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ASSESSMENT OF PERSPECTIVE AREAS IN THE NORTH ABSHERON UPLIFT ZONE OF THE SOUTH CASPIAN BASIN AND GEOLOGICAL AND GEOCHEMICAL FEATURES OF THE UPPER PART OF THE SECTIONS: A STUDY FROM THE GARABAKH FIELD

Abstract: The article considers the important role of attracting the upper part of the sections to the study in order to expand exploration and prospecting activities in one of the promising field Garabakh, located in the Northern Absheron Upland Zone of the South Caspian Basin. The geological and geochemical properties of seabed sediments were studied as a result of appropriate integrated investigations. So that, based on the results of static sounding, geotechnical drilling, continuous seismoacoustic profiling and laboratory studies, as well as the absence of any faults and gas seepages on the surface and normal bedding of the sediments in the upper sections indicate the stable features of the studied area from the point of view of engineering geology.

Key words: continuous seismoacoustic profiling, high-resolution seismic exploration method, points of general depth, upper part of the section, static sounding.

Language: English

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Introduction

The increasing demand for oil and gas reserves in the world rises the need for the development of deep-seated hydrocarbon deposits located both onshore and in deep water zones. In recent years, the development of the oil industry in Azerbaijan and the use of advanced technologies (drilling equipment) have made it possible to conduct exploratory drilling in the deeper zones of the South Caspian Aquatory.

The main hydrocarbon reserves of Azerbaijan are connected with the South Caspian Basin. The geological, lithostratigraphic and tectonic characteristics of the South Caspian Basin are very complex, since all the oil and gas containing structures are complicated by mud volcanoes [5-26, 28, 37, 42, 45, 46]. In total, 353 mud volcanoes and mud volcanic manifestations are located in Azerbaijan, 154 of which are marine volcano. The distribution of mud volcanoes in the offshore oil and gas bearing regions are statistically equivalent to 30 in the Absheron archipelago, 92 in the Baku

archipelago and 32 in the deep water zone of the South Caspian Basin [4].

The South Caspian Basin is a subsiding basin between the colliding Arabian and Eurasian plates. This factor creates favorable conditions for the formation of geological events, such as mud volcanism and earthquakes. The increase in seismic activity is also affected by the activity of mud volcanoes [29, 32-34, 47, 48]. There is a paragenetic link between these natural events. In this regard, during the year, 5-6 eruptions are recorded in Azerbaijan. As a result of the eruptions, the various gases are emitted on the Earth's surface. The height of the volcanic flame reaches 100-500 m. A large volume of volcanic breccia are brought to the surface [4]. The organic and mineral composition of volcanic breccias, including oil shales (found among them) are ejected from different depths, exceeds the average values of sedimentary rocks, which causes a violation of the natural balance of the environment



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[30, 31, 35, 36, 44, 49]. In addition, as a result of the daily activity of the mud volcanoes, a number of gases, high salinity waters, and mud-water mixtures also are emitted to the surface. Geochemical point of view forms unique volcanic landscapes, as well as oil-impregnated areas. These landscapes belong to geochemical rare fields that have a negative impact on living organisms, both on land and in the marine environment.

The risk of mud volcanoes in the marine environment in Azerbaijan attracts attention from several aspects. As already noted, seepage of natural gases is observed in those areas where mud volcanoes occur, and these zones are known for their promising structures (containing hydrocarbon reserves), and deposits produce oil and gas. Depends on paroxysm or the daily actions of mud volcanoes the areas are very dangerous to carry out any industrial activity. In order to study the engineering-geological properties of the mentioned seabed areas, which are characterized by a wide spread of gas seepages, there was an urgent need to conduct geological, geochemical and geophysical surveys in these areas [1, 2, 38]. Thus, the main tasks of these studies were to perform the following complex activities: the studying of physical and mechanical properties of the rocks that form the upper part of the sections, determining deep faults, assessing the engineering and geological conditions, and selecting sustainable areas for construction and installation of engineering hydraulic structures.

Geological setting of the study area

The North Absheron Uplift Zone is located between the Middle and South Caspian basins, and contacts North Absheron basin from the north. This area was subjected to active tectonic processes. In ancient geological periods, sea level has been changed by regression and transgression, and in this

regard, the sea beds and deltas have also changed. These factors had a significant impact on the geological structure of the region.

