The mechanism of formation and prospects of non-structural traps in the South Caspian megadepression

Khuraman Z. Mukhtarova, Gulter J. Nasibova

Azerbaijan State University of Oil and Industry, Republic of Azerbaijan, Baku, xuraman.muxtarova@asoiu.edu.az

Abstract. The article examines the geodynamic conditions for the formation and distribution of non-structural traps in the oil and gas regions of Azerbaijan, such as the interfluves of the Kura and Gabirri, Yevlakh-Aghjabadi, Ganja, Lower Kura, the Baku archipelago, Shamakhi-Gobustan and Absheron. For this purpose, the surfaces of the Baikal basement, Mesozoic and Maikop deposits of the region were modeled and analyzed. The modeling revealed a submeridional uplift (positive tectonic element) that began to develop in the Maikop between the Kura and South Caspian basins. This has strongly influenced the folding and especially the formation of non-structural (tectonically sealed, lithologically limited, stratigraphic unconformity-associated) traps in the region. As a result of the analyzes, we clarified the geotectonic characteristics of the formation of non-structural traps (tectonically sealed, lithologically limited, stratigraphic unconformity-associated) and compiled their distribution maps based on them. The analysis of these maps makes it possible to substantiate the features and reasons for the formation and distribution of non-structural traps in the region. Thus, tectonically sealed traps were formed mainly in the oil and gas-bearing areas of the Kura and Gabirri interfluve, the Lower Kura, Shamakhy-Gobustan, Absheron and Baku archipelago, which are not only located in an active geotectonic zone, but likewise, the geological section of these oil and gas-bearing regions (OGRB) significantly differs from the Yevlakh-Aghjabadi and Ganja clay composition (clay rocks), and therefore, high parameters of the development of mud volcanism and clay diapirism are seen in the area. By contrast, in the Yevlakh-Aghjabadi and Ganja oil and gas regions, mainly effusive rocks have developed, which have incompetent properties and resist geotectonic – tangential-horizontal-compressive forces. Formed in this part of the region, the traps associated with lithological wedging out have been mainly formed by covering the effusive or relief ledges. It should be noted that quantitatively, the traps with stratigraphic unconformity are developed relatively poorly and coincide with the distribution of lithologically wedge-out traps. The aim of the study was answering a number of questions that may arise when non-anticline traps are involved in exploration work.

Key words: non-anticlinal traps, basin, sediments, sealed, lithologically limited, stratigraphically unconform.
Oil and gas deposits of Azerbaijan, which have developed mainly in traps of anticlinal type and are related to the deposits of the productive Lower Pliocene layer, have been exploited for over a half a century now, and therefore, most of them are at the late stage of exploitation. Because most of the deposits formed in traditional traps have been discovered and are currently at the final stage of their exploration, studies of the conditions of the development of hydrocarbon (HC) deposits in non-anticlinal traps and studies of their potentials are some of great importance.

The paper is focused on traps of non-anticlinal type, discovery and study of deposits formed in them, based on novel geological, geophysical and geochemical methods, modeling of conditions of formation of hydrocarbon deposits in non-anticlinal traps of the Kura and South Caspian depressions (SCD) and substantiating their potentials.

Materials and methods.

According to the materials we obtained from non-structured traps of Azerbaijan, which have been discovered and studied, we see that those objects have been mostly found during geophysical studies. The studies allow the positive evaluation of the prospects of the Upper Cretaceous and Paleogene-Miocene deposits in the Middle-Kura depression, Pliocene deposits – in the Lower Kura depression and the South Caspian region, and also suggest the high probability of discovering oil and gas deposits in non-structured traps associated with those deposits (Gadjizade, 2003).

Successful searches for and exploration of oil and gas deposits are often related to geodynamic study of the origin and history of geological development of the basin. Therefore, in the process of the study of the deep structure of the region from the perspective of formation of non-anticlinal traps, we used ArcGIS software to developed 3D models based on depths of embedding of the surfaces of the Baikal-aged basement, Mesozoic and Maikop deposits (Fig. 1) [Maikop is a regional stratigraphic element, general name for Oligocene-Lower Miocene rocks in the territory spanning the western Black Sea coast to the eastern Ciscaucasia – Translator’s note].

