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# Oil and gas potential and modern seismicity of the Azerbaijan sector of the Caspian Sea

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Hydrocarbon deposits of the Republic of Azerbaijan are located in the South-Caspian oil and gas basin, on the territory of the Absheron Peninsula and the adjacent waters of the Caspian Sea. There are more than 80 oil and gas fields here. For this purpose, this article presents the geological structure of the South Caspian Depression, as well as the Apsheron-Pribalkhansk zone. Conducted analysis of oil and gas reserves and modern seismicity of the Caspian Sea. Increase in recoverable oil reserves, stabilization of mining at this stage — the task number is one for the oil field. It has been established that in recent years the level of seismic activity in certain areas of the Caspian Sea has risen, and the amount of seismic energy released in the Central Caspian Sea has increased by several dozen times. Distribution of density of epicenters in the whole alpine part of the region carries a weakly expressed wave character, which is represented by an alternation of differentiated zones of elevated and lowered concentration of epicenters. Zones have a predominantly north-western, submeridional and subshirot space. To determine the regularity of the distribution of hypocenter centers in the region, a diagram of the dependence of the number of earthquakes on the depths was built. In the waters of the Caspian Sea, 90 % of the hypocenters are located at a depth of more than 35 km. Together with them meet and close surface earthquakes. It was assumed that the change in the flow of oil in many seabed areas of the northern part of the Absheron-Balkhan storage system is associated with strong ($m_l$>3.0) earthquakes of characteristic type. Besides, there was a schematic model, which characterizes the formation of oil and gas fields in the structures, caused by the stress on the local area. The formation of the zone of localization of oil is associated with the accumulation of stresses in the local geodynamic fields and the formation of cracked media, although in such areas there is a gap, the probability of migration of hydrocarbons and hydrocarbons. On the basis of the above, it is possible to assume that there is a definite regularity between the oil and gas fields and seismicity in one and the same interval.

**Key words:** Absheron-Balkhan system, oil and gas deposits, hydrocarbon migration, earthquake source mechanisms.

**Introduction.** The Caspian Sea is one of the largest continental water bodies in the world. At present, the territory of the Caspian region is under the jurisdiction of five Caspian states: Russia, Kazakhstan, Turkmenistan, Azerbaijan and Iran. The Caspian region is usually understood as the area of modern sedimentation within the Caspian drainage basin, which includes the waters of the Caspian Sea, the Caspian lowland, the Ustyurt plateau, as well as the low plains of Western Turkmenistan and Azerbaijan. Geologically, the Caspian region is very heterogeneous. It is located at the junction of the four largest tectonic structures of the earth's crust. Here the Riphean-Paleozoic folded structures of the Ural-Mongolian and Paleozoic-Mesozoic structures of the Mediterranean mobile belts, as well as the platform structures of the ancient East European (Caspian Epicaledonian plate) and young Central Eurasian platforms (West Turanian Epihercynian plate, Scythian

Epikimerian plate and Tersko-South Caspian Alpine marginal foredeep), which is the cause of active geodynamic processes [Gadzhi-Kasumov et al., 2012].

The depth of the sea in the northern part of the Caspian Sea is only 2—4 m, in the south it reaches 1200 m. According to geophysical studies, the surface of the crystalline basement in the area of the Cheleken-Absheron threshold plunges sharply to the south from depths of 2—3 km to 20 km or more. The Northern Caspian is represented by a typical continental crust, covered with a sedimentary cover of small thickness and consisting of «granite» (about 10 km thick) and «basalt» (15—20 km) layers. In the South Caspian Basin, the earth's crust has a completely different, oceanic, structure and consists of two layers: a thick (over 20 km) sedimentary stratum and a «basalt» layer 10—15 km thick. The «granite» layer is completely absent here. The Mohorovich boundary in the depression area is located at a depth of 30—35 km. In the direction of the Caucasus and Kopetdag, it plunges to 45—50 km or more. The latest studies have shown that the structure of the earth's crust of the South Caspian depression as a whole is in good agreement with the typical characteristics of other deep sedimentary basins [Guliev et al., 2009; Dubinina, 2015].

The Caspian region is a strategically important region of Azerbaijan due to its high oil and gas potential. The results of the analysis confirm the presence at the bottom of the Caspian Sea of a large hydrocarbon base of global importance and capable of ensuring the sustainable development of the region throughout the entire period. By this time, more than 430 local uplifts had been identified in this area, of which about 60 were prepared for deep drilling. As a result of exploration, 47 fields were discovered with total proven oil and gas reserves of about 3.3—4.0 billion tons [Mehtiev et al., 1987].

Seismic studies of the Caspian Sea provide additional information about the deep tectonic processes taking place in this area, which is important for the seismic zoning of the Caspian Sea and in determining the possible connection between the sea and the sea. Until recently, the search for oil and gas was based on the study of anticlinal structures [Həsənov et al., 1999]. Even now, the search for non-anticline oil and gas fields in Azerbaijan is practically not carried out, since the genesis of such areas and the mechanism of hydrocarbon formation are poorly understood.

**Oil and gas potential of the Caspian Sea**. The study of the geological structure of the Caspian Sea by geophysical methods began in the 1930s. It was widely developed in connection with the creation, especially in the 1980s, of novel equipment and digital technologies that provided a good geological basis for quantitative assessments of hydrocarbon resources.