The activity of Paleo Volga, as well as evictical movements, plays an exceptional role in the change of sea level, the formation of stratigraphic sequences and the collection of clastic rocks. North Absheron Uplift Zone has an asymmetrical structure from far and wide directions in the southeastern part. Asymmetry of this part is reflected in the burial of the Kirmaki Suite sediments from the 2300-2400 m to 3400-3600 m depth at the 60-65 km distance from the Khazri Uplift (located in the north-western part to the south-eastern) to Garabakh Uplift. It should be noted that the subsidy of the hypsometric level is not periodic. This is due to the formation of relatively large and small terraces that separate the structural groups which form the uplift areas.

The oil-gas reserves of the north-western part of the Absheron archipelago are associated with the sediments of the Productive Series of Lower Pliocene. Unlike the Absheron peninsula, the oil potential in the north-eastern part of the archipelago are mainly related to the sandy horizons of the Gala, Kirmeki, Post-Kirmeki suites of the Productive Series.

The Garabakh structure (Fig. 1) is located in the north-western part of the Absheron archipelago and covers an area 40 km from the Neft Dashlari deposit. Here the relief of the seabed is smooth and deepens in a northeasterly direction. The depth varies from northwest to southeast (from 135 to 185 m). Based on the data of the point of total depth, this fold is a brachyanticlinal structure that extends from northwest to southeast. The south-western wing of the asymmetric structure is located under the straight (18°), and northeast under a flat ($3-5^\circ$) angle [3, 4, 27, 39, 41-43].

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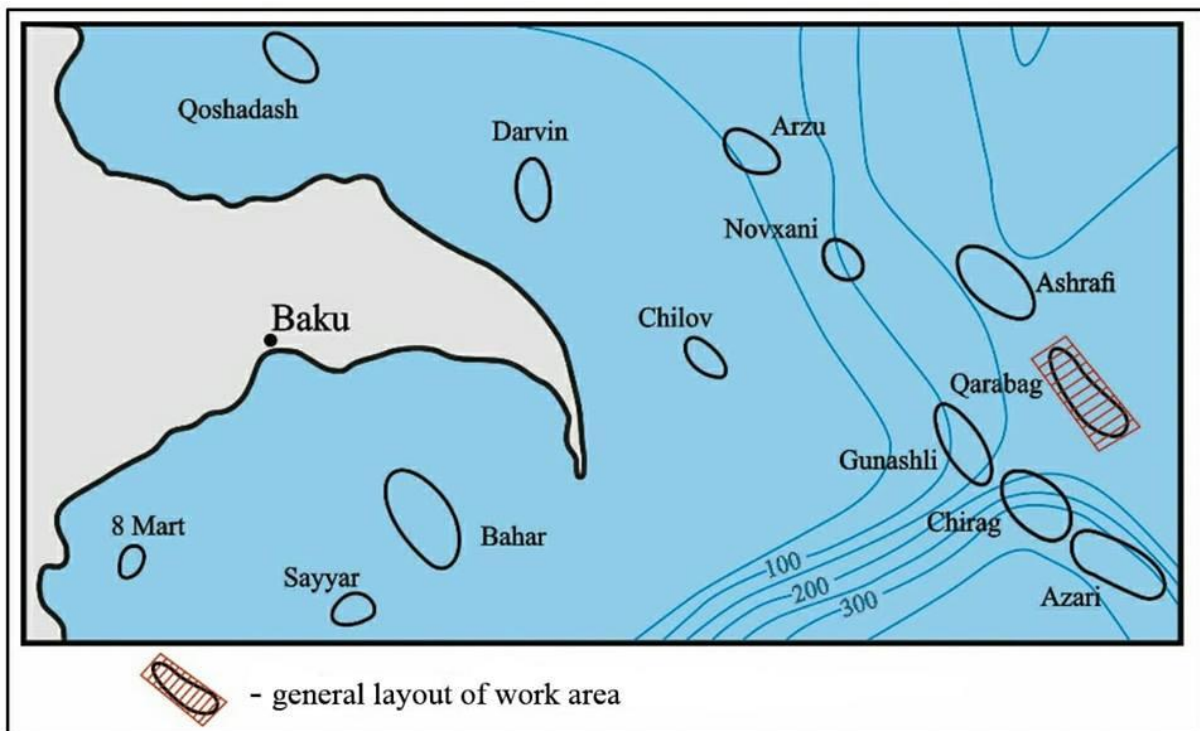


Figure 1 - Schematic map of the study area.

