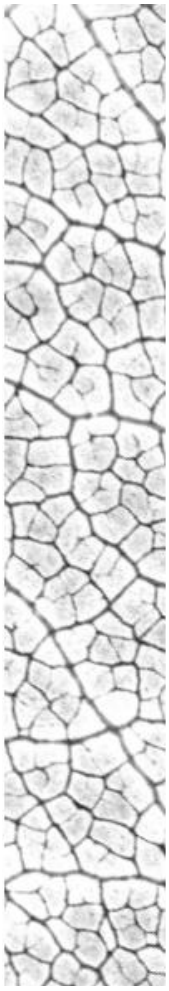

EurAsian Journal of BioSciences
Eurasia J Biosci 14, 3299-3308 (2020)

Forecast of development zones of non-anticlinal traps in the Paleozoic complex of the south area of the Pre-Caspian basin

D. K. Azhgaliev [1*], G. V. Voronov [2], S. N. Nursultanova [1], K. M. Taskinbayev [1]

[1] Candidate of Geological and Mineralogical sciences, Atyrau Oil and Gas University named after Safi Utebaev, KAZAKHSTAN
[2] Senior Researcher, Atyrau Oil and Gas University named after Safi Utebaev, KAZAKHSTAN
*Corresponding author: D. K. Azhgaliev

Abstract
Taking into account the current stage of study, the article discusses the structural and developmental features of the Paleozoic complex of the Pre-Caspian basin, which is associated with the prospect of discovering new large hydrocarbon deposits. In assessing the prospects of oil and gas, the factor of paleobatimetric analysis and reconstructions of the paleo-environment of sedimentation was considered as one of the main ones. Factors of a regional scale that contribute to the formation of non-anticlinal type traps are substantiated.

Keywords: Pre-Caspian basin, bead region, Paleozoic complex, sediments, analysis, non-anticlinal trap, oil and gas prospects, hydrocarbon deposits, paleo-depths, sedimentation

Azhgaliev DK, Voronov GV, Nursultanova SN, Taskinbayev KM (2020) Forecast of development zones of non-anticlinal traps in the Paleozoic complex of the south area of the Pre-Caspian basin. Eurasia J Biosci 14: 3299-3308.

INTRODUCTION

The degree of objectivity and reliability of the forecast of local objects, perspective in the oil and gas bearing, as is known, is determined by the completeness of the coverage of available data on their internal structure and the results of paleotectonic reconstructions of the sedimentation environment. The low level of knowledge of the Paleozoic complex of the Pre-Caspian basin, in particular the lack of conditioning materials and the limited availability of new drilling data, until recently led to the formation of conservative approaches based on the representation of objects in the so-called “static” state, without taking into account its development due to conditions and the influence of sedimentation factors. The methodology of prospecting works for lack of other possibilities was based, to a greater extent, on representations based on structural constructions according to uninformative seismic data. Obviously, in such a situation, the quality of the forecast and the success of search research continued to remain at an inadequate level.

Taking all the data into account and further improving the methodology of paleotectonic analysis, based on which the study of the features of sedimentation conditions in connection with the study of the paleo-depths of the sedimentation basin, allows us to predict a significant increase in the efficiency of exploratory studies. This is also evidenced by the world practice of geological exploration (Huseynov, Gaiman, Shik & Surtsukov, 1988; Kerimova, 1987; Kobzarev, 1995). In turn, a more detailed analysis of sedimentation conditions opens up wide opportunities for a better level of identification and preparation of search local objects that define a new direction in Kazakhstan, based on the forecast and justification of promising non-anticlinal objects by the nature of the geological structure.

Taking into account the available data for recent years, the southern (south-western, southern, and southeastern border) and eastern segments, in comparison with the rest of the basin of the Pre-Caspian basin, are characterized by sharp differences in the depths of the surface of subsalt deposits (reflecting horizon P_1). Structurally, the main elevated zones (Astrakhan-Imashevskaya, Karaton-Tengiz platform, South Emba Uplift, Temirskaya and Zhanazholskaya) are clearly distinguished, associated with the areas of carbonate accumulation and which are contrastingly and hypsometrically located in comparison with the rest (relative to the deep-sea part) pool. At lower levels of occurrence, the Atyrau-Shukat, North-Caspian, Kursai-Akzhar zones, etc. are distinguished.