As shown by the analysis carried out by experts from the Institute of World Economy and International Relations (IMEMO) of the Russian Academy of Sciences and the Institute of Geology and Development of Combustible Fossils, current estimates of recoverable oil reserves in the Caspian Sea range from 4 to 6 billion tons [Gadzhi-Kasumov et al., 2012; Kazimova et al., 2015]. At the same time, out of the total volume of hydrocarbons, the share of oil, according to the cited authors, accounts for at least 5.5—6.0 billion tons, or, minus 1.5 billion tons of already produced oil, at least 4.0 billion tons of residual resources belonging to Azerbaijan, Turkmenistan and Iran [Kerimov et al., 1990; Ermolkin, Kerimov, 2012]. The annual oil production in the Caspian Sea is ~240 million $m^3$. It is predicted that by 2021—2024 oil production in the Caspian Sea will be 200 million tons/year, and gas — 270 billion $m^3$/year [Arabov, Arabov, 2019].

***Azerbaijan sector***. The main impetus for the beginning of oil production in the South Caspian was given at the Azeri-Chirag field, discovered during the existence of the USSR, located on the Apsheron segment of the Apsheron-Pribalkhan zone of the Caspian (Fig. 1). Its recoverable reserves have been estimated as 730 million tons and included in the preparation and development since 1997. In 1998, the Azerbaijan International Operating Company (AIOC) started drilling a new well at a water depth of 135 m using the Dada-Gorgud semi-submersible platform.

Due to technical limitations, the rig was unable to drill out the lower parts of the section and completed the hole at a depth of 2500 m. After re-equipment, this rig, which received the new name Istiglal, deepened the well to 6316 m. Drilling revealed three gas condensate horizons. The next well, drilled at a water depth of 348 m to a depth of 5892 m, also found three main gas condensate-saturated horizons. Specialists of the British oil company BP (British Petroleum Corporation) estimate the reserves at the Shah Deniz fields as about 150 billion m$^3$ of gas and about 24 million tons of condensate. According to Azerbaijani experts (SOCAR), the total forecast resources are 400 billion m$^3$ of gas and 200 million tons of condensate [Gadzhi-Kasumov et al., 2012; Yetirmişli, 2000].

Despite some setbacks, the discovery of the Shah Deniz field signaled that ample hydrocarbon reserves could be found in the South Caspian Basin. At the same time, the discovery of a second gas field (after the Bakhar) and the presence of exclusively gas manifestations in the bore hole, in the Umid area in the interval from 2150 m of the bottom hole — approximately in the same strip, gravitating towards the outer zone of the shelf or the upper zone of the continental slope, suggests that these parts of the basin as a whole can be characterized mainly by gas condensate fields of medium and small scale — based on the size of the known structure and features of the reservoirs [Vorobyov et al., 1999].

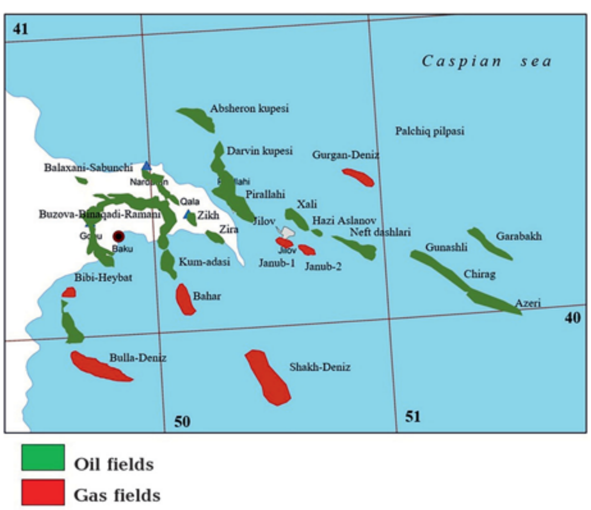


Fig. 1. Schematic map of the location of oil and gas fields of the Apsheron oil and gas bearing [Shikhova, 2020].

Thus, in the western part of the South Caspian and especially in its inner region, the period of discoveries of large oil fields is apparently ending, and the period of gas and condensate discoveries is beginning. The reserve of such discoveries is probably far from being exhausted, yet their scale will probably differ from that of oil discoveries.

The Baku oil and gas region is a large region in terms of oil production and reserves on the territory of modern Azerbaijan. The oil fields of the region are located within the South Caspian oil and gas basin, on the territory of the Apsheron Peninsula and the adjacent water area of the Caspian Sea. There are more than 80 oil and gas fields here. Shah Deniz, the main fields are Azeri-Chirag-Guneshli, Oil Rocks, Bahar, Sangachali-Sea, etc. Oil is also developed in the Caspian Sea [Gadzhi-Kasumov et al., 2012]. The modern Baku oil and gas basin still plays the role of the main engine of the Azerbaijani economy. Consequently, the main task for the Azerbaijani economy — the growth of hydrocarbon reserves in the South Caspian Basin and the stabilization of oil and gas production in this area — can be achieved through the organization of prospecting and exploration work both in new unexplored regions and in old oil and gas bearing areas where there is infrastructure is well developed and there is a surplus of labor force. The implementation of these activities should be carried out using new scientifically based concepts and progressive modern search methods.

***Seismicity of the Caspian Sea***. Strong earthquakes have repeatedly occurred in the water area of the Caspian Sea. In the last century, the region underwent 15 strong earthquakes with magnitude $M \geq 5.0$, intensity 6—8 at the epicenter according to the MSK-64 scale. They were felt in Baku and coastal areas up to points 5—7 [Serikova, 2013].