Methodology and approaches

The construction of engineering hydraulic installations (deep water foundations, stationary platforms, floating drilling rigs, etc.) in the study territory makes necessary to conduct the integrated surveys and also laboratory analyzes of the gases, waters and rocks. The main task of the performed engineering and geophysical works on the survey site by of high-resolution seismic exploration method is to identify the possible presence of potential hazards during the engineering construction of drilling rig and subsequent exploratory drilling in the design point. Related to the main task of the study, drilling

of wells, Cone penetration test, as well as continuous seismo-acoustic profiling bathymetry, Sonar surveys and geochemical laboratory analyzes were performed. The microfaunistic studies and physico-mechanical properties of collected samples from the well drilled on the upper part of sections (up to 210 m) were carried out too. The absorbed gases of the bottom sediments and near-bottom waters, as well as the samples taken from the different intervals was studied using thermovacuum degasser in laboratory. The analysis of obtained gases was investigated in gas-liquid chromatography.

Results and discussions

Samples taken from the wells of the research area consist of Quaternary sediments (Baku stage).

Using the study of sonar, it was found that the relief of the seabed is almost flat. Several small depressions, located close to each other in the relief, were found in most places on the seabed.

The wave scenes of the obtained timel sections were analyzed and some reflected specious boundaries were recorded. These boundaries consist of three conventional seismic horizon borders that are continually monitored, representing the water layer of the seabed and the upper part of the

sediments. In parallel, wave scenes of the continuous seismo-acoustic profiling almost repeat each other. In the obtained profiles was observed a section that consist of parallel numbers reflected boundaries. Here, the depth of exploration is up to $185 \div 200$ m.

The analysis of time sections of HRS CDP at the survey site on the structure have shown that at best the seismic anomalies in the wave field structure were manifested in the form of "bright spot" [50] type anomalies in Akchagyl – New Caspian sediments (Fig. 2).

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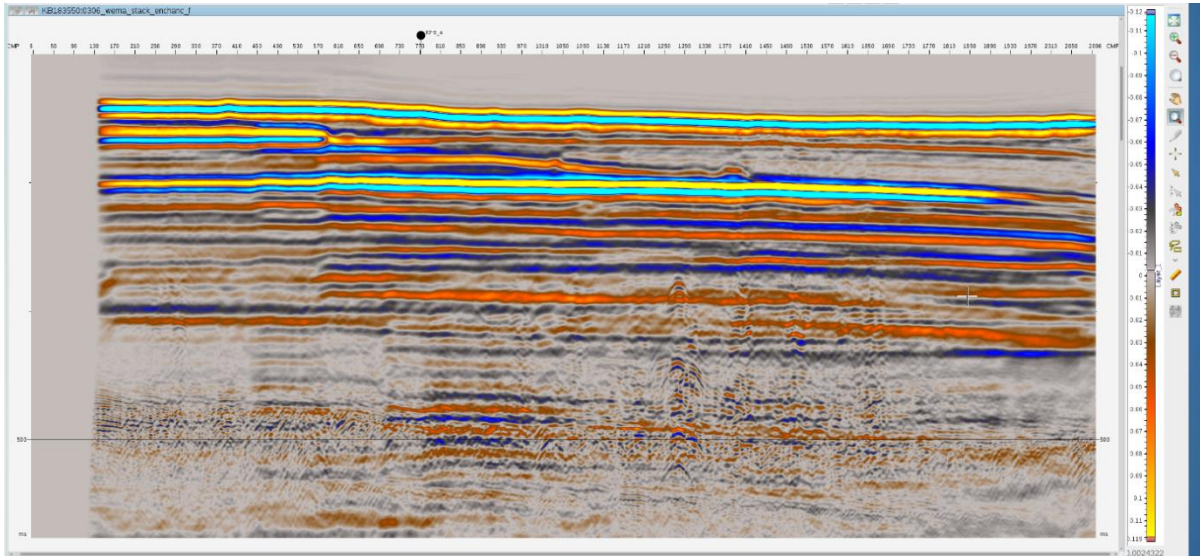


Figure 2 - Enlarged fragment of the upper part of the section.