Model we developed for the bed floor of the Maikop rocks demonstrates that a submeridional regional elevation between the South Caspian and Lower Kura basins which has obviously played an important role in development of non-anticlinal traps was formed in this specific period. Furthermore, the results of development of those models allow us to express the opinion about hierarchal pattern of tectonic development of those two basins in various time periods, about their approximate similarity, rise of great interest, especially to their pit sides, from the perspective of non-structural traps. We determined the development of non-structural traps in the studied territory through complex analysis, by studying factors directly and indirectly influencing their development. Positions of geostuctural elements in relation to geodynamically active zones (Zonenshteyn, 1990), which result in tangential and vertical tectonic movements, are known to play a key role in the formation of non-structural traps in the region.

Results and discussion. The studied oil and gas-bearing regions (OGBR) of the interfluves between the rivers Kura and Gabirri, Yevlakh-Aghjabadi, Shamakhi-Gobustan and Lower Kura, being relatively close to the collision zone, are significantly subjected to compressive stress from tectonic and vertical forces (Narimanov, 2014).

The degree of the effect of compressive stress depends on remoteness of studied objects from the collision zones, degree of complication by disjunctive faults, presence of magmatic formations, thickness of the crust, and also lithological composition of strata and a number of other factors. Most local elevations of Oligocene-Quaternary sedimentary complex between the Kura and Gabirri rivers are diapirc folds, formed by incompletely compressed clays. It has to be noted that this type of local elevation is

Key words: nonanticlinal traps, basins, wells, exploration, screened, lithologically limited, stratigraphically irregular
usually complicated by regional, longitudinal and transversal, diagonal and radial faults (Narimanov, 2014). In such structures, there form sealed tectonic traps and places of concentrations of local character. The conducted studies of non-anticlinal-type traps in the territory of the OGR between the rivers Kura and Gabirri revealed that in this part of the region that we studied, mostly tectonically sealed traps have formed (Fig. 2).

Morphological peculiarities of local elevations in the territory of the OGR between the Kura and Gabirri rivers significantly vary according to the sedimentary Cretaceous-Eocene-Quaternary complex. Therefore, in the structures Sajdag, Tarsdallar, Nouth Tarsdallar, Gurzundag, on the surface of Cretaceous-Eocene complex, there are mainly seen isometric, rarer short of brachyelevations, close to isometric. On the surface of Oligocene-Quaternary deposits, there are seen elongated brachifolds, and linear brachifolds of the form. This suggests that in the Cretaceous-Eocene period, folding occurred in the places where the dominant tectonic forces were taking actions through mechanism of transversal bend or were covering the ledges of more ancient bases. Compressive stresses in the studied region increased in the Oligocene-Quaternary period, affecting the relatively upper part of the sedimentary layer. This is indicated by the development of folds of thrust type (Tarsdallar, Gushguna, Sajdag, Gurzundag, Udabna, Boyuk Palantokan, etc) above the Cretaceous-Eocene rocks (Narimanov, 2014; Aqabekov, Mamedov, 1960).

Transition of normal faults, which complicate the structures in various stratigraphic complexes, from ancient to more recent reverse faults and the thrusting folds demonstrates the diversity of the effects of various tectonic movements on different phisi-
cal-mechanical properties of the Cretaceous and Oligocene-Quaternary deposits. This is reflected in the appearance of plicative and disjunctive dislocations on the sedimentary cover, which resulted in the development of tectonically sealed (intensity of tangential tectonic movements), and lithologically wedging out traps (relatively small amount) near the structural traps (Aqabekov, Mamedov, 1960).

Fig. 2. Map of distribution of tectonically sealed traps: 1- OGBR of the interfluve between the Kura and Qabirri; 2-Yevlakh-Aghjabadi OGBR; 3- Lower Kura OGBR; 4-the Shamakhi-Gobustan OGBR; 5- OGBR of the Baku Archipelago; 6-the Absheron OGBR (K. Z. Mukhtarova, G. J. Nasibova)

On the structure of Tarsdallar oil and gas bearing region of the Kura and Gabirri interfluve, more than 30 exploration wells have been drilled, including four wells (1, 4, 9, 9) from which oil has been extracted. From Eocene sediments in the local fold Tarsdallar, from exploration well № 1, at the depth of 2,882-2,855 m, there was obtained an oil fountain, flow rate of which equaled 300 t/d and 150,000 m³/d of gas. The deposits have formed in a tectonically screened trap (Yusifov, Suleymanov, 2015).