A strong ($M$=6.6) deep-focus earthquake occurred in the Caspian Sea north of Absheron on September 18, 1961. It was felt up to 7—8 points on the northern coast of the republic (Siyazan, Gilazi, Nasosnaya), in Absheron, and in Baku up to 6 points. Another strong earthquake (*M*=6.2), which occurred on January 27, 1963, north of Absheron, was also felt in Baku up to 6 points. Plaster fell down in places, andstone walls cracked [Etirmishli et al., 2016, 2019].

The earthquake that occurred on March 6, 1986, with *M*=6.2, was felt on Oil Rocks with an intensity of 7—8 points, in Baku up to 5 points. Earthquakes on August 24, 1989, with *M*=5.7 in the northern marine subzone and on September 16, 1989, with *M*=6.2 in the middle part of the Caspian, were felt in the northern coastal regions of the republic and Baku with an intensity of 5 points [Etirmishli et al., 2019].

The beginning of the century was characterized by increased seismicity in the southern marine subzone. In 2000, south of Absheron, a seismic event took place in the form of two shocks, which were felt almost throughout the entire territory of the republic. In Baku and nearby, the intensity reached 6—7 points. This event was accompanied by many aftershocks, some of which were tangible.

In recent years, the level of seismic activity in certain water areas of the Caspian has increased, and the amount of seismic energy released in the Central Caspian has increased several times. Along with strong seismic events, many weak earthquakes were recorded in the study area.

Note that the formation, migration, and accumulation of hydrocarbons in the Caspian region occur in the sedimentary cover. In order to elucidate the nature of seismogeodynamic and dynamic changes in the region, we analyzed the nature of the distribution of earthquakes over area and depth, which determines the geodynamic energy status of the sedimentary cover.

To find the patterns in the distribution of earthquake hypocenters in the region, a diagram of the dependence of the number of earthquakes on depth was plotted (Fig. 2). In the water area of the Caspian Sea, 50 % of hypocenters lie at a depth of more than 35 km. At the same time, near-surface earthquakes also occur. As seen in Fig. 2, 20 % of hypocenters lie at a depth of 0—20 km, corresponding to the Meso-Cenozoic complex of deposits, which is promising in terms of oil and gas potential. The manifestation of earthquakes in the sedimentary cover indicates that the layers in this range are in a mobile energy state [Trofimuk et al., 1981; Kerimov et al., 1990; Jafarov et al,. 2005; Etirmishli et al., 2016; Shikhova, 2020].

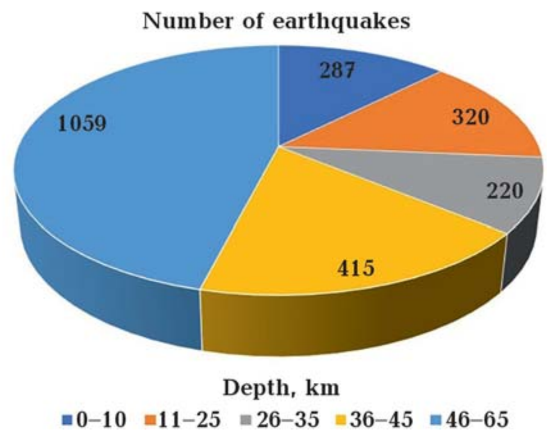


Fig. 2. Earthquake depth distribution diagram for 2003—2022 for the territory of the Caspian Sea.

Fig. 3 shows a map of earthquake epicenters with local magnitude $m_l$≥0.1 and $m_l$≥4.0 for 2003—2022. Earthquake epicenters are taken from the catalogs of the Earthquake Research Bureau of the Republican Center of the Seismological Survey of the National Academy of Sciences of Azerbaijan. In general, the seismic activity of the region is evenly distributed. According to its seismo-geological features, the region is divided into two parts — the northern, seismically passive, belonging to the Scythian-Turan platform, and the southern, within the Eastern orogenic-folded belt. The boundary between them is not clear but rather a strip of varying width, approximately corresponding to the system of tectonic sutures that limit the Scythian-Turan platform from the south at the level of the consolidated crust. Here, the number of recorded earthquake epicenters decreases northwards until their complete disappearance. The epicenters within the strip are grouped into lines oriented both along and across, apparently fixing the position of activated faults in the preorogenic edge of the platform area.

As seen in the figures, earthquakes, which are occasionally recorded in the inner regions of the Scythian-Turan platform outside this strip, are most likely random, secondary, and can be initiated by seismic waves from the most powerful earthquakes.

Most of the oil and gas fields discovered in the South Caspian Basin lie in the zones of tectonic faults and around.

As the results of the generalization of materials on seismic zoning show, the Alpine belt is characterized by highly differentiated seismicity, in the distribution of which certain regularities are established. In the northern part of the belt, adjacent to the platform, there is a zone of high (7—9 points) intensity of earthquakes, in which there are several nodes with the highest activity — Makhachkala Krasnovodsky, Apsheron-Pribalkhansky, Gyzylagadzhsky, Shakhovo-Azizbekov (Fig. 4). To the south of this zone there is zoning transverse to the strike of the Alpine belt, which is expressed by the alternation of areas of high (7—9 points) and relatively low (5—6 points or less) intensity of earthquakes. The lowest intensity of earthquakes in the alpine sector of the Caspian is observed in the central region of the South Caspian depression.

An analysis of the distribution of earthquake epicenters makes it possible to identify seismological provinces — zones of concentration of epicenters.