Structural plan by reflecting horizon N_{2sr} (Annex), associated with the roof of the Surakhani suite of the Middle Pliocene varies from elevation of

-1270 m in the eastern part of the site, to 1450 m, monoclinaly sinking in the south-West direction (Fig. 3).

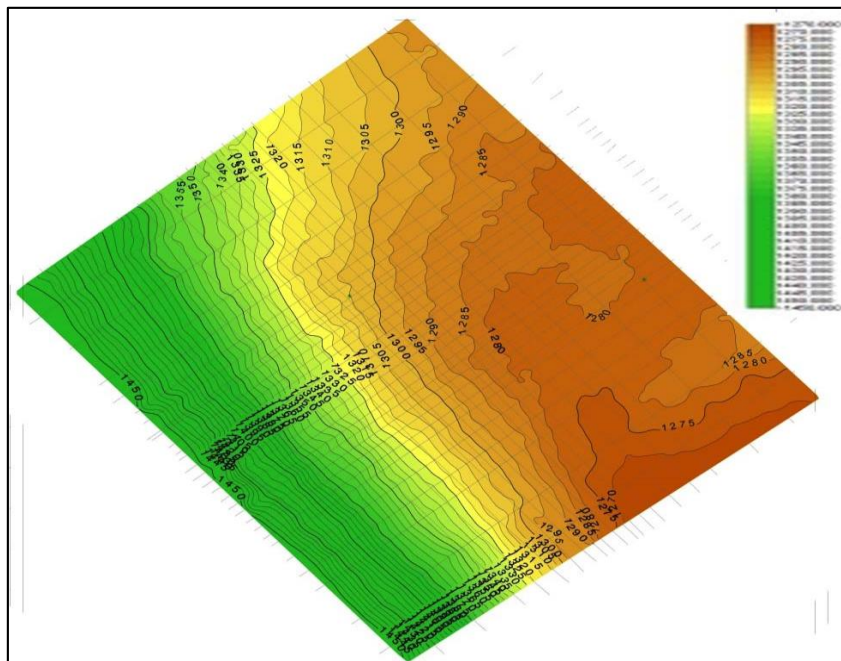


Figure 3 - Structural map by reflecting horizon N_{2sr} (roof of Surakhani suite).

From the seismic profile obtained in the study, it seems that no dislocations and gas-saturated zones have been encountered, and sediments have a simple geological structure.

The marine relief is almost stable and smooth. Seabed relief is almost stable and smooth. In the north or south direction or vice versa, the layers related to the studied seismic acoustic profiles are inclined towards the southern wing of the area. Examining of images of seismic acoustic profiles in

connection with west to east or vice versa, from the standpoint of inclination the slightest tendency is recorded in the eastern wing of the area.

When viewing acoustic maps of seismoacoustic profiles from west to east and in the opposite direction, there is a slight tendency to slopes in the eastern wing of the square. The increase was recorded in the depths of the sea to the south and southeast in the project area. In general, the area was

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fixed in a flat slope. All the above-mentioned facts can be seen in acoustic illustrations.

According to Cone penetration test data, some thin sandy layers were observed in several depth intervals. Based on the conducted comparative studies, adequacy was established with engineering-geological drilling and continuous seismo-acoustic profiling.

According to the classification of V.A. Sulin, it was found that the waters extracted from the rock

samples belongs to the chloride-magnesium ($MgCl_2$) type and has an aggressive effect on reinforced concrete structures made of portlandcement [4].

Seven engineering-geological element (flowing; soft plasticity; dense plasticity; semi-dense loam; flowing, soft and dense plastic clay) were established within two lithological units (clay and loam) in the geological structure of the study area using the result of complex studies on the rock samples taken from wells (Fig. 3).