Received: May 2019
Accepted: March 2020
Printed: September 2020

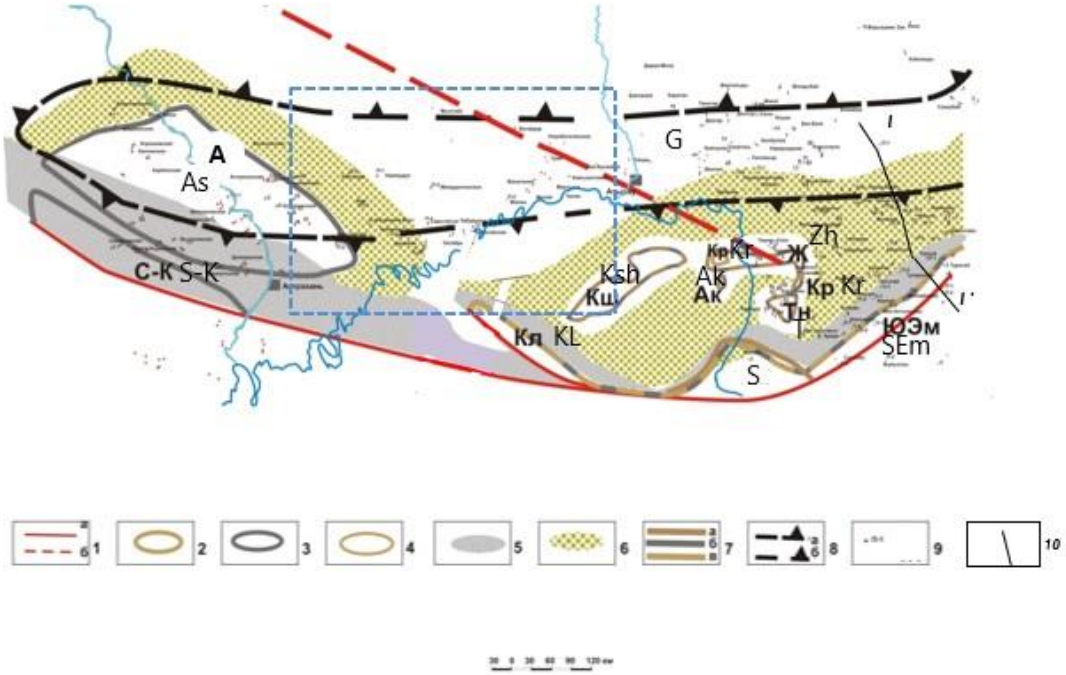

Fig. 1. Tectonics of the Paleozoic complex of the southern part of the Pre-Caspian basin (Obryadchikov, 2019)
Legend: 1 - faults: bead region and pre-bead region, b-Azgirsky;
2-4 - contours of carbonate massifs (2-Devonian-Tournaisian, 3-Lower Bashkir, 4-Assel-Sakmara);
5 - pre-bead cones of removal of artinsky terrigenous deposits;
6 - distribution area of oil-bearing clay-carbonate deposition deposits;
7 - age of the border of carbonate platforms: a - Devonian-Tournaisian, b - Lower Bashkir, c - Assel-Sakmara;
8 - the border of the Astrakhan-Aktobe zone of elevated bedding: a-confident, b-presumed;
9 - wells and seismic and geological profiles;
10 - line of regional geological and seismic profile.
Foundation ledges: A - Astrakhan, G - Guryevsky.
Carbonate massifs and platforms: As - Astrakhan, Ksh - Kashagansky, Zh - Zhylgansky, Kr - Kairansky, Ak - Aktoty, Kr - Korolevskiy, T - Tengiz, SK - Smushkovsko-Karakulskaya, Kl - Kalamkas-sea, S- South, SEm - South Emba.

These structural features indicate a probably widespread in the Paleozoic stratum of contrastively expressed accumulative forms, which are associated with the formation of large promising objects with non-anticlinal type traps.

Taking into account the influence of the environment and sedimentation factors, the features of the formation of non-anticlinal type traps in the deposits of the Devonian, Carboniferous, and Lower Permian are separately emphasized. A preliminary analysis of local objects on 2D regional profiles allows us to estimate the scale of the processes of accumulation of precipitation and accumulative forms, which are associated with non-anticlinal type traps. The available data suggest that almost all large accumulations of oil and gas in the Paleozoic deposits have an increased complexity of the internal structure, which is primarily due to the complex genesis and is associated with non-anticlinal type traps.

The most significant role is played by large geological events associated with the displacement of large upper-order structures, the activity of large paleo-river systems, regional slopes of the sediments, and the prevailing significance of certain sedimentation factors. In this regard, four regional regions are distinguished within the Pre-Caspian basin for a further more detailed assessment of the structure and prospects, differentiated by the degree of influence of the factors noted above and the features of sedimentation at the Paleozoic stage of development.

MATERIALS AND METHODS

The initial experience in conducting research in a new direction for the study of non-anticlinal type traps (hereinafter - NAT) in the Pre-Caspian basin dates back to the period 1989-1992 (Soloviev, Nemtsov, Obryadchikov et al., 1989; Turkov, Nikolenko, Volozh et al., 1992). This experience, taking into account the focused research of recent years (Obryadchikov & Taskinbaev, 2019), allows us to more objectively evaluate the structure and development of large and medium-sized tectonic elements of the southern part of the Pre-Caspian basin (**Fig. 1**). One of the tasks in this case is to justify the relationship of the formation of these tectonic elements with the lithological-facies accumulation conditions at various stages of development.

For the southern (south-western, southern and southeastern border) and eastern segment, in

comparison with the rest of the Pre-Caspian basin, sharp changes in the depths of the subsalt bed surface (reflecting horizon P_1) are especially characteristic. Structurally, the main areas of carbonate accumulation (Astrakhan-Imashevskaya, Karaton-Tengiz platform, South Emba Uplift, Temirskaya and Zhanazholskaya) are clearly distinguished, which are contrastingly and hypsometrically high in comparison with the rest (relative to the deepwater part) of the basin. In this case, individual elements of the south of the Pre-Caspian basin with respect to the depths of the basement surface and the subsalt bed are characterized by inversion (Azhgaliev, Obryadchikov, Taskinbaev et al., 2018).

There is a difference in the assessment of the structure and development of the uplifts of the Karaton-Tengiz platform and the South Emba Rise on the one hand, and the Astrakhan, Temir, Zhanazhol and most of the elevated sections of the North Caspian and Atyrau-Shukat zones of the base ledges, on the other. Large uplifts Kashagan, Zhayylgan (Primorsky arch), Tengiz and the South Emba uplift (Saztobe, Bekbulat and others) are confined to areas of deep basement (Obryadchikov, 2019). In comparison with them, the uplifts of the Astrakhan, Temir, North Caspian, Novobogatinsky arch (ledges) correspond to the areas of elevated basement. Taking into account the greater thickness of the Paleozoic section, in the first case, a wider interval of the prospective section of the section should be predicted, including Upper Devonian-Tournaisian, Middle Devonian and Dodevonian deposits. In the second case, with the spread of sections with a reduced section, wide opportunities are expected for the formation of NAT associated with the structures of cladding of large ledges and ancient uplifts in the conditions of regional slope, lithological and stratigraphic screening - in areas of sharp uplift of Paleozoic deposits. In both cases, geological and geophysical assumptions are very favorable for predicting deposits in NAT, including those associated with large sedimentary uplifts that can contain and accumulate significant hydrocarbon volumes (Azhgaliev, Voronov, Obryadchikov, Taskinbaev et al., 2019).

The main conclusion of recent studies (Azhgaliev, Obryadchikov, Taskinbaev et al., 2018; Azhgaliev, Voronov, Obryadchikov, Taskinbaev et al., 2019) is that almost all of the large known oil and gas accumulation zones in the Paleozoic sediments of the Pre-Caspian basin are associated with non-traditional type traps (NAT). In addition, the developmental features and the formation of the Pre-Caspian basin determine below the following very favorable prerequisites for the wide development of NAT in the Paleozoic stratum.

