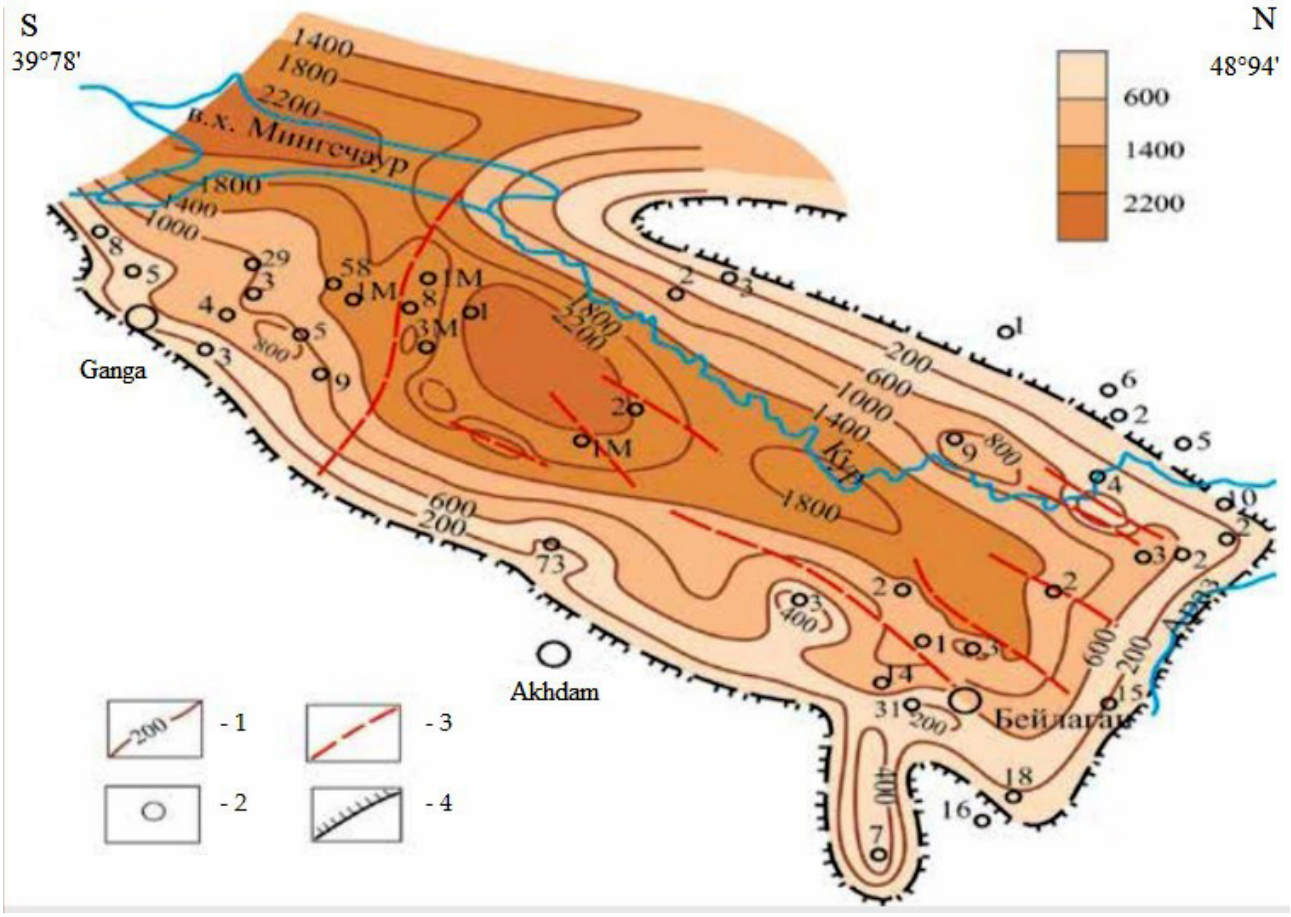

Fig. 3. Paleostructural conditions of the Mesozoic sedimentary surface at the end of the Eocene [Rakhmanov, 2007]
Legend: 1 — contours; 2 — parametric, research and exploration boreholes; 3 — faults; 4 — pinch out zone of sediments.