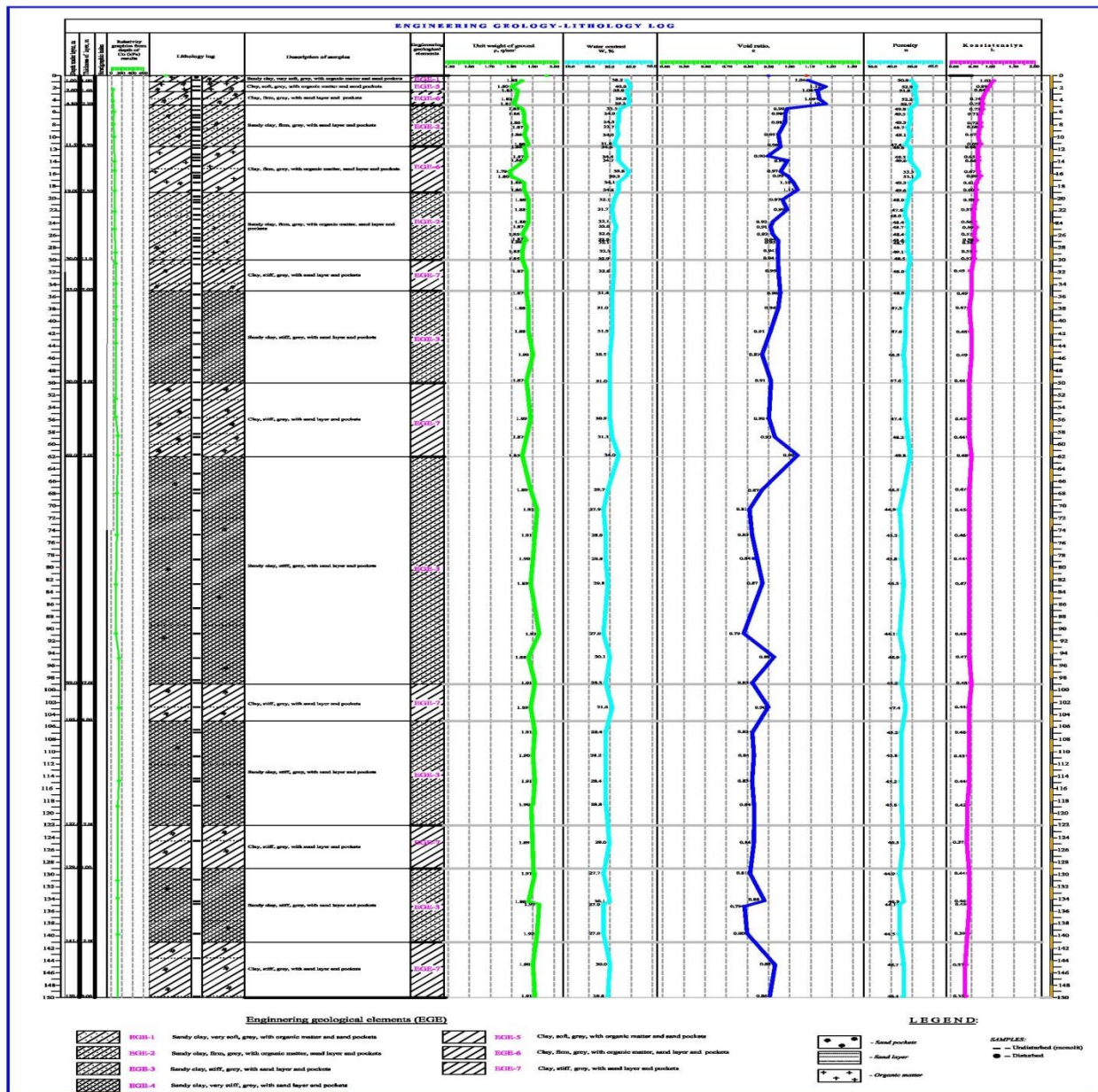


Figure 3 - Engineering-geological and lithological sections of the area.

The average amount of degassed gases of the rock and water samples is 0.17 %. The gas component varies between $CH_4 \div C_6H_{14}$.

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Conclusions

The geological age of the studied samples is Quaternary (Baku stage).

The relief of the seabed is stable and due to the strong underwater currents, several small (0.7 x 1.6 m) depressions were formed here. The use of continuous seismic acoustic profiling shows that

there were no serious dislocation zones in the Garabakh field.

The average amount of degassed gases is 0.17 %, and their composition varies between CH₄ ÷ C₆H₁₄.

It was found that the waters of the studied samples are chloride-magnesium (MgCl₂) type.

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