- Development of sedimentation in the Paleozoic basin of a variety of contrastive accumulative forms (side and relatively submerged sedimentary ledges, piNATles, etc.).

- The development and formation of large inversion uplifts (on the example of the southern part of the Pre-Caspian basin) and, at the same time, the preservation of the stratigraphic completeness of the Paleozoic stratum (D2-P1ar) in the context of relatively deep-water inner regions of the sedimentation basin.

- Frequent variability in terms of the contours of the Pre-Caspian sedimentary basin, hydrocarbon migration in the boundary band of these changing contours over different periods and stages of the Upper Paleozoic (Azhgaliev, Obryadchikov, Taskinbaev et al., 2018; Obryadchikov, 2006; Adepoju, et al, 2017).

- The presence in the section of the pre-bead parts around the entire perimeter of the Pre-Caspian basin of the “alignment” strata, which include shallow-water carbonate deposits of the Upper Visean-Bashkir age (C1v3-C2b), formed at known depths, allowing preliminary assessment of paleo-depths and that “zero” mark, from which it is possible to carry out all subsequent paleobatimetric constructions (Obryadchikov, 2006).

RESULTS AND DISCUSSIONS

An analysis of sedimentation conditions and conditions with an emphasis on determining the depths of the sea basin allows us to more objectively justify the role of certain factors of sediment accumulation (vertical tectonic movements of the positive and negative signs, paleotrophies, fluctuations in the local erosion basis, the influence of unevenness of the bottom of the sea basin, disagreement and breaks in sedimentation , etc.) (**Fig. 2**). Schematic illustration of the influence of various sedimentation factors in principle reflects and allows you to simulate the development of typical local structures on the southeastern side of the Pre-Caspian basin (Biikzhal, Ushmola, Akkuduk, Tortai), and also to determine, as a first approximation, some approaches to assessing the trends in the paleo-depths of the marine basin (**Fig. 2**). Subsequently, this makes it possible to distinguish the corresponding paleofacial zones, which are diagnosed depending on the nature and specific composition, size of fragments, sediment accumulation rates, and bedding features (Taskinbaev, 2018).

Structural construction of the southern and south-western part of the Pre-Caspian Basin (the area between the Ural-Volga) show the development of large-scale uplift of the subsalt horizons reflecting P3, P2 and P1 (**Fig. 3**).

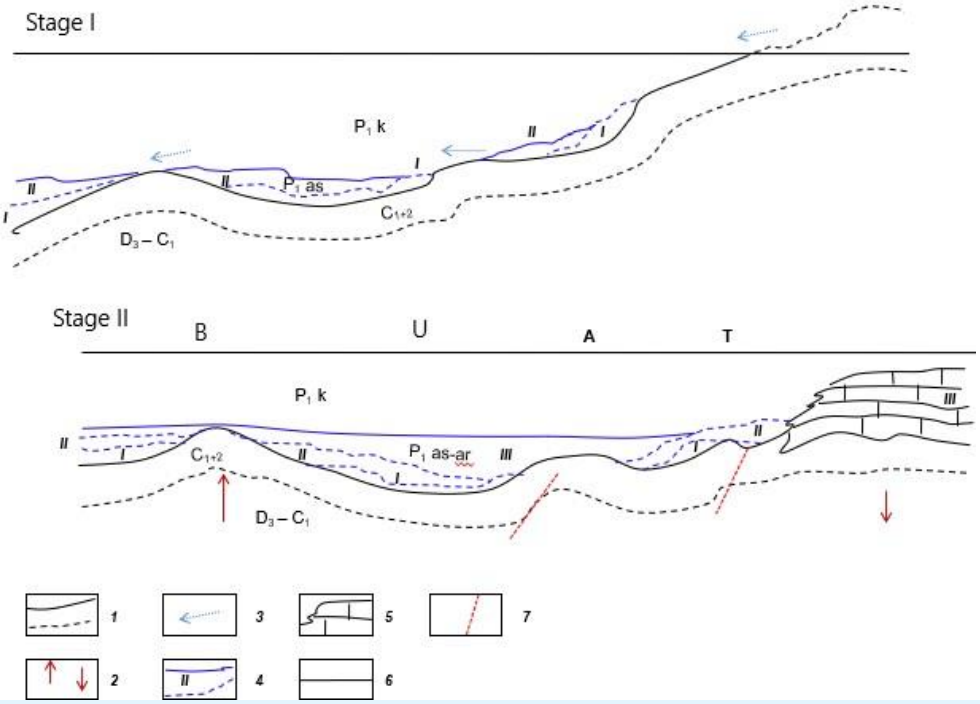

Fig. 2. Scheme of the influence of various factors of the marine basin on the nature of sedimentation, sequentially at stages I and II (composed by Azhgaliev D.K.)
Legend: 1 - the position of the paleorelief, 2 - vertical tectonic movements of the opposite sign, 3 - the direction of flows and drift of clastic material, 4 - the position of successive sedimentation cycles, 5 - the deposition zone of shallow carbonates, 6 - the surface of the water, 7 - fault.
Local structures: B - Biikzhal, U - Ushmola, A - Akkuduk, T – Tortai