Рис. 3. Палеоструктурный условия мезозойской осадочной поверхности в конце эоцена [Рахманов, 2007]
Условные обозначения: 1 — контуры; 2 — параметрические, исследовательские и разведочные скважины; 3 — разрывы; 4 — зона выклинивания отложений.

sediments at the end of the Eocene, are found on the south-western bank of the Southeastern part of Yevlakh-Agjabedi sedimentary basin [Gurbanov, Aliyev, 2014].

In the paleostructures located in the central and north-western part of the south-western bank, the Upper Cretaceous sediments are 200–300 m deep, separated in the southeast by Aghjabadi, Beylagan, Sovetler, etc. and in paleostructures, it lies at a depth of 600–1200 m. This shows that these regions were subject to more intensive subsidence during the Paleocene and Eocene (see fig. 2B).

In the Oligocene-Early Miocene (Maykop) period, the sedimentation process in the Southeastern part of Yevlakh-Agjabedi basin is accelerated. At the end of the Maykop age, in the Yevlakh and Agjabedi depressions located in the centre of the basin, the Upper Cretaceous sediments were buried to a depth of 3800–4000 m, and the depressions migrated in the axial direction of the depression and came closer to each other (fig. 4).

The subsidence process includes the Naftalan-Godekboz meridional uplift zone, which separates the Yevlakh and Borsunlu depressions. The hypsometric level of the upper Cretaceous sediments drops to 2000–2500 m [Suleymanov A.M., Zeynalov R.L., 2006].

The dome part of the Muradkhanli uplift, which is a washing zone on the north-eastern bank of the basin, is also covered by upper Maykop sediments with a thickness of 250–400 m (fig. 3). The paleostructure of the upper Cretaceous sediments in the Zardab anticline, which sinks faster, is closed by the 900–1200 m contour. The Amirarch anticline located in the northwest is also approximately at the level of the Zardab anticline (fig. 5). These structures, as they were at the end of the Eocene, are asymmetrical, separated from the wedge zone of the Maykop sediments by a

narrow but deeper synclinal depression (see fig. 1, fig. 5). [Aslanov, Aslanzade, Khuduzade F., 2022].

Most of the structures located on the south-western bank of the Yevlakh-Aghjabadi basin are more clearly reflected. The paleostructures of the Upper Cretaceous sediments at the end of the Maykop age, which have preserved their asymmetric structure, are characterized by a closed contour at least every 200 m. Closed contours are 400, 1200 and 2400 m, respectively, in the South Beylagan, Agjabedi and Sovetler paleostructures located in the south-eastern part of the basin [Salmanov et al., 2012].

The Gulluja structure, located in the highest part of the south-western bank, is also characterized by a 400 m contour. While the Gazanbulag paleostructure, which is closed by a contour of 1800 m in the northwest direction, is separated from the Lesser Transcaucasia monocline by an asymmetric saddle with a depth of 100 m in the southwest, the neighbouring areas of Ajidara, Sariyaldag, and Aliushagi slightly complicate the structure of the regional monocline in the form of small structural protrusions [Kocharli Sh. S., 2010].

In the paleostructural factor of the Upper Cretaceous sedimentary surface at the end of the Miocene, no serious changes occurred compared to the end of the Maikop age. As before, the Yevlakh and Agjabadi depressions are the most intensive subsidence zones, and the Upper Cretaceous sediments are buried to a depth of 5000 m (see fig. 4).

The Naftalan-Godekboz uplifts retain their previous stretching direction and depth of lying (2000–2500 m). In the Borsunlu depression, which is located west of the uplift zone, the descent process increases slightly and the Upper Cretaceous sediments are buried up to 3200–3400 m (see fig. 1).

The asymmetric structure of the basin in the width direction increases slightly during the Miocene. More areas on the north-eastern bank, including the structures belonging to the Kurdemir-Saatli buried uplift zone, are also subjected to the subsidence process. Most of the structures located on the southwest bank were wash zones located above the Miocene sea level. Only the Sovetel structure, located northeast of the Miocene sedimentation zone, is buried 600 m deeper than at the end of the Maykop age (see fig. 4) [Huseynov B. B., Salmanov A. M., Magerramov B. I., 2019].

In the structures located in the Zardab-Muradkhanli zone, the surface of the Upper Cretaceous sediments decreases and reaches 800 m in the dome part of the Muradkhanli uplift, and 2000 m in the dome part of the Zardab uplift. The existing structural terrace in the Amirarch area descends to a depth of 2200 m (see fig. 3).