The North Caucasian province corresponds to the northern slope of the Greater Caucasus, the Terek-Caspian trough, and the Prikumsko-Tyulenev uplift zone of the Scythian plate. The maximum concentration of earthquake epicenters in this sub-province is characteristic of its orogenic zone. With access to the plain, seismicity drops sharply and is expressed mainly by single epicenters. These form sub-meridional lines transverse to the main strike of the sub-province (see Fig. 4).

The East Caucasian province, in essence, describes the boundary between the orogenic systems of the Caucasus and the deep-water basins of the Middle and South Caspian. Geologically, it corresponds to the coastal folded zones of Eastern Dagestan, the Apsheron Peninsula and the archipelago, the Baku archi-

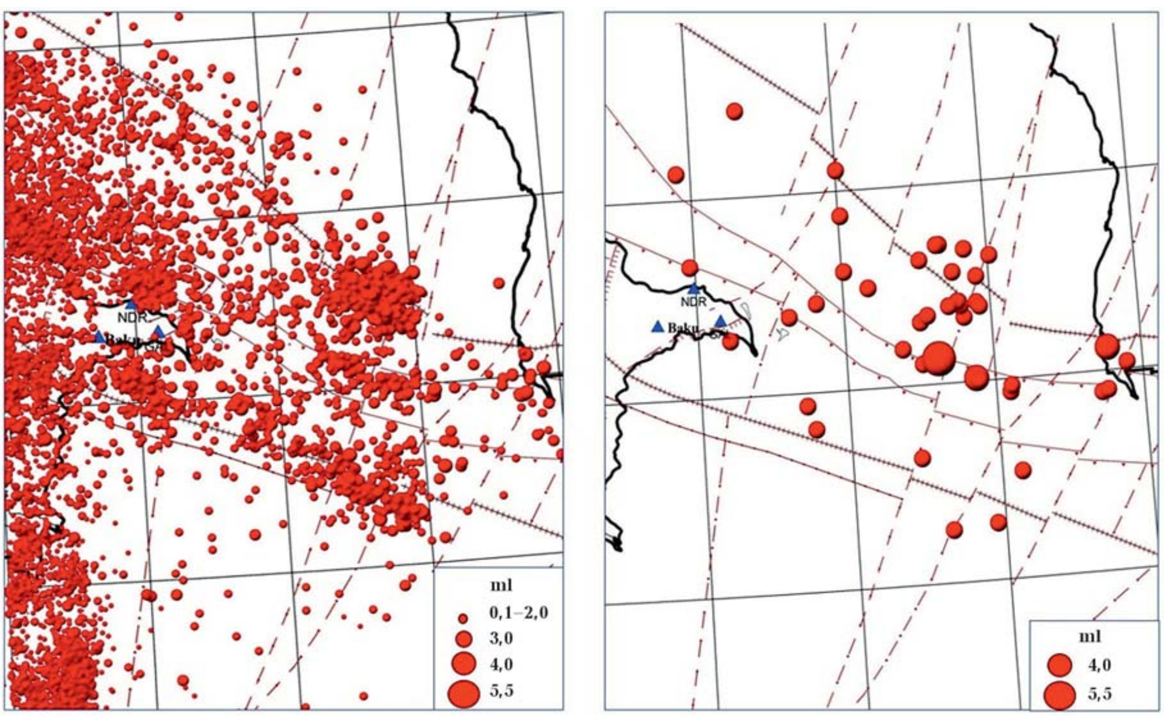


Fig. 3. Map of epicenters of earthquakes that occurred in the Caspian Sea in 2003—2022.

pelago, and the Low-Kurinsk-Enzeli region, developed in the Cenozoic part of the sedimentary cover and having the same strike. Less distinct and perhaps more problematic is the belonging to this sub-province of the region of Eastern Talysh [Gadzhi-Kasumov et al., 2012].

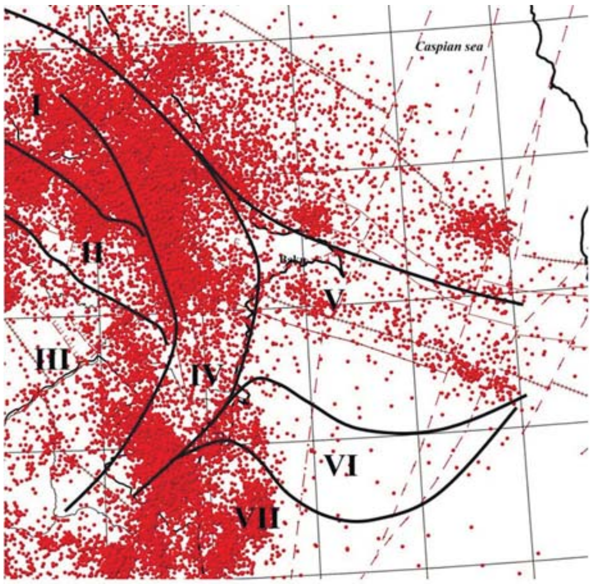


Fig. 4. Map of earthquake epicenters for seismological provinces of the Caspian Sea in 2003—2021: I — North Caucasian province, II — Province of the Greater Caucasus, III — Transcaucasian province, IV — East Caucasian province, V — Apsheron-Krasnovodsk province, VI — South Turkestan province, VII — Iranian-Turkestan province.