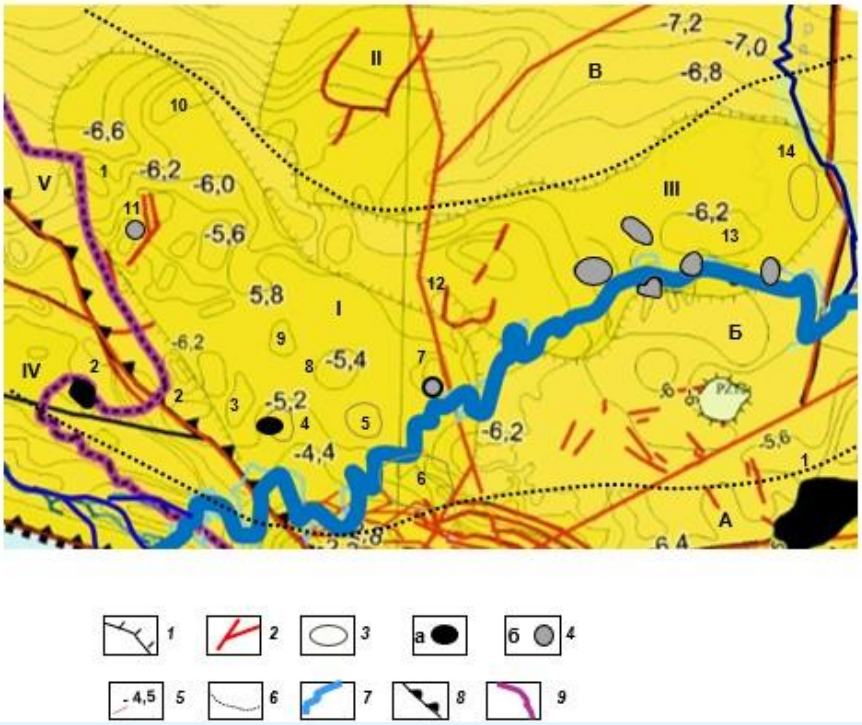

Fig. 3. Structural diagram of the P1 horizon of the southwestern part of the Pre-Caspian basin in the Ural-Volga interfluve (according to data by U.A. Akchulakova et al., 2009-2013)
Legend: 1 - tectonic elements of a higher order. I - October-Koshalak group of uplifts; arch elevations: II - Myntobinsky, III - Novobogatinsky, IV - Astrakhan arch, V - Zavolzhsky deflection; 2 - faults; 3 - local uplifts: 1 - Koksazdy, 2 - Kazan East, 3 - Kobyakovskaya, 4 - Alga, 5 - Oktyabrskoe, 6 - Karakol-Zhambai Sea, 7 - Zaburunye, 8 - Saryshagyl Zapadny, 9 - Zhantoka, 10 - Koshalak 11 - Kumisbek, 12 - Sazakurak Zapadny, 13 - Novobogatinsk, 14 - Sarayshik; 4 - hydrocarbon deposits: a) PZ: 1 - Kashagan, 2 - Imashevskoye; b) MZ; 5 - isohypses along the Paleozoic surface, km (OG P1); 6 - forecast contours of facies (paleogeomorphological) zones: A - shallow carbonate shelf, B - coastal strip of the plume, C - relatively deep water zone; 7-8 - borders: 7 - Northern Caspian, 8 - Astrakhan geoblock, 9 - neighboring states.

The development and formation of various paleofacial zones, the determination of their contours in space can be indicated by the results of a comprehensive analysis of seismic and aeromagnetic data, as well as new drilling data in recent years on the areas of Imashevskaya, Kobyakovskaya, Alga (Azhgaliev, 2019). In accordance with the strike of local structures in the plan, the density of their distribution and manifestation in the structural plan, 3 lithological-facies zones are identified that correspond to the paleo-environment of the shallow shelf, the coastal shallow strip of the shelf and relatively deep-water zone. As can be seen, the western part of the Ural-Volga interfluve is characterized by contrasting and elongated in the form of uplift (OG P1), more developed fault tectonics. The amplitude of the structures at the level of isogypsum minus 4.7-5.6 km varies within 150-300 m (Kobyakovskaya, Kazan East, Koksazdy, Koshalak, Alga). The uplifts are often confined to submeridional faults (Alga, Kobyakovskaya, etc.).

In the eastward direction in the middle part of the Ural-Volga interfluve, the character and structure of the uplifts is different. At the isogypsum level minus 5.3-5.8 km, the structures are characterized by an isometric and dome-shaped plan (Zhantoka, Saryshagyl Zapadny, Oktyabrskoye, Zaburunye, Sazankurak Zapadny). In the eastern part, a relatively “quiet” monoclinic occurrence of the Paleozoic stratum is observed with a plunge to the north along the P3 and P1 horizons in the depth interval minus 7.0–9.2 km and 6.1–7.4 km, respectively. At the level of isohypses minus 6.2 km, rare, but at the same time, large and uplifting large elevations of Novobogatinsk and Saraishik are highlighted.

With increasing depths (OG P3), the amplitude and structural nature of the uplifts increase. Additional factors for differentiating the territory according to sedimentation conditions are established according to the anomalous magnetic field (hereinafter - AMF). On the southern margin of the Pre-Caspian basin, the region of increased magnetic field “leaves” for the most part in the water area and partially covers the latitudinal strip along the seashore in the southern section of the Ural-Volga interfluve (Azhgaliev, Karimov, Kovrizhnyh & Shagirov, 2018). Against this background, the AMF still traces the upper northern boundary of the distribution of the alleged large Paleozoic objects. A series of large uplifts along the Paleozoic complex was identified, which structurally in terms of uplift correspond to the Kobyakovsky, Oktyabrsky and Novobogatinsky ledges of the basement (Azhgaliev, 2019; Azhgaliev, Karimov, Kovrizhnyh & Shagirov, 2018). In this regard, it is assumed that the zone corresponding to anomalies with an increased value of the magnetic field indicates areas with elevated occurrence of Devonian and Pre-Devonian deposits and the basement surface (depth interval 8-10 km). Accordingly, in these zones there is a high probability of the development of large objects, including those associated with promising Devonian deposits.

The influence of the main sedimentation factors can be traced in the analysis of regional seismic profiles, with the help of which elevated structural sections are linked with various morphological forms representing various genetic types of NAT. In the context of the southeastern border of the Pre-Caspian basin, a detailed examination and analysis of the data allows us to judge by the number of characteristics of the time field that some NATs are associated with deposits of both the Devonian and Carboniferous and the Lower Permian. Those. about the widespread distribution of NAT in a significant range of depths (5.5-7.5 km) (**Fig. 4**).

Various sedimentation conditions at different stages of sedimentation reflect the nature and certain types of traps in the Upper Devonian, Carboniferous, and Lower Permian strata (Voronov & Kuantaev, 2017). In the Upper Devonian-Lower Carboniferous sequence (OG P3 - P2D), carbonate constructions of significant scale are projected. These formations are more characteristic of the inner more submerged areas of the sedimentation basin (**Fig. 4**).