When evaluating the oil and gas potential of the Mesozoic complex, it should first be noted that the Kura geoanticline, which is a remnant of the South Caucasus massif, is considered an unpromising region in terms of oil and gas, since the area consists of volcanic complexes during the Jurassic period.

More favourable conditions for the formation of hydrocarbons in the sedimentation basins were when the Upper Cretaceous sediments were accumulated. In addition to regional oil and gas deposits, these deposits have industrially important oil and gas properties in some areas. [Aslanov, Aslanzade, Khuduzade F., 2020].

In the Mesozoic sediments, there were top seals that ensured the accumulation of hydrocarbons and their preservation. Such a cover for the Upper Cretaceous sediments is the Paleocene-lower Eocene and mainly Maykop clay sediments. Most of the folds in the region were developed during the Late Cretaceous and Paleogene. It is these structures that have become favourable traps for the accumulation of hydrocarbons formed in rocks and subjected to lateral migration. At the same time, the stratigraphic traps formed in the siltation zones of syngenetic oil-gas sediments are also important in terms of oil and gas [Schroot, 2005].

The main oil-gas complexes in the Yevlakh-Agjabedi basin are of Mesozoic and Paleogene-Miocene age. Paleostructural development history of these complexes is of great importance in terms of determining the time of the beginning of the mass generation of oil and gas, determining the migration directions, formation and preservation of oil and gas deposits. The part of the upper Cretaceous sediments of the Yevlakh-Aghjabadi depression up to the Santonian is considered unprospective. The upper part of the section was collected in paleotectonic and paleogeographical conditions favourable for the formation of hydrocarbons [Salmanov, Yusifov, 2013].

Here, the thickness of sediments gradually increases towards the centre of the depression and reaches 700–800 m, consisting of pelitamorphic limestones alternating with marl layers. In this regard, the Maastrichtian floor sediments are of greater importance. The underline of the Upper Cretaceous sediments to a depth of more than 5000 m indicates that there are thermobaric conditions necessary for the generation of hydrocarbons in the sediments.

The Mesozoic surface on the northeast bank of the Southeastern part of Yevlakh-Agjabedi depression, which is considered more promising in terms of oil and gas, resembles a monocline with a relatively low