The next geosctructural element, Yevlakh-Aghjabadi depression (YAD), is farther from the collision zone than the OGBR between the Kura and Gabirri rivers. Stratigraphic section of this part of region – from the perspective of lithofacies – is significantly different from the one described earlier. In that area, the effusive rocks, which played a key role in formation of the structures, have spread quite broadly. One may see their various complications with different types of faults. Because the effusive rocks are taking sealing effect on the compressive stress, the complex of sedimentary rocks of the region is exposed to those forces quite poorly (Rakhmanov, 2007).

However, tangential tectonic forces have caused formation of sealed tectonic non-anticlinal traps in the area. Various types of non-structural traps associated with effusive Cretaceous massifs develop from erosive crust of the terrain or local elevations or resulted from those effusive ledges (massifs) of younger deposits. Non-anticlinal traps, formed as a result of covering those or other elevations, mainly develop in wings of the folds as lithologically limited (wedging out) traps (Fig. 3).

Fig. 3. Map of distribution of lithologically limited traps (for legend see Fig. 2) (K. Z. Mukhtarova, G. J. Nasibova)
By overlapping the effusive ledges and massifs in the YAD, the Paleogene-Eocene deposits form overlapping folds, in wing parts of which, lithologically limited (wedged out) traps develop. Clear examples are the structures Sovetlar, Muradkhanli, Beylagan, Gulluja, Jarli. Almost complete absence of the mechanism of transverse bending during the formation of the folds leads to their very weak development at elevations, and resulting into formation of overlapping folds of buried origin. In addition, the fact that elevations such as Duzdag and Shirvanli are complicated by faults of thrust type with low amplitude indicates weakness of the mechanism of transverse bending in those areas (Mukhtarova, 2020). For this reason, there emerged non-structural traps, formed because of effusive ledges, biogenic massifs, lithological wedging out. However, in this territory, there have also developed non-structural traps with stratigraphic unconformity, where significant concentrations of oil and gas were found.

The deposits of massif-strata type have been discovered in the Upper Cretaceous effusive formations in the area of Muradkhanli, where industrial oil is being extracted from 54 wells. Oil extraction varies 5 t/d to 500, 800, 1500 t/d. Hydrocarbon deposits of massif-strata type in the reefogenic and effusive formation have been formed by complex spatial structure of pores and hydrodynamic isolation of the collectors (Rakhmanov, 2009).

It has to be noted that other than the Muradkhanli deposits, Azerbaijan has deposits related to reef and reef-like formations, which have mainly formed in YAD and were discovered as a result of scientific-experimental, theoretic studies, and using geophysical methods (Sorsor, Jarli, Zardab, and other) (Akhmedov, 2006).

Reef formation of 150-200 m thickness and 2,000 m width, located near the uplift in the southwest wing of the Sorsor structure, is composed of alternating layers of aphanite and limestone of organic origin. The studies revealed that the formation is a separate near-the-shore reef resembling an island, which is interesting by the fact that it is saturated with water that was found to contain solute gas in some cases (Akhmedov, 2006).

The Zardab structure is located deeper hypsometrically, and the surface of the effusive formations is covered by carbonate Upper Cretaceous deposits. Seismic records clearly show a reef-like non-uniform formation in the Upper Cretaceous deposits of the uplift part of the Zardab structure. The study of amplitude characteristics of seismic waves of this formation suggests variability of the lithological composition, and thus the formation may be considered promising. This is evidenced by extraction of oil from the Upper Cretaceous-Eocene rocks in three of 13 wells, drilled in the area, including one of the Maikop suite (Akhmedov, 2006).

We should note that due to occurring tectonic processes and development of the structures in the Absheron and Baku Archipelagos, there also have formed lithologically limited traps, which are highly promising (Mukhtarova, Nasibova, 2018).