In carbon, carbonate structures are not excluded in the pre-bead part of the pool. Due to the peculiarities of paleobatimetry of the basin, the Lower Permian stratum is characterized by accumulation of filling and lateral build-up strata, and it predicts traps having a lenticular structure, lying inside clin-forms, located near amplitude disturbances (most often in the omitted part of the step-ledges). In the Middle-Upper Carboniferous, it is obvious that NATs are associated with large protrusions and uplifts, confined to zones of stratigraphic and lithological disagreements (cladding traps, substitution, and located near faults).

An important role is assigned to the main factors of the marine sedimentation environment, on the basis of which conditions are created for the formation of non-anticlinal type traps. The step-like convergence and subsidence of the subsalt bed under the influence of block tectonics from the foundation favored the formation of several levels (zones) of sedimentation. At each level, the accumulation and formation of various accumulative forms took place, at the same time, detrital material continued to move further into more submerged areas of the marine basin. As a result, along with the coastal shallow water removal cones, which were established along sections of the Tortai, Aiyrshagyl, Molodezhnaya, Sholkara, and other areas, the next level outflow cones corresponding to the deeper sea area (Matken-Biikzhalsky step) were formed.

According to all available geological and geophysical data and assumptions, deep-sea drift cones are projected in the southeast at the level of Zhantai, Aznagul, Ushkan, Biikzhal, Ushmola, Mashly, Sarykask and others (Voronov & Kuantaev, 2017; Azhgaliev, Voronov. Obryadchikov, Taskinbaev et al., 2019). There

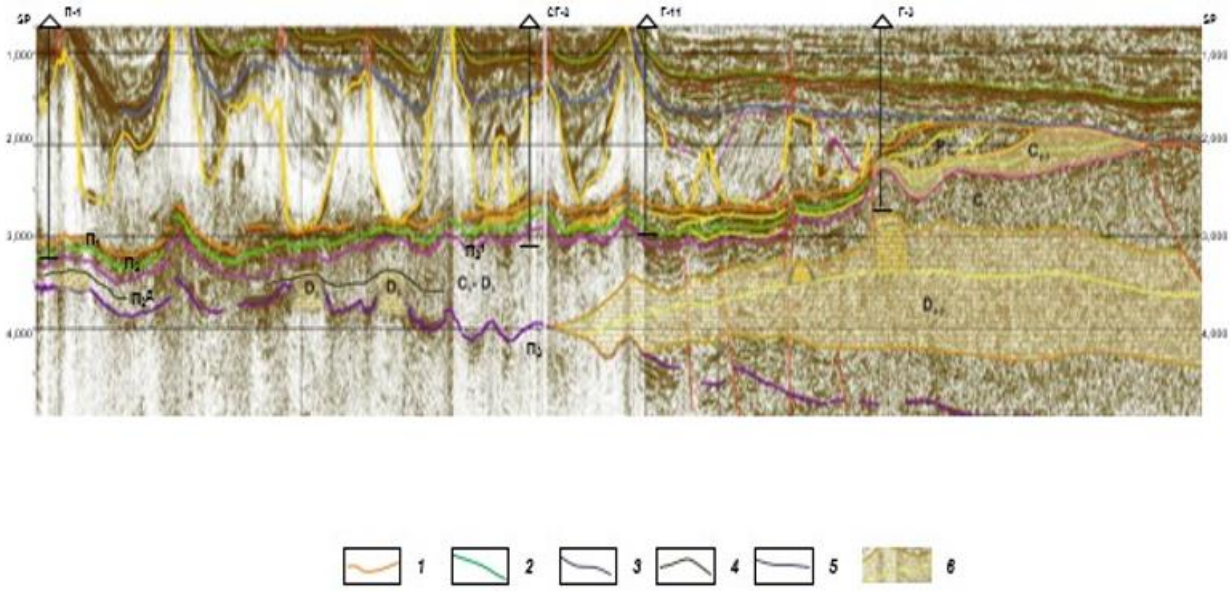

Fig. 4. Southeast of the Pre-Caspian basin. Temporary section along the Zhusalysay – Plain profile (line I – I ′ in Fig. 1) (Voronov & Kuantaev, 2017)
Legend:1-5 - Paleozoic reflecting horizons: 1 - P1 (surface of subsalt deposits), 2 - P2 (roof of the Middle Carboniferous), P21 (roof of the terrigenous Lower Carboniferous), P2D (the roof of the Upper Devonian carbonates), P3 (the base of the Upper Devonian); 6 - carbonate deposits and structures.

is a high probability of traps formed in the sediments of deep-water drift cones in the Carboniferous and the Lower Permian and with which all previously obtained oil manifestations are associated with the structures of the Matken-Biikzhal stage (Karashungul, Ulkentobe Yugo-Zapadny, Yessekzhal, Matken). However, the lack of objective methodological “approaches” did not allow, at the early stages, to effectively conduct prospecting work on these structures to refine the contours of oil and gas structures.

An analysis of data on sections of known subsalt deposits shows that the internal structure of sediments of the reservoir part is due to the wide development of macroinhomogeneities (sandiness, clay content, filtration-capacity properties, fracturing), which are the result of the influence of factors and conditions of sedimentation, depth of the marine basin and accumulation of sediments. At the same time, factors of a geological and ecological order (paleotopes, paleo-winds) that have a different effect on the position of zones inside carbonate platforms and massifs that are search-friendly and which may contain rocks with improved filtration-capacitive properties (FCP) are important and should be taken into account.

The results of drilling of a number of ultra-deep wells (G-1 Tasym Southeast, U-5 Urikhtau, K-3 Koblandy, SG-2 Biikzhal and others), which are located in relatively submerged deep-water parts of the Pre-Caspian basin, show the prevalence over a significant area mainly terrigenous and carbonate-terrigenous sedimentation. The areas where these wells are located determine in facies terms the areas of development of areas of predominantly terrigenous and carbonate-terrigenous sedimentation and, based on the available materials, large uplifts along the Paleozoic stratum can be expected. Data on the Zhusalysay and Tasym Southeast areas allow us to predict the development of NAT associated with various paleofacial zones of the sedimentation basin. For example, the Tasym Southeast uplift, confined to the Atyrau-Shukat zone of ledges, was formed under conditions of cladding of an ancient ledge with sediments of a younger age (vestment trap) (Azhgaliev, Karimov & Isaev, 2018).