The Apsheron-Krasnovodsk province describes the zone of a deep suture (Turkmen suture) between the Karabogaz ledge (crown) of the Turan plate and the South Caspian basin of the Alpine belt. The transverse zonality of its western sector is apparently related to the block differentiation of the Karabogaz dome, which, in turn, can be activated due to the influence of orogenic movements in the Caucasus and subsidence in the South Caucasus depression [Gadzhi-Kasumov et al., 2012]. Fig. 5 shows a seismotectonic map of earthquakes in the Caspian Sea for 2003—2022 ($m_l \geq 3.0$) and large oil fields in the region.

The Iranian-Turkestan province covers the Bogrovdag-Elburs and Kopetdag orogenic-folded systems and is divided into two longitudinal zones — the northern (water area) and the southern, proper orogenic. The northern zone is characterized by a low concentration of earthquake epicenters, which increases only in its eastern part (lower reaches of the Atrek River); in the southern zone, the highest concentrations of earthquake epicenters are noted, which are also characterized by the highest intensity [Gadzhi-Kasumov et al., 2012].

The distribution of epicenter densities in the whole Alpine part of the region has a weakly pronounced wave character, which is represented by the alternation of differently oriented zones of increased and decreased concentrations of epicenters. The zones have a predominantly northwestern, sub-meridional, and sub-latitudinal strike; the first and second are typical mainly for the Caucasian province.

From the diagram of the maximum possible earthquakes, it follows that for the conjugation zone of the Scythian-Turan platform and the Alpine belt as a whole, earthquakes with a magnitude of more than 5.0 may be characteristic. Zones allow the accumulation of potential tensile energy, and as the stress in the environment increases, a cracked structural zone is formed. When the energy accumulation in this medium reaches its limit, that is, at the last moment of the tensile strength of the layers, the trunk collapses, and the accumulated energy is released in the form of waves. Hydrocarbons are known to migrate in such zones and form deposits in the resulting structures. Almost 60—65 % of discovered oil and gas fields are located in and around fault zones.In some cases, it is possible to accumulate potential energy in local areas inside the blocks, where stress is accumulated in layers [Gadzhi-Kasumov et al., 2012]. Such zones are often observed parallel to fault zones as characteristic anticlinal forms of low amplitude. Searching for them should take into account paleoseismic conditions.

So, for example, similar characteristic localizations were observed on seismic profiles developed in the Volga-Ural and Tatarstan regions. To confirm the result, three wells were drilled, and it was confirmed that oil was localized in this zone [Lebedev, 2002]. The for-