In the studied region, the development of non-structural traps, which are related to the stratigraphic unconformity, occurs through changes in Paleotectonic and Paleogeographic conditions in the sedimentary basin and occurrence of interruptions in the process of sediment-accumulation. It has to be noted that such a type of traps was developing in the region against the background of mixed tectonic processes, mainly in the YAD. However, in the oil and gas-containing districts Absheron and Baku archipelago and other territories, such traps developed as a result of active uplifting tectonic movements, causing stratigraphic or angular unconformities (Narimanov, 2019).

In the area of Chilov, the industrial oil bearing was obtained from the lower section of the Productive series (Pre-Kirmaki, Gala suites (suites of Productive series, lower Pliocene)), which consists the upper limb of the allochthon, while the oil bearing in the northeast limb of the structure is associated with the Post-Kirmaki sandy, Gala and Pre-Kirmaki suites, which consist the lower part of the thrust fault, i.e. autochtonous part. Naturally, the border between the allochthon and autochton makes up the stratigraphic unconformity, as a result formed tectonically screened types of traps respectively. It should be noted that the obtained gas manifestations with flow rate of 40÷100 th. m³/d, which were obtained during the drilling, mainly have a great interest (Mukhtarova, Nasibova, 2018).

Analysis of geological-geophysical data (various profiles, time section, maps of the region) allows us to express the opinion that the formation of traps of lithological-stratigraphic type on the slope areas of the structure resulted when Eocene-Paleocene deposits had been wedged out because of the adhesion to effusive formations, especially in the Beylagan-Muradkhanli-Jarli direction in the Kura depression (Akhmedov, 2006). At the same time, on the Mesozoic surface in this area, there are Gabirri-Ajinothur, Pre-Lesser-Caucusus, Talysh pidmount, Mingachevir-Jafarli, Mugan-Salyan, Lower-Kura depressions, which are covered by thick marine sedimentary Cenozoic rocks.
In the zones where those rocks adhere to effusive and volcanic rocks, carbonates, the likelihood of formation of lithologically wedging-out traps and deposits is high. One can expect complication of those objects by deep faults, as well as direct connections between them. Our geological-geophysical studies of the Beylagan, Muradkhanli, Jarli, Aghjabadi, Zardab, Garajali, Mususlu, Jalilabad, Babazanan structures suggest extremely high probability of discovering a number of non-structural traps, associated with erosive-accumulative, effusive formations and reef structures, as well as those resulted from weathering and deformation of fractured parts adherent to those formation. One of the reasons of the emergence of traps of this type has been the differences in the history of geological development, time of formation of the traps and conditions of accumulation of precipitations. Tectonic development of the studied region, formation of non-structural traps in the area, study of paleoprofiles for the period between the Cretaceous to the modern period for the purpose of more detailed study of the formation of HC deposits in them point out to the complication of the zone by a deep fault prior to the Cretaceous period, increase in the tectonic activity at the end of the Lower Cretaceous period, and before the formation of the Shiringum structure in the area, and later – Sovetlar (Gadjizade, 2003; Akhmedov, 2006). This fact allows us to judge about the main role and strong influence of the compressive stress, directed from the southwest to northeast, on the fold formation, similarly to the Lower Kura.

At the same time, more favorable conditions for the formation of non-structural wedge-out traps, related to faults and fault mirrors, were created by increase in the tectonic activity in early Oligocene. The thickness of the Maikop (Oligocene+Lower Miocene) deposits and their mostly clayey lithological composition are of great interest. Therefore, sandy lenses, which may have been formed in this stratum, could be of great interest from the perspective of potential of non-structural traps.

In the zone of folding of the Saatli-Garajali, Mususlu-Garabujag, Soyudkhanli-Fakhirli, there are non-structural traps that are associated with reef formations. Seismic time section demonstrated a number of massive buried concentrations of biogenic origin in the region Mususlu-Garabujag. According to the data from the well drilled in the neighboring plot of Garajali, the local effusive deposits are overlapped by Upper Cretaceous limestones, and in the elevation core, the reefs of biogenic origin are overlapped by alternation of Miocene-Paleogenic marlstones, limestones and sandstones. Those data are coherent with the results obtained using the methods of seismic and gravimagnetic surveys (Rakhmanov, 2009).