In general, the instrument parts of the Pre-Caspian basin (southwest, south, southeast, and east) are characterized by a rather high density of identified Paleozoic structures. Paleobatimetric constructions in the analysis of sedimentation conditions (taking into account the transitional zones from the sides to the inner regions of the basin) make it possible to establish a more detailed level of the dominant strike of large structural elements and to substantiate the side-wall location of large morphologically developed systems.

The identified carbonate platforms on the eastern side of the Pre-Caspian basin (Temir and Zhanazhol steps) determine the distribution of carbonate complexes KT-I and KT-II. In the section of the Tuzkum-Kozhasaysky uplift zone (Zhanazholskaya step), a limited development of the KT-I member was noted as a result of erosive “cutting” and regional lithological wedging in the western direction. It is possible that similar geological processes took place along the western edge of the Temir tectonic step. As a result of the regional nature of wedging out deposits even further to the west of the ledge, the development of the lower carbonate stratum KT-II is also gradually lost.

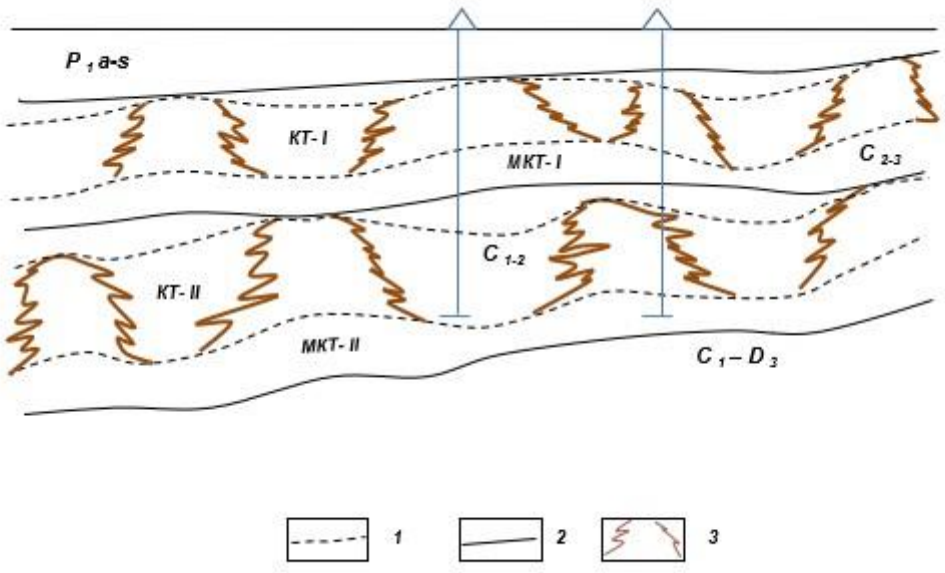

Fig. 5. The principal structure of carbonates within the thicknesses of KT-I and KT-II on the eastern side of the Pre-Caspian basin (composed by Azhgaliev D.K.)
Legend: 1 - restriction of carbonates in the roof and sole; 2 - stratigraphic borders; 3 - sections of carbonates containing oil and gas deposits.

The development of favorable organogenic systems and decompression zones within the carbonates KT-I and KT-II is objective, from the point of view of expanding the area of territories promising for setting up exploratory work, when the search interest is focused on the entire thickness of KT-II / KT-I as a whole, as a single object of study (**Fig. 5**).

New favorable prerequisites are provided for clarifying the quantitative assessment of oil and gas content throughout the carbonate stratum in the direction of a significant increase in the volume of forecast resources and the potential of the eastern side zone as a whole.

Unfortunately, the results of testing objects in the column after drilling were often ambiguous and poorly matched with the parameters of reservoirs defined by well logging data. The fact that there is a mismatch between the given readings on the GIS and the results of the actual testing is seen as the reason for the significant yet unrealized potential of the intervals recommended for the GIS within packs of KT-II and KT-I. There is a weak correlation between the results of testing and the values of the reservoir properties of reservoir rocks by well logging. The available results of testing promising objects (intervals in carbonate packs) from recent years of work (Tuzkum, Urikhtau, Urikhtau Vostochny, Urikhtau Yuzhny and others) show a rather complicated picture of the distribution of reservoir rocks in the section, which at this stage of the study of carbonates, as a rule, it is explained by the development of secondary processes characteristic of the eastern side (leaching, dolomitization, calcification). Along with this, one should take into account the specific features and uniqueness of the layered occurrence of carbonate complexes in the section of the eastern side, and therefore, within the greater part of the Pre-Caspian basin, we assume that the zonality in the distribution of reservoir rocks is nevertheless the result of a variety of sedimentation conditions and determines the need for this non-standard approaches.

In the section of the Urikhtau uplift along the roof of the Devonian complex (OG “R”; PGD Services), a large object (carbonate structure) was identified (**Fig. 6**).

A stable boundary characterizing the basement of a large carbonate body, presumably associated with the base of the Upper Devonian, is also identified below it in the section (Azhgaliev, Voronov, Obryadchikov, Taskinbaev et al., 2019; Obryadchikov & Taskinbaev, 2019). The seismic horizon P3 is confined to this age boundary. According to the data of drilling the first exploratory well in the range of 4966-4975 m, an increase in gas readings was obtained, followed by intensive oil and gas development. As a result, the resource assessment for category C_3 of a large trap, attributed by the authors to the non-anticlinal type, was refined, and structural constructions for subsalt seismic horizons (PGD Services) were adjusted. The Devonian uplift along the isogypsum minus 5400 m has dimensions of 7.2 km x 5.4 km, the amplitude is more than 800 m. The reservoir area is significant and amounts to 36.2 sq km.