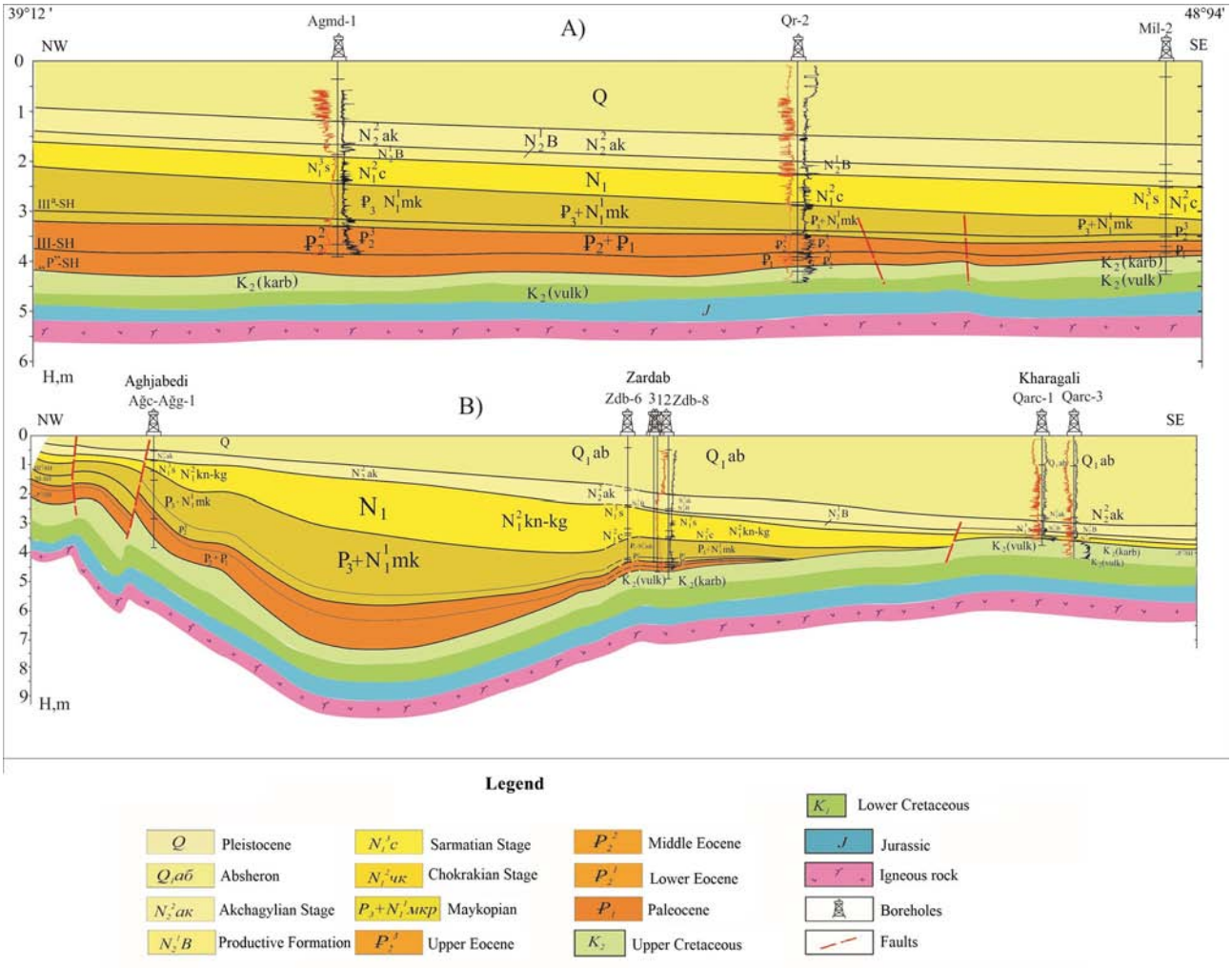

Fig. 4. Geological profile in the direction: A) Akhdam-Mil; B) Agjabedi-Zardab-Kharagali [Aslanov, Aslanzade, 2022]

Рис. 4. Геологический профиль в направлении: А) Агдам-Мил; В) Агджабеди-Зардаб-Караджалы [Асланов, Асланзаде, 2022]

Условные обозначения: Q — Плейстоцен; N_2^2*ак* — Акчагыльский этап; N_2^1*B* — Продуктивная формация; N_1^3*c* — Сарматский этап; N_1^2*чк* — Чокракский ярус; P_3+N_1^1 *мкр* — Майкопский; P_2^3 — Верхний Эоцен; P_2^2 — Средний Эоцен; P_2^1 — Нижний Эоцен; P_1 — Палеоцен; K_2 — Верхний Мел; K_1 — Нижний Мел; J — Юрский; Магматическая порода; Скважины; Разрывы.

bank at the end of the Eocene. Upper Cretaceous sediments lie here at depths of 4000–5000 m. Eocene, Maykop and Miocene sediments are baulk on the northeast direction in the uphill parts of the monocline [Rakhmanov, 2007].

Borsunli and Agjabedi depressions with maximum thickness were oil and gas generation, while Muradkhanli-Zardab and Amirarch areas, where carbonate sediments were spread with minimum thickness, were accumulation zones of hydrocarbons.

Paleogene clay sediments lying unconformable on the washed surface of the Upper Cretaceous have paleogeological conditions favourable for the formation of stratigraphic type traps in either carbonate or volcanic sediments of the Upper Cretaceous (Amirarch). Structures are bordered by closed contour of 200 and 300 m. The steeper south-western wings of the asymmetrical structures are considered more promising because they are located in the direction of oil and gas migration. On this bank of the depression, no closed structures were detected by seismic exploration methods in the distance of 40 km from Zardab to Amirarch [Aslanov, Aslanzade, 2022].