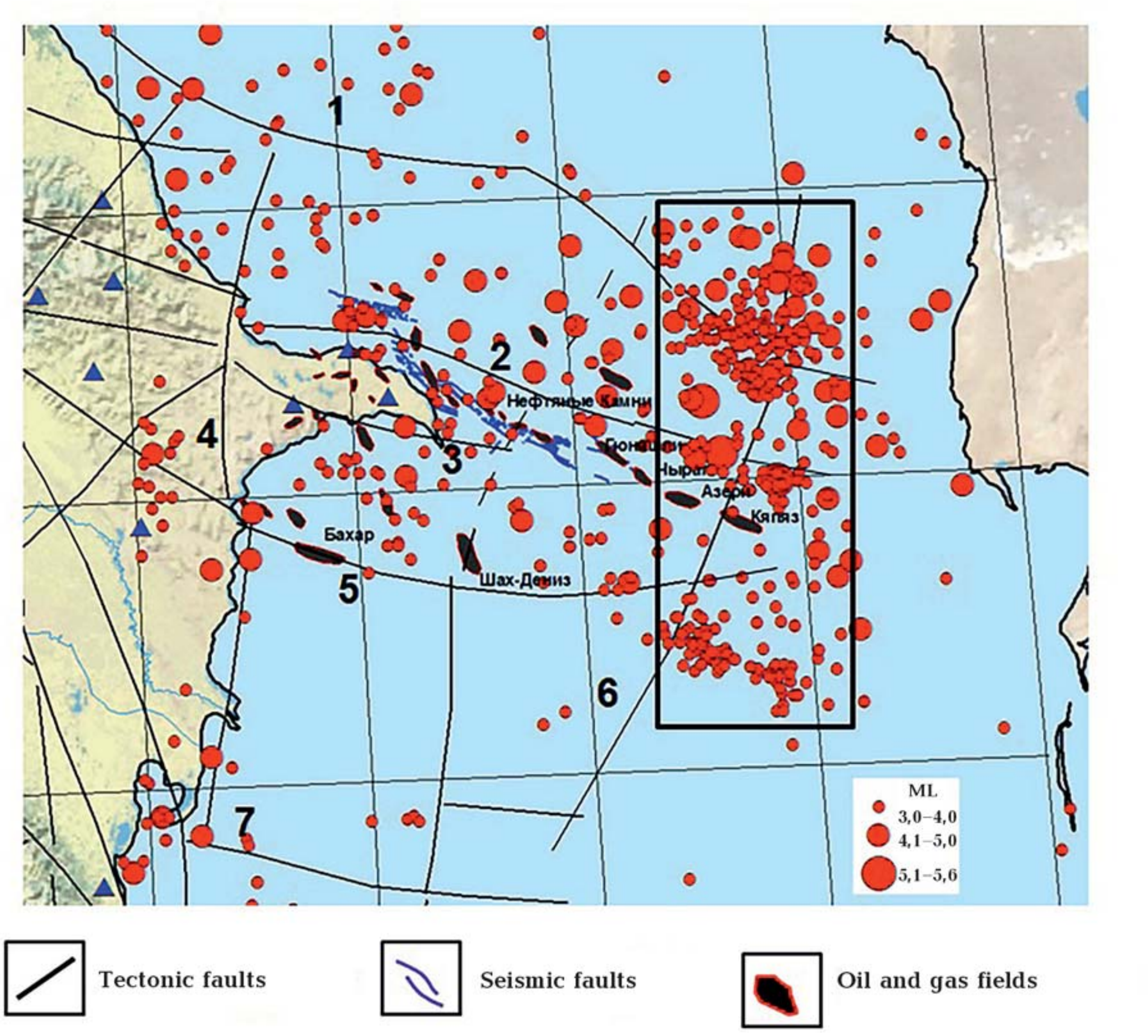


Fig. 5. Map of epicenters of earthquakes that occurred in the Caspian Sea for the period 2003—2022 ($m_l$≥3.0). Faults: 1 — Makhachkala-Krasnovodsk, 2 — Apsheron-Balkhan, 3 — Sangachal-Ogurchi, 4 — Yashma, 5 — Gizilagaj, 6 — Shakhovo-Azizbekov, 7 — Garabogaz-Safidrud.

mation of such zones is associated with the accumulation of stresses in local geodynamic fields and the formation of a fractured medium; although there is no fracture in such areas, the probability of hydrocarbon migration and sedimentation is very high. Logically, the accumulation of oil and gas in fields of geodynamic origin is consistent with the mechanism that occurs in lithological and stratigraphic fields.

The study and exploration of such sites in separate sedimentary complexes in the South Caspian Basin should meet modern requirements.

Based on a joint analysis of the main elements of the seismogenic fault tectonics of the studied region and the mechanisms of earthquake sources for the period 2003—2022, it has been established that for the territory of the Central Caspian Basin, for small angles of the extension axes, large angles of the compression axes are typical, which indicates the predominance of fault-shear movements there. Given the choice (according to geological data) of preferred fracture planes, both right and left strike slips are encountered. Earthquakes occur under close compressive and tensile stresses (shear type of movement). Reverse faults are also found on the territory of the Northern Caspian [Kazimov, Kazimova, 2016]. A comparative analysis of the focal mechanisms of earthquakes that occurred in 2003—2018 showed that, generally, the trend of the predominance of shear movements within the studied region remains (Fig. 6).

From the standpoint of the modern plate tectonic model, the presence of the East European, Scythian, West Turanian, Lesser Caucasian, South Caspian, and Iranian lithospheric mesoplates. According to [Murzagaliev, 1998], the Scythian and Lesser Caucasian plates move along an azimuth of 18° at a speed of 1.92 cm/year and simultaneously rotate counterclockwise by $2.03\times10^{-70}$. The West Turanian and Iranian mesoplates are moving northwest along the collision sutures at a rate of 1.7 cm/year, while the South