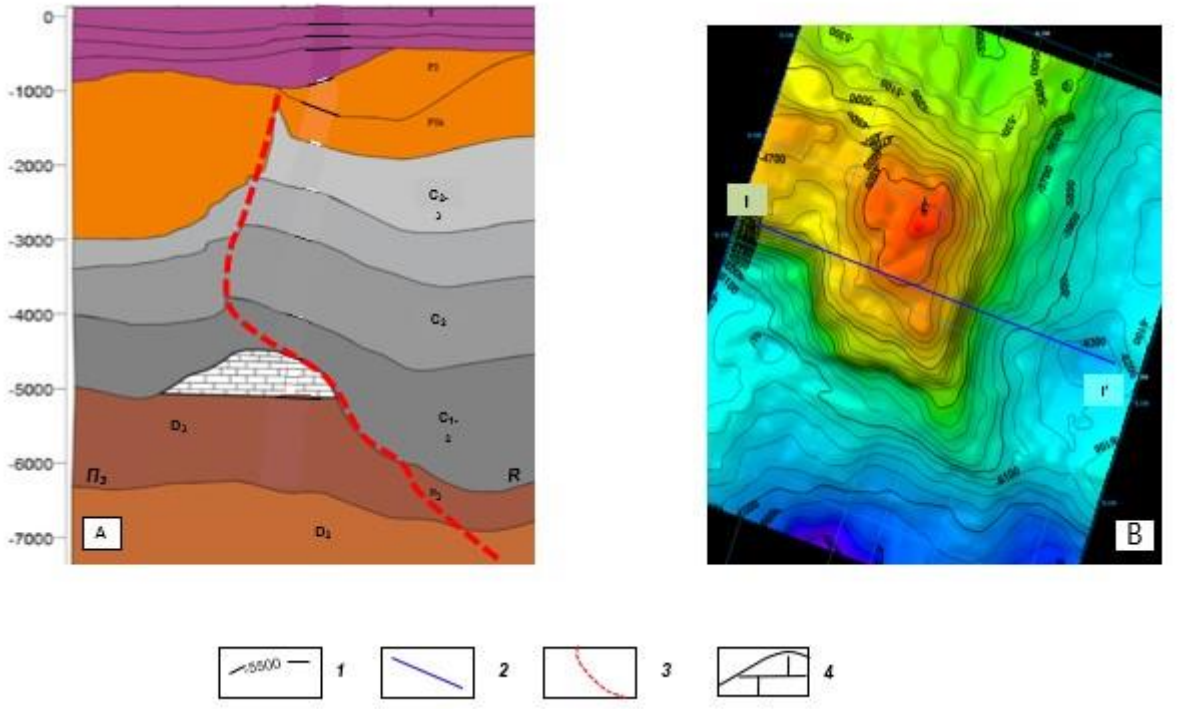

Fig. 6. Non-Anticline Paleozoic trap Urikhtau (according to "PGD Services", 2012; supplemented by Azhgaliev 2019)
Legend: 1 - isohypses along the reflecting horizon "R"; 2 - line geological section; 3 - tectonic disturbance; 4 - carbonate building.

Obtaining a positive result in the Upper Devonian sediments during drilling on the Urikhtau Square indicates the possibility of further cyclic development of carbonates and the high prospectivity of the lower Upper Devonian-Lower Carboniferous part of the section within the eastern side, as well as the Caspian basin as a whole. Taking into account the confirmation of the drilling of a large organogenic building of the Famennian age on the Urikhtau Square, subsequently, it is necessary to increase the depth of the study of Paleozoic carbonate deposits in the east of the Pre-Caspian basin with the aim of further effective development of prospecting works aimed at studying deep-lying perspective horizons in the thickness of KT-III.

As we can see, the potential and possibilities of studying NAT in the southern part of the Pre-Caspian basin seem extremely wide. The prediction of non-anticlinal-type traps seems promising, in particular, with the use of the paleo-depths of the sedimentation basin analysis to assess the prospects.

In general, taking into account the initial stage of development of this promising direction in the forecast of oil and gas prospective structures associated with NAT, it is possible to state to a certain extent new opportunities for significantly improving the efficiency of prospecting for deeply submerged Paleozoic deposits of the Pre-Caspian basin, which are associated with the discovery of significant oil and gas deposits . In this regard, many methodological issues are becoming relevant again, including those related to the assessment of the morphology and genesis of large objects, as well as the refinement of approaches to assessing the predicted resources of NAT. Therefore, taking into account the specific structural and developmental features of the Paleozoic complex of the Pre-Caspian basin, traps capable of concentrating large-scale hydrocarbon accumulations are associated with objects of this category.

CONCLUSION

1. Clarification of the features and models of sedimentation makes it possible to substantiate paleobatimetric analysis as a key stage in the forecast of large promising non-anticlinal objects and the main criterion in assessing the prospects of oil and gas potential of the Paleozoic sediments of the Pre-Caspian basin.

2. The development and formation of local structures should, in combination with a change in the depth of the sedimentation basin, also take into account the concomitant tectonic processes of horizontal and vertical sign, the main factors of sedimentation. Taking into account the studies carried out to study and predict the development of NAT within the Pre-Caspian basin, the authors, in principle, according to the degree of prospectivity and characteristic features of sedimentation conditions, as well as the scale of the processes that determine the accumulation of sediments, substantiates 4 categories of lands:

- areas of development of carbonate platforms and massifs confined to predominantly side and instrument zones, including strata KT-I, KT-II and KT-III;

- areas of development of large objects with respect to deep-sea genesis, determining the distribution area of the main belt of carbonate-terrigenous sedimentation;

- areas of development of promising deep-seated objects of a deeper-water genesis associated with the Devonian and pre-Devonian complex at depths of 8-10 km;

- areas of sedimentation uncompensated by sedimentation with abnormally deeply lying promising objects of complex genesis.

3. The results of the analysis of potential field anomalies can significantly complement the range of studies on the prediction of non-anticlinal-type traps in connection with the high prospects of deep-seated objects in the sediments of the Devonian and pre-Devonian complex.