We should note the differences in the geotectonic regime of the formation of the structures of the Middle and Lower Kura, which are separate geospatial elements of the Kura intermountane depression. Therefore, the main reasons of this in the Middle Kura depression were the development and convergence of the Greater and Lesser Caucasus, whereas in the Lower-Kura depression it was caused by the influence of northeast-oriented compressive forces of the Iran-Afghan plate (Narimanov, 2014). The conditions of sediment accumulation in the Lower Kura depression are characterized by both the accumulation of sandy collectors and thicker clayey strata. There, the deposited strata of clays of regional character played a big role in the formation of diapir elevations and thus in the formation of non-structural traps in areas Garasu, Padar, Saatli, Orta Mugan, Shorsulu, Sarkhanbavli.
Based on the history of geological development and contemporary structural condition of the territory, we should note that the processes of fold development which took place in the late Pliocene occurred only in the northeast slopes of the Mугan-Salyan and Garasu depressions, Kurovdag-Neftchala anticlinal belt, Padar fold (Mukhtarova, Nasibova, 2020).

Being mixed-type deposits, hydrocarbon deposits of the Kura depression occur in structural, lithologically limited, stratigraphic traps, and especially in massive-layered (uplift), structural-lithological, lithological-stratigraphic traps.

Effusive formations of the Muradkhanli deposits, which are related to the traps of this type, are represented by collectors of fracture-cavern type. Deposits of stratum-uplift type on the Muradkhanli are also associated with deposits of the horizons of the Middle Miocene, Chokrak, which have infiltrated the effusive formations. The Jafarli deposits, which belong to this zone, were also formed in the uplift part of the structure.

The Sovetlar field, which belong to the Ganja OGR, are associated with massif-strata traps. There, the collectors are organic limestones. The Maikop series in the east areas of the Ajidara, Gazanbulag developed causing a structural-stratigraphic trap by unconfirm embedding over the middle Eocene rocks. Lithological-stratigraphic fields of Yevlakh-Aghjabadi depression are associated with the Lower Eocene, and deposits of the Middle Miocene, which regionally oil and gas bearing. In the area of the Gazanbulag in the Ganja zone, and in the areas of the Western Amirkh, Zardab, Muradkhanli, Jafarli and Bozgobu in the Yevlakh-Aghjabadi depression, industrial flows of oil were obtained from those deposits (Yusifov, Suleymanov, 2015).

Moreover, in the area of the Jafarli, in the deposits of the Middle Eocene, there were discovered deposits related to non-structural type of traps. It has to be noted that in the area, there are also traps of lithological type. Lense-like traps were found in the areas Gazanbulag (Lower Maikop), Tartar, Beylagan, etc (Rakhmanov, 2007).

Within the SCD (including the land part), the oil and gas bearing is mainly related to the deposits of the Productive series (PS) (lower Pliocene). Relatively large hydrocarbon deposits, which have been formed in the Caspian basin, are concentrated in the Absheron-Balkan anticlinal zone, those in the land – on the Absheron Peninsula. In general, those deposits of latitudinal direction have formed in the regions that are associated with paleosubduction zone (Mukhtarova, Nasibova, 2018). South of the Absheron oil and gas zone, the largest HC deposits are Sangachal, located on the north anticlinal line of the Baku archipelago. The study of paleotectonic development of a number of structures of the Absheron and Baku archipelagos revealed that specifically the development of local elevations from continental sediments promoted the formations of non-structural type of traps, associated with wedging out of layers, on their wings. Analysis of paleoprofiles revealed that the fold formation in the Kura intermontane depression occurred in the early Chokrak, Pontian and Pliocene, and in SCD – in the early Pliocene.

Looking at the movement from west border to the east-south-east, we may judge about changes in the age of oil-bearing sedimentary complexes, as well as differences in the patterns of granular compositions in the strata. East-oriented growth of sandiness in the lithofacies’ composition of the deposits in the Lower Kura depression indicates the domination of negative tectonic movements in respective time period. Particularly this condition leaves no doubts regarding the formation of lithologically limited traps in the areas by wedging out of those same sandy strata westward. At the same time, the deeper it is, the more the growth, unlike the granular composition of the rocks. Throughout the studied territory, especially in the west of the Lower Kura, there was observed rhythmic variability in the lithological compositions of the strata. This indicates presence of fluctuating tectonic movements. Such a sharp variability in sediment accumulation allows the division of the territory into western and eastern zones. Based on the studies we performed, we may state high number, low capacity of non-anticlinal traps in the western zone, and – by contrast – low number and large capacity in the eastern zone.