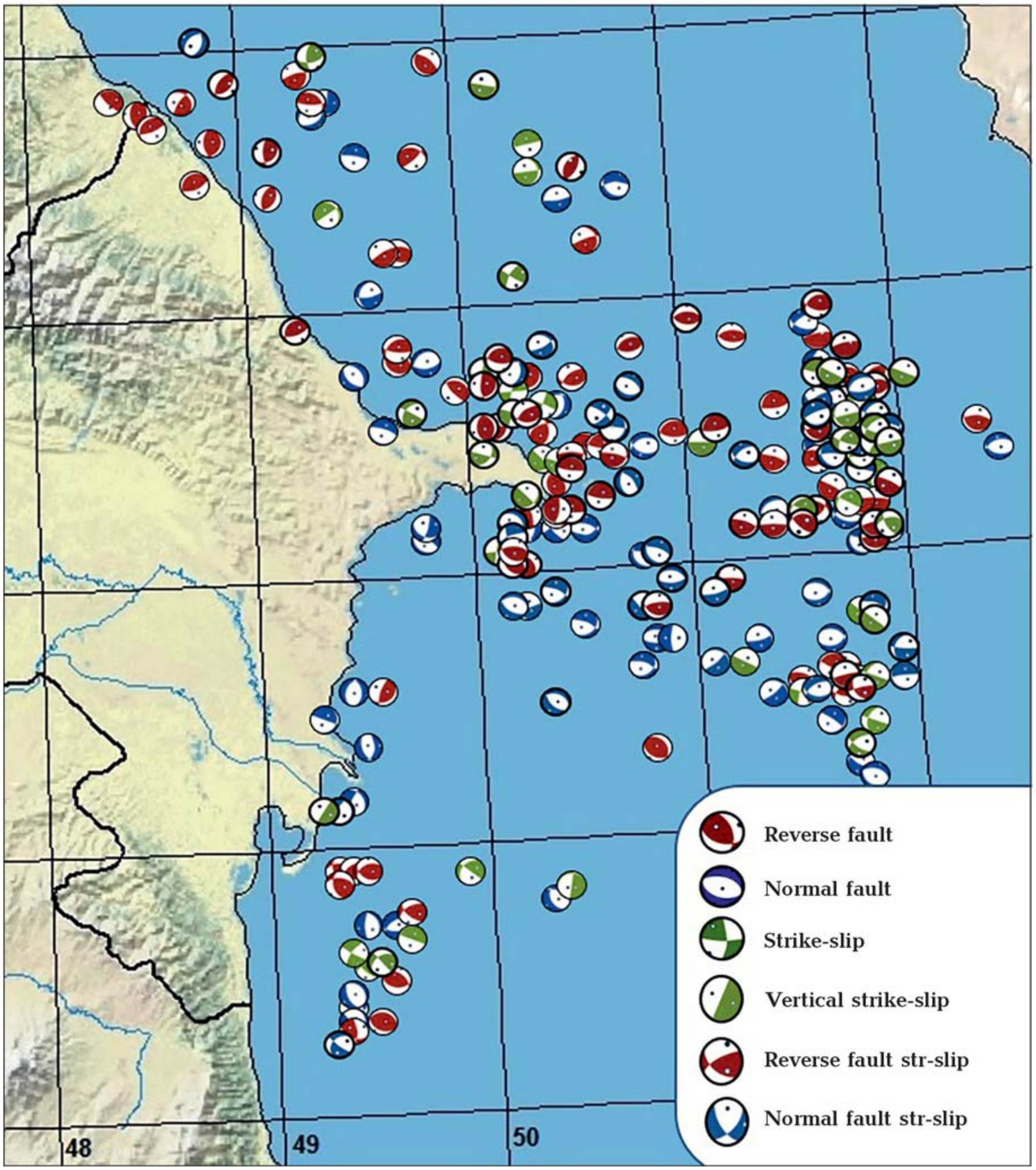


Fig. 6. Focal mechanisms of earthquakes in Azerbaijan ($M\geq3.0$) in 2003—2022.

Caspian plate is shifting along an azimuth of 319° at a rate of 0.4 cm/year. Relative to the East European Plate, it rotates at an angular velocity of $0.6 \times 10^{-70}$ counterclockwise. Thus, the Caspian region found itself in the center of convergence of several plates with different kinematic parameters. All this determined the complexity of the stage of geodynamic development and the conjugation of heterogeneous geostructural elements.

The main mechanism in the Caucasian-Caspian suture zone of the collision of the Euro-Asian and Arabian lithospheric plates turned out to be the pulsating pressure to the N-NE of the Arabian plate ledge, associated with the opening of the Red Sea and Aden rifts. It led to a sharp transverse compression of the orogenic belt and the Caspian basin, the bending of all mountain systems of Asia Minor and the Middle East to the northeast, the formation of nappe-thrust morphostructures, diagonal left-lateral displacements of large blocks, longitudinal underthrust zones with a steep dip of seismic focal surfaces to the northeast. The dynamics of the evolution of morphostructures and the main features of the relief are determined by the mechanism of horizontal compression-tension. The vertical component of relief differentiation can be considered a derivative of this mechanism. As a result, the edges of the Scythian and Arabian plates during the Pliocene-Quaternary time were brought together by 350—400 km. The Caspian depression is sharply deformed; its middle part is oriented from west to east [Etirmishli et al., 2016].

In order to analyze the change in the orientation of the main compression and extension axes with depth, we constructed a distribution scheme for the orientation of the main compression and extension axes of the Caspian region in the depth intervals of 26—45 and 45—80 km. As seen in Fig. 7, the tendency of the SW-NE orientation of the extension axes and the NW-SE orientation of the compression axes manifests progressively more clearly with depth.

**Conclusions.** The seismicity of the Caspian region is characterized by a very uneven distribution over the area. In the water area of the Caspian Sea, 90 % of hypocenters are distributed at a depth of more than 45 km, and 10 % of hypocenters at 0—20 km. The manifestation of earthquakes in the sedimen-

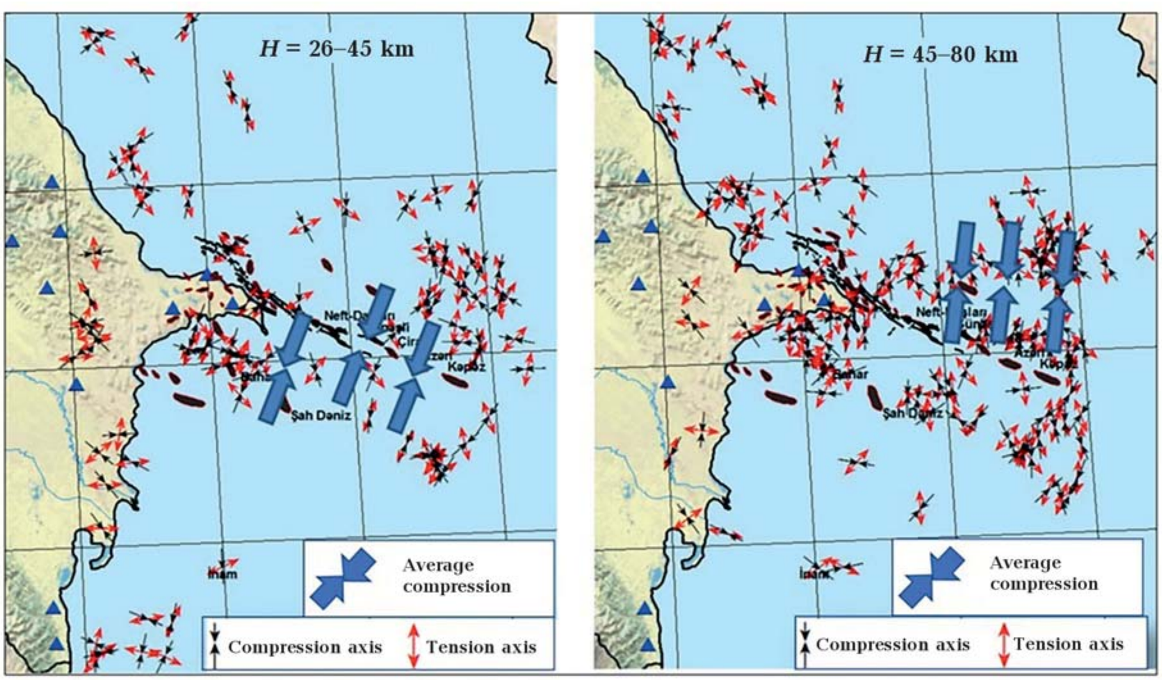


Fig. 7. Scheme of orientations of the axes of compressive and tensile stress mechanisms of earthquake sources in the Caspian Sea in 2003—2022 ($m_l \geq 3.0$).

tary cover indicates that the layers in this range are in a mobile energy state.