4. The different categories of lands identified by the Paleozoic complex of the Pre-Caspian basin in terms of their degree of perspectivity determine the need to clarify the perspective zoning scheme. For the first time in the zoning of deep-seated objects, data were used from analysis of sedimentation conditions and paleo-depths of the sedimentation basin. At the same time, the possibilities for justifying prospects are expanded by considering the entire area of the Pre-Caspian basin (including: instrument zones and various segments) in a single key, which, in turn, allows us to give more objectivity in the analysis of paleobatimetry and sedimentation conditions.

5. In the future, an important section in assessing the conditions of formation and potential of non-anticlinal traps in the Paleozoic sediments of the Pre-Caspian basin should be considered the development of methodological approaches for more reliable determination that accompanied promising blocks of oil and gas resources.

REFERENCES

Adepoju, A. O., Oyewo, E. O., & Adigun, M. O. (2017). Perception of Cassava farmers of climate change on Cassava production in Ido local government area of Oyo State, Nigeria. Current Research in Agricultural Sciences, 4(3), 61-67.

Azhgaliev, D.K. & Taskinbaev, K.M. (2019). Geological and geophysical prerequisites for predicting non-anticline traps in the Paleozoic complex of the Caspian basin. Bulletin of the Academy of Sciences of the Republic of Bashkortostan, no 3 (95), pp. 5-14.

Azhgaliev, D.K. (2019). Structural and tectonic structural features of the Paleozoic deposits of the Myntobinsko-Novobogatinsky zone on the south-western border of the Caspian basin. Problems of the collection, preparation and transport of oil and oil products. Ufa State Petroleum University, no 3 (119), pp. 19-34.

Azhgaliev, D.K., Karimov, S.G. & Isaev, A.A. (2018). The regional study program is the next important step in assessing the oil and gas potential of sedimentary basins in Western Kazakhstan. Georesources, no 1 (I quarter), pp.16-24.

Azhgaliev, D.K., Karimov, S.G., Kovrizhnyh, P.N. & Shagirov, B.B. (2018). Features of the structure and development of carbonates in the Paleozoic on the southern border of the Caspian basin. Bulletin of the Ural State Mining University, no 3 (51), pp. 73-80. Yekaterinburg.

Azhgaliev, D.K., Obryadchikov, O.S., Taskinbaev K.M. et al. (2018). Comprehensive study of non-anticlinal oil and gas traps in the Republic of Kazakhstan. Report on the IRN topic BR05236633 on research activities (General questions of the study of non-anticlinal traps by the example of the Caspian depression). Atyrau.

Azhgaliev, D.K., Voronov, G.V., Obryadchikov, O.S., Taskinbayev, K.M. et al. (2019). A comprehensive study of non-anticlinal oil and gas traps in the Republic of Kazakhstan. Report on the IRN BR05236633 topic on research activities (Paleozoic complex of the Caspian depression). Atyrau.

Geta, S.P., Zhemchuzhnikov, V.G., Nugmanov, Y.D. & Uvakov, K.A. (2011). Sub-salt structure of Tasym, experience of geological exploration of deep horizons of the Astrakhan-Aktobe system of uplifts. Actual problems of geology and oil and gas potential of the southern part of the Caspian depression. Atyrau: Society of Petroleum Geologists of Kazakhstan (ONGK), pp. 87-88.

Huseynov, A.A., Gaiman, G.M., Shik, N.S. & Surtsukov, G.V. (1988). The methodology for forecasting and searches for lithological, stratigraphic and combined oil and gas traps. Moscow: Pochva.

Kerimova, V.Yu. (1987). Searches and exploration of oil and gas deposits in stratigraphic and lithological traps. Moscow: Pochva.

Kobzarev, G.Yu. (1995). Non-anticlinal traps - new objects of oil and gas exploration in the Aryskum trough of the South Torgai depression. Geology of Kazakhstan, no 3.

Obryadchikov, O. S. & Taskinbaev, K. M. (2019). Oil-Bearing Capacity of the Great Depths of the East of the Caspian Depression and the Conditions for the Formation of Oil and Gas Accumulations. «Journal of Computational and Theoretical Nanoscience», Special number (August), pp. 1-11.

Obryadchikov, O.S. & Taskinbaev, K.M. (2004). The geodynamic nature of the sedimentary cover and oil and gas prospects of the Aral-Caspian region. Geology of the regions of the Caspian and Aral seas. Almaty: Kazakh Geological Society KazGEO, pp. 91-99.

Obryadchikov, O.S. & Taskinbaev, K.M. (2004). The geodynamic nature of sedimentary cover and oil and gas prospects of the Aral-Caspian region. Almaty: Kazakhstan Geological Society “KazGEO”, pp. 91-99.

Obryadchikov, O.S. & Taskinbaev, K.M. (2019). Structural Features of the Southern Border of the Caspian Depression According to Geological and Geophysical Data and Prospects for the Search for New Hydrocarbon Accumulations. «Bioscience Biotechnology Research Communications», no 5 (September), pp. 254-263.

Obryadchikov, O.S. (2006). Paleobatimetric analysis of sedimentation conditions. Proceedings from abstracts of the scientific and practical South-Russian conference: Problems of basin and geological and hydrodynamic modeling. Volgograd, pp. 40-41.

Soloviev, B.A., Nemtsov, N.K., Obryadchikov, O.S., et al. (1989). Model of the geological structure of the Arman-Elemes zone of uplifts in the southeast of the Pre- Caspian basin. Geology of oil and gas, no 2, pp. 22-26. Moscow.

Taskinbaev, K.M. (2018). Non-anticlinal traps - a significant reserve for increasing the hydrocarbon resources of Kazakhstan. Oil and gas, no 2, pp. 52-58.

Turkov, O.S., Nikolenko, V.P., Volozh, Yu.A. et al. (1992). Experience in predicting the development zones of non-anticlinal traps in the subsalt complex of the southeast of the Caspian Basin. Oil and Gas Geology, no 7, pp. 12-16. Moscow.

Voronov, G.V. & Kuantaev, N.E. (2017). Offshore cones and turbidites of the Caspian depression are new objects. features and prospects of oil and gas searches. Almaty, pp. 311-321.