Development of the traps in the Kura and South Caspian depressions is associated with the difference and complexity of sediment-accumulating and tectonic conditions, and in the Kura depression – with volcanic activity, and in SCD – with the activity of horizontally tangential movements, occurring in the zone of paleosubduction. While non-structural traps in region of the Kura depression of the studied region are associated with elevation of the core, composed of volcanic formations, such traps in the SCD have been formed as lithologically limited as a result of wedging out the strata westward and increasing differences between the granular compositions of the rocks that comprise it.

Complication of the wash out surface by gullies suggests significant role of paleogeographic conditions in the development of bay-like traps of stratigraphically and lithologically sealed types in Hashim-
khanli, Muganli, Sarkhanbayli, Agchala, Khirmandali in the period of their formation. They were discovered using common depth point technique of seismic survey in the lower horizons of the PS of the southwest board of the Lower Kura Depression, but the survey of oil and gas bearing by drilling was insufficient (Gadjizade, 2003).

Sand masses, which are replaced on all the sides by clayey deposits as a result of frequent change of the bed of the Paleovolga and its tributaries on the Absheron Peninsula and Absheron archipelago and the north part of the Baku archipelago, and in the Lower Kura depression – such of Paleokura and its tributaries, can form traps of lens-like, lace-like, hollow-like, bar and other forms. Such a type of lithologic traps often occurs in the delta fronts, on continental slopes, abyssal and delta plains. Those traps are present in the anticlinal structures that have been formed as a result of fold-formation of continental sediments in the PS age, in the Pre-Akchagil period (upper Pliocene) and – even more intense – in the Quaternary period. There are data about the formation of various traps of lithological type in the sections of the of the Gala, Pre-Kirmaki and Kirmaki suites, on the wings of the anticlinal structures of the Absheron Peninsula and archipelago, formed in the Paleovolga delta, and those traps have been studied quite well.

Segmentation of the examined territory by tectonic faults of various scales greatly complicates its study from geotectonic standpoint, i.e. studying structures, geological positions of which are closely associated with those faults. Longitudinal faults of regional scale are distinct by higher amplitude, and anticlinal structures that develop along those faults are complicated by transversal and radial faults, as well as mud volcanism. Such a complex – from the geological perspective – situation allows us to state extremely high tectonic activity in the region. This particular territory is known for high likelihood of formation of HC deposits in the structures that are complicated by faults and characterized by traps of various structures and types.

Despite the fact that the areas between the rivers Kura and Garibir, Yevlakh-Aghjabadi, and Lower Kura are separate elements of the Kura intermontane depression, they are included in the collision zone of the Greater Caucasus, Lesser Caucasus, Talysh and Alborz. From this perspective, all the processes occurring in the area are reflected to a certain degree. The studies focusing on formation of non-structural traps in the areas of the Dalar, Tovuz, Boyuk Palantokan, belonging to oil and gas-containing region between the rivers Kura and Garibir, revealed that the rates of precipitation-accumulation in the territory of Boyuk Palantokan equaled 146 m/M years in Paleogene (Eocene, Maikop). Therefore, the thickness of the Maikop suite deposits was the highest, equaling 2,000 m (Narimanov, 2014). Complication of the area by a deep fault in the early Lower Eocene and the following development of this fault in the subsequent periods indicate positive conditions for the formation of non-structural traps in the area.

Anticlinal zones that have formed as continuation of the SCD in the zone we studied in the land of the Lower Kura depression continue in the Baku archipelago. Most structures in the area have been complicated by mud volcanoes and – from the tectonic standpoint – are grouped in anticlinal zones Pirsaat-Hamamdag, Kalamaddin-Mishovdag-Bandovan and Kurovdag-Garavelbagi-Neftchala. Currently, industrial exploration is underway in the structures Kurovdag, Garabagli, Neftchala, Mishovdag, Kalmaz, North Kursangi, South Kursangi, Kalamaddin. The overall thickness of the sedimentary cover in the east of the territory is over 19-20 km, including 6 comprising Pliocene-Anthropogenous sediments (Mukhtarova, Nasibova, 2020).