The lowest level of seismic activity central region characterizes the South Caspian depression. According to the considered indicator, almost the entire North Caspian and the northern part of the Middle Caspian are seismically passive. The conjugation zones of the Scythian-Turan platform and the Alpine belt as a whole are characterized by earthquakes with a magnitude of more than 5.0.

The boundary between aseismic and highly seismic areas crosses the Caspian Seafrom the city of Makhachkala to the southern border of the Kara-Bogaz-Gol Bay. The frequency of destructive earthquakes with a magnitude of more than $M$=5.0 is 4—5 years. The epicenters of earthquakes with magnitude $M$≥5.0 are confined to inter-fault blocks and fixed along the faults.

The formation, migration, and accumulation of hydrocarbons in the Caspian region take place in the sedimentary cover. The manifestation of earthquakes in the sedimentary cover indicates that here, the layers are in a mobile energy state. Hydrocarbons' formation, migration, and discovery are associated precisely with this range. Based on the above, there is a pattern for oil and gas fields and seismicity in the same depth interval.

Based on a joint analysis of the main elements of the seismogenic fault tectonics of the studied region and the mechanisms of earthquake sources for the period 2003—2018. It has been established that for the territory of the Central Caspian Basin, for small angles of the extension axes, large angles of the compression axes are characteristic, which indicates the predominance of fault-shear movements. However, reverse faults have been established on the territory of the Northern Caspian and in the region with oil deposits. An analysis of the orientation of the main compression and extension axes with depth revealed a sourse-east-north-west trend in the orientation of both the compression and extension axes.

The development of geological exploration and large-scale production of hydrocarbons in the future will lead to major discoveries, economic projects, and intensive development of the oil and gas complex in the region. In this regard, studying the history of the formation and development of the oil and gas complex of the Caspian region is an urgent task, and undoubtedly, the analysis of history can contribute to the development of the oil and gas complex. For further development of the territory of the Caspian Sea, it is necessary to intensify the development of geological exploration and the introduction of innovative technologies into the practice of hydrocarbon production, which in the future will allow developing the oil and gas complex in the region at a proper level.

On the other hand, the effect of earthquakes on the process of involvement in the filtration flow of oil is the greater, the smaller the depth of the earthquake source that caused filtration pressure waves in the deposit. Taking into account the fact that in recent years the level of seismic activity in certain water areas of the Caspian has increased. The amount of seismic energy released in the Central Caspian has increased, it can be assumed that the change in oil production in many offshore fields in the northern part of the Absheron-Pribalkhan fold system is associated precisely with this.

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# Нафтогазовий потенціал і сучасна сейсмічність азербайджанського сектору Каспійського моря

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Республіканський центр сейсмічних досліджень Національної академії наук Азербайджану, Баку, Азербайджан

Родовища вуглеводнів Азербайджанської Республіки розміщуються в Південнокаспійському нафтогазоносному басейні, на території Абшеронського півострова та прилеглої акваторії Каспійського моря. Тут знаходиться понад 80 нафтових і газових родовищ. У статті наведено геологічну будову Південнокаспійської западини, а також Абшерон-Прибалханської зони. Проаналізовано запаси нафти і газу, а також розглянуто сучасну сейсмічність Каспійського моря. На сьогодні першорядним завданням є збільшення запасів нафти, що видобуваються, і стабілізція видобутку. Встановлено, що останніми роками підвищився рівень сейсмічної активності в окремих районах Каспійського моря, а кількість сейсмічної енергії, що виділяється в Центральному Каспії, зросла в кілька десятків разів. Розподіл щільності епіцентрів землетрусів у всьому району є слабко вираженим хвильовим — виявлено чергування зон підвищеної та зниженої концентрації епіцентрів. Розподіл цих зон переважно північно-західний, субмеридіональний та субширотний. Для визначення закономірності розподілу осередків гіпоцентрів у регіоні побудовано діаграму залежності кількості землетрусів від глибин. В акваторії Каспійського моря 90 % вогнищ знаходяться на глибині понад 35 км. Разом із ними трапляються і поверхневі землетруси (0—10 км). Передбачалося, що зміна дебіту нафти на багатьох ділянках морського дна північної частини Абшерон-Балханської зони пов'язана з відносно сильними ($m_l > 3{,}0$) землетрусами типу скидо-зсув. Зроблено припущення, що формування зон локалізації нафти пов'язано з накопиченням напружень у локальних геодинамічних полях і утворенням тріщинуватих середовищ, якими можлива міграція вуглеводнів. На підставі викладеного можна припустити наявність певної закономірності між родовищами нафти та газу, сейсмічністю та зміною геодинамічного режиму.

**Ключові слова**: Абшерон-Балханська зона, поклади нафти та газу, міграція вуглеводнів, механізми вогнищ землетрусів.