In this area, which has a monoclinal structure according to seismic exploration data, the Upper Cretaceous sediments lie at a depth of 4000–5000 m. Eocene, Maykop and Miocene sediments are successively baulk on the northeast direction in the uphill parts of the monocline. Paleogeological conditions

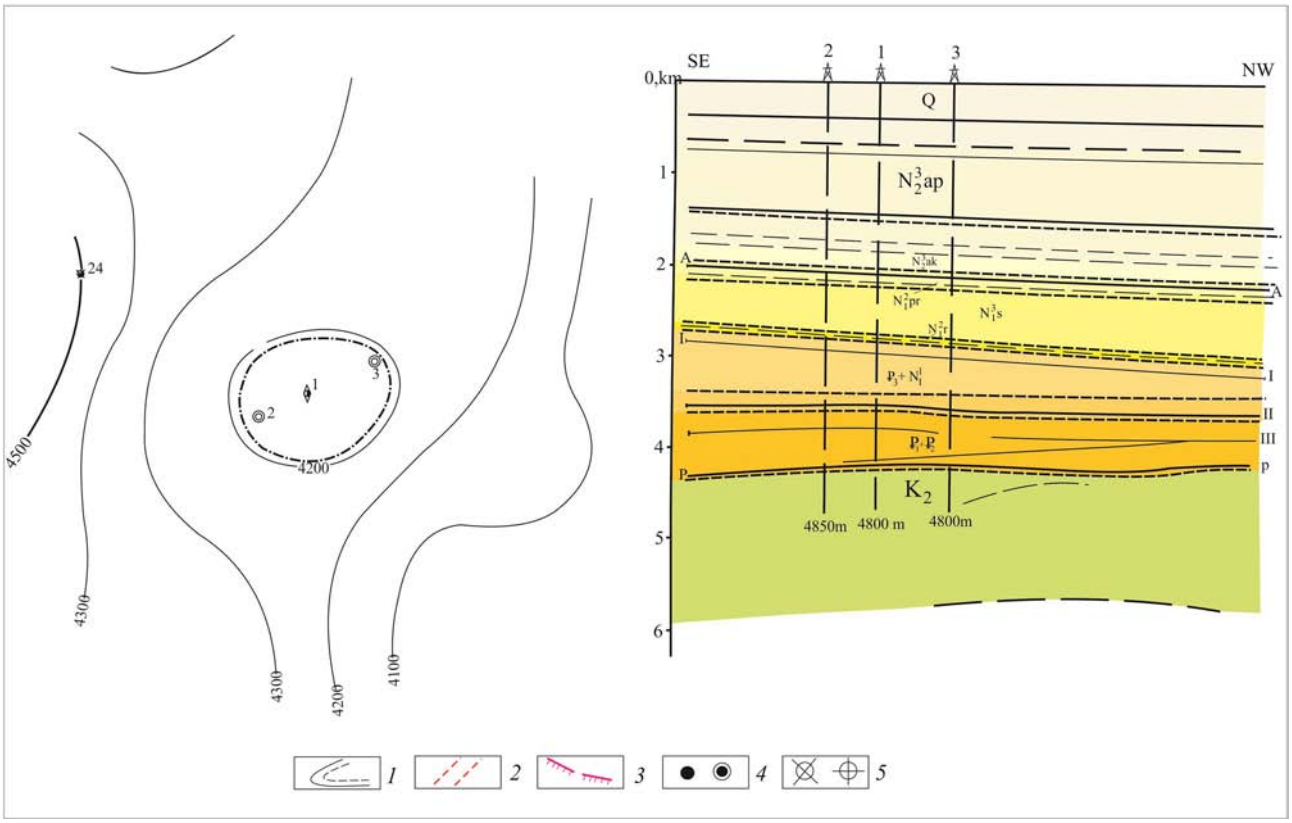

Fig. 5. Structural map of the Zardam and Shikhbagi Uplifts and seismic profile section [Aslanov, Aslanzade, 2022]

Legend: 1 — Isohypses of the Upper Cretaceous effusive rocks surface; 2 — faults; 3 — pinch-out line of the marl layer of the Middle Eocene; 4 — oil production boreholes from Upper Cretaceous and Eocene sediments; 5 — boreholes cancelled for geological and technical reasons.

Рис. 5. Структурная карта Поднятий Зярдам и Шихбагы и разрез сеймогеологического профиля [Асланов, Асланзаде, 2022]

Условные обозначения: 1 — изогипсы поверхности эффузивных пород верхнего мела; 2 — разломы; 3 — линия выклинивания мергелевого слоя среднего эоцена; 4 — скважины, добывающие нефть из отложений верхнего мела и эоцена; 5 — скважины остановлены по геолого-техническим причинам.

were favourable for the formation of stratigraphic type traps in Cretaceous carbonate and volcanic sediments in the areas covered by Paleogene clay sediments unconformable lying on the washed surface of the Upper Cretaceous.