After having studied the paleotectonic development of the structures of Baku archipelago and the Lower Kura, we may confidently state about the age of oil and gas bearing and the migrations, which are the main indicators of the development of deposits in the non-structural traps that have developed in the area. In the Lower Kura depression, the development of some structures began since the lower PS (Mishovdag, Kalmaz) and some – since the early Miocene (Kalamaddin, Boyuk and Kichik Harami, Gırlig) and continues to this day. The start of the development of the structures Kalamaddin, Boyuk and Kichik Harami, Gırlig, formed in the northwest, since the Chokrak period and acquirement of the respective form of the structure already in the Pontian age give reasons to state strong influence of tectonic movements particularly in this direction, and the embedding of the base for complications of the structures by faults due to growth of tectonic activity in the late Chokrak – early Diatom ages (Narimanov, 2014).

Also, there was study of paleotectonic development of other structures comprising the continuation of the anticlinal zone within the Baku archipelago. Since the continuations of the Pirsaat-Hamamdag anticlinal zone of the Lower Kura within the Baku archipelago are Garasu-Dashli-Sabail, Kalamaddin-Mishovdag-Bandovan-deniz-Yanan Tava-Atashgha, and such of Kurovdag-Neftchala are Kurchushi-Shirvan anticlinal zones, there were determined common features in their tectonic development.
There were studies of paleodevelopment of a number of structures, such as H.Aslanov, Chilov island, Gunashli, Azeri, belonging to Absheron archipelago, where the formation of the structures was confirmed to start even prior to Pliocene. Significant complication of the upland part of the folds allows us to assume the strong influence of tectonic movements. Due to the fact that those movements have tangential and vertical pattern, the folds are segmented by longitudinal and latitudinal faults. Therefore, thrust faults are seen on the Chilov structure, reverse faults in the Hazi Aslanov, and through faults in the folds of Guneshli and Azeri. This suggests weakening of the tangential tectonic movements toward the elevations of Gunashli-Azeri in the period of the formation of Chilov and H.Aslanov folds. Looking at the structures of Gunashli and Azeri, one may assume that the direction of tectonic forces during the fold formation was mainly perpendicular to the bedding, i.e. vertical (Mukhtarova, Nasibova, 2018).

Identifying the lithofacies’ composition, collector and sealing capacities, the degree of subjection to tectonic influence of the complex of deposits, in which the HC deposits have developed through the geological-geophysical studies is of great importance. Therefore, new geologic-geophysical exploration works would give a possibility of complex study of the conditions of the development of the deposits, as well as their qualitative-quantitative parameters, and would coordinate the direction of the studies.

It has to be noted that one of the most relevant problems as of now is correct evaluation of prospects of oil and gas bearing of HC deposits, especially those of non-anticlinal, non-standard types. Developing a model of the deposits, formed in non-structural traps, based on geological-geophysical studies, allows determining collector and sealing properties of the deposits, conducting in-detail studies of geometric shape and spatial position of the deposits, and according to the maps we charted for the distribution of non-structural traps across the studied region, one could compare quantitative and qualitative values of the deposits formed in the non-structural traps.

Conclusions.

1. Model that we developed for to the surface of the basement of the Baikal Mesozoic and Maikop periods revealed that one of the factors that had a significant impact on the formation of non-structural traps between the areas of the study was regional elevation of submeridional orientation, which started to form in the late Maikop period.

2. Non-structural traps in the interfluve between the Kura and Gabirri rivers are mainly of tectonically sealed type and diapir origin, and in the YAD, those traps have been formed as a result of local Upper Cretaceous elevations and positive elements of terrain, covered or adherent sediments on their slopes, which were forming traps of lithological wedge out. By contrast, in the Lower Kura and the SCD, on the structures of continental sediments, there formed non-structural traps of tectonic wedging out and sealed types.

3. According to the results of the study of the mechanism of the formation of non-structural traps in the considered region, we gave classification of non-structural-type traps, clarified geography their distribution, and charted maps of their distribution.

References


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