In the north-western part of the north-eastern bank of the depression, in the Late Cretaceous-Early Paleogene epochs, the Garkhun-Amirarch tectonic zone was separated from the Shikhlar-Ujar uplift zone by a synclinal depression from the northeast. In this case, it is possible to assume the presence of stratigraphic type traps in the Upper Cretaceous sediments in the Shikhlar-Ujar uplift zone.

On the south-western bank of the Southeastern part of Yevlakh-Agjabedi depression, Upper Cretaceous sediments are recorded at a depth of 200–300 m to 3000–4000 m. Hydrocarbons generated at great depths started to migrate in the southwest direction along the bank of the depression, the existing structures have become convenient traps for oil and gas accumulation. At the same time, although the regional faults caused the dispersion of hydrocarbons, in some cases they created conditions for the formation of tectonically screened traps [Aslanov, Aslanzade, 2022].

One of the prospective areas of the Southeastern part of Yevlakh-Agjabedi depression is the south-eastern centricline where the Upper Cretaceous sediments lie at depths of 3500–5000 m. Temperatures calculated on the surface of Mesozoic sediments reach 150–1700 °C in the central part of the basin, Mesozoic sediments are in the pre-excavation zone, while 80–1200 °C on the north-eastern bank, and decrease to 60–700 °C on the south-western bank, indicating that they are in the infiltration zones.

The most favourable conditions for the formation of hydrocarbons in the Mesozoic sedimentary complex in the Yevlakh-Aghjabadi basin occurred during the Maastrichtian age of the Upper Cretaceous. The

most suitable paleostructural conditions for their accumulation and formation of deposits existed in the structural and lithostratigraphic traps formed in the baulk zones of carbonate sediments and in the dome parts of the more developed anticlinal structures [Yusifov, Rakhmanov, 2012].

Discussion

The Southeastern part of the Yevlakh-Agjabedi depression, situated within the Lesser Transcaucasian monocline in Azerbaijan, exhibits significant geological complexity and potential for hydrocarbon exploration. The region features a diverse array of structural elements, including protrusions and hemisynclines, contrasting with the more gently pitched monocline to the northeast. Mesozoic sedimentary sequences, predominantly Jurassic-Lower Cretaceous volcanogenic terrigenous and Upper Cretaceous volcanogenic carbonate rocks, indicate a rich stratigraphic history crucial for understanding the basin's hydrocarbon potential. Extensive geological mapping, stratigraphic profiling, and seismic exploration have revealed that while Upper Cretaceous sediments exhibit varied thicknesses across the basin, with notable accumulations in the Borsunlu and Agjabedi structures, they also display significant erosional and subsidence features. These structural and lithological variations have important implications for hydrocarbon accumulation, with favorable conditions identified particularly in the Maastrichtian carbonate sediments and associated paleostructural traps. The integration of paleogeological and sedimentary data suggests that the basin holds substantial hydrocarbon resources, particularly in areas with thick, well-preserved carbonate sequences and favorable structural configurations for trapping oil and gas.

Conclusion

The Southeastern part of Yevlakh-Agjabedi depression features a complex geological structure characterized by monoclines, anticlines, and synclines, influenced predominantly by volcanic and carbonate rocks spanning the Jurassic to Late Cretaceous periods. Sediment thickness varies notably, reaching up to 800 m, with Upper Cretaceous carbonate sediments identified as highly promising for hydrocarbon accumulation. Paleogene tectonic activity played a crucial role in creating favourable traps for hydrocarbons, particularly in anticlinal and synclinal structures. The basin's Upper Cretaceous sediments, notably those from the Maastrichtian age, are considered ideal for hydrocarbon generation due to favourable thermal conditions and sedimentary composition. Comparative analysis with neighbouring basins highlights distinct geological features and underscores the basin's potential. Future exploration efforts should focus on advanced seismic surveys and borehole drilling to verify resource potential and assess economic viability. Balancing environmental considerations with potential economic benefits remains essential for sustainable development in Azerbaijan's hydrocarbon sector.

In conclusion, the Southeastern part of Yevlakh-Agjabedi depression represents a promising area for hydrocarbon exploration and production, with the Upper Cretaceous carbonate sediments, especially from the Maastrichtian age, offering the most favourable conditions for significant oil and gas reserves. Future exploration efforts should focus on delineating and further assessing these prospective areas using advanced geological and geophysical techniques.

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