

# Regional study is the next important stage in evaluation of oil and gas industry potential of sedimentary basins of Western Kazakhstan

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**Abstract.** The article presents the general state of exploration and regional geotectonic characteristics of the structure of the basins of Western Kazakhstan (the Caspian Basin, Ustyurt-Bozashi and Mangyshlak). Principal results of regional studies carried out on the «Comprehensive study of sedimentary basins of the Republic of Kazakhstan» project for 2009-2013 are given. Based on this, topical issues in the study of the deep structure of basins are emphasized, from the perspective of further assessment of the forecasted hydrocarbon potential.

In accordance with the new deep drilling data (5.5-7.0 km and more) in recent years, the importance and necessity of specifying the structure and high prospects of the Paleozoic deposits are substantiated. In this regard, it is stated that it is advisable to post a parametric well in the future with an anomalous projected depth (14-15 km) in the central part of the Caspian Basin (Eurasia Project). Also, the program of regional studies (geotraverses and 2D seismic profiles) on the most important geological «cuttings» from the sides of the Caspian basin to the center, the zones of its articulation with the other basins that apply in the south, was considered. The characteristic of the problems solved by the program of regional study of the basins of Western Kazakhstan is given.

**Keywords:** basin, depth, oil and gas content, drilling, seismic studies, study, Paleozoic deposits, West Kazakhstan, Caspian basin, Ustyurt-Bozashi, Mangyshlak, geophysical anomalies, West Turan plate, oil and gas prospects

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## State of exploration, results of previous years and landmarks

Sedimentary basins of Western Kazakhstan in the Caspian region (the Pre-Caspian, Ustyurt-Bozashi, Mangyshlak) concentrate almost all significant deposits and facilities that ensure the fulfillment of planned targets for oil production. The development strategy of the Republic of Kazakhstan envisages the increase of oil production by 2020 to 100-120 million tons per year, which is 1.5 times higher than the current production level. At the same time, the expansion of oil production is mainly due to the giant and large Paleozoic deposits of the Caspian region (Tengiz, Karachaganak, Kashagan and Zhanazhol groups, Uzen, Kalamkas, Zhetibai, and Imashevsky) geotectonically related to the Caspian basin and the west of the Turan plate.

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The high capabilities of the most significant, three domestic “giants” (Tengiz, Karachaganak, Kashagan) nevertheless cannot fail to take into account one of the main factors of the high content of sulfur elements in oil and gas (hydrogen sulphide, mercaptan, etc.). This, to our knowledge, is associated with the strengthening of ecological pressure on the environment and increasing the corresponding requirements for exploratory wells and development of new promising areas and deposits. Meanwhile, the gradual depletion of the existing reserves makes it increasingly necessary to replenish the mineral and raw materials complex with new reserves. Taking into account the planned production levels, the annual increment of recoverable reserves, optimal for replenishment of the extinguished reserves, is estimated at about 100 million tons or more for the future.

In total there are about 280 hydrocarbon fields in the territory of Kazakhstan, located within six oil and gas basins (the Caspian Sea, Mangyshlak, Ustyurt-Bozashi, Shu-Sarysu, Yuzhno-Torgai, and Zaisan Basins) with a total recoverable reserves of industrial categories of

about 5.5 billion tons of oil and 3.0 trillion m<sup>3</sup> of free and dissolved gas (Figure 1). Of the total, 233 fields have been discovered in the Caspian region, including 8 in the water area of the Northern and Middle Caspian. Of these, 162 fields have been discovered in the Caspian Basin, 55 in Mangyshlak and 18 in Ustyurt-Bozashi. In general, despite this, further sustained economic growth and the development of the oil and gas industry require the expansion of the resource base for hydrocarbon resources on shore and off-shore, which requires studies on further assessment of new opportunities within the existing oil and gas basins and prospective oil and gas basins of Kazakhstan.

The outlined early delay in the planned replenishment of the hydrocarbon potential and the timely preparation of conditioning facilities for drilling was a consequence of the lack of systematic study of sedimentary basins during the last 20 years. The research of the structure and prospects of the territories for objective reasons was unplanned and fragmented. The works were carried out, mainly, on separate local sites and contract territories and, as a rule, near areas with known and developed hydrocarbon fields and developed infrastructure.

Simultaneously, in the period from 1991 a significant amount of new geological and geophysical information was accumulated, which did not receive timely and comprehensive analysis. As a result, this affected the quality and success of geological exploration, which, in turn, restrained a reasonable increase in the volume

of forecasted resources, increment of reserves, and discovery of new hydrocarbon fields. In these conditions, it is necessary to increase the geological exploration volumes with an emphasis on the discovery of large hydrocarbon fields in the most studied areas, especially in the Caspian region, which has been studied best with respect to modern research methods. This region contains all the most significant hydrocarbon fields, and therefore, the effective further economic development of the sector involves carrying out explorations in the most promising significant areas related to new discoveries in the Paleozoic deposits, capable of replenishing the hydrocarbon material resource base in a multiple and short timeframe (Karabalin, Iskaziyeu, Azhgaliev, 2013).

Under these conditions, at the initiative of the Committee for Geology and Subsoil Use of the Ministry of Industry and Energy of the Republic of Kazakhstan (hereinafter referred to as CGSU) and KazMunaiGas NC (hereinafter – KMG) for the period of 2009-2013 the **“Comprehensive study of sedimentary basins of the Republic of Kazakhstan” (CSSB RK) project was carried out**. These studies on such a wide scale were carried out for the first time and undoubtedly are the first experience in carrying out a comprehensive geological study and assessing the prospects of large areas across all 15 sedimentary basins of the country. The main argument and basis for the formulation of such studies was the lack of systematic, consistent, and integrated study of promising areas and sedimentary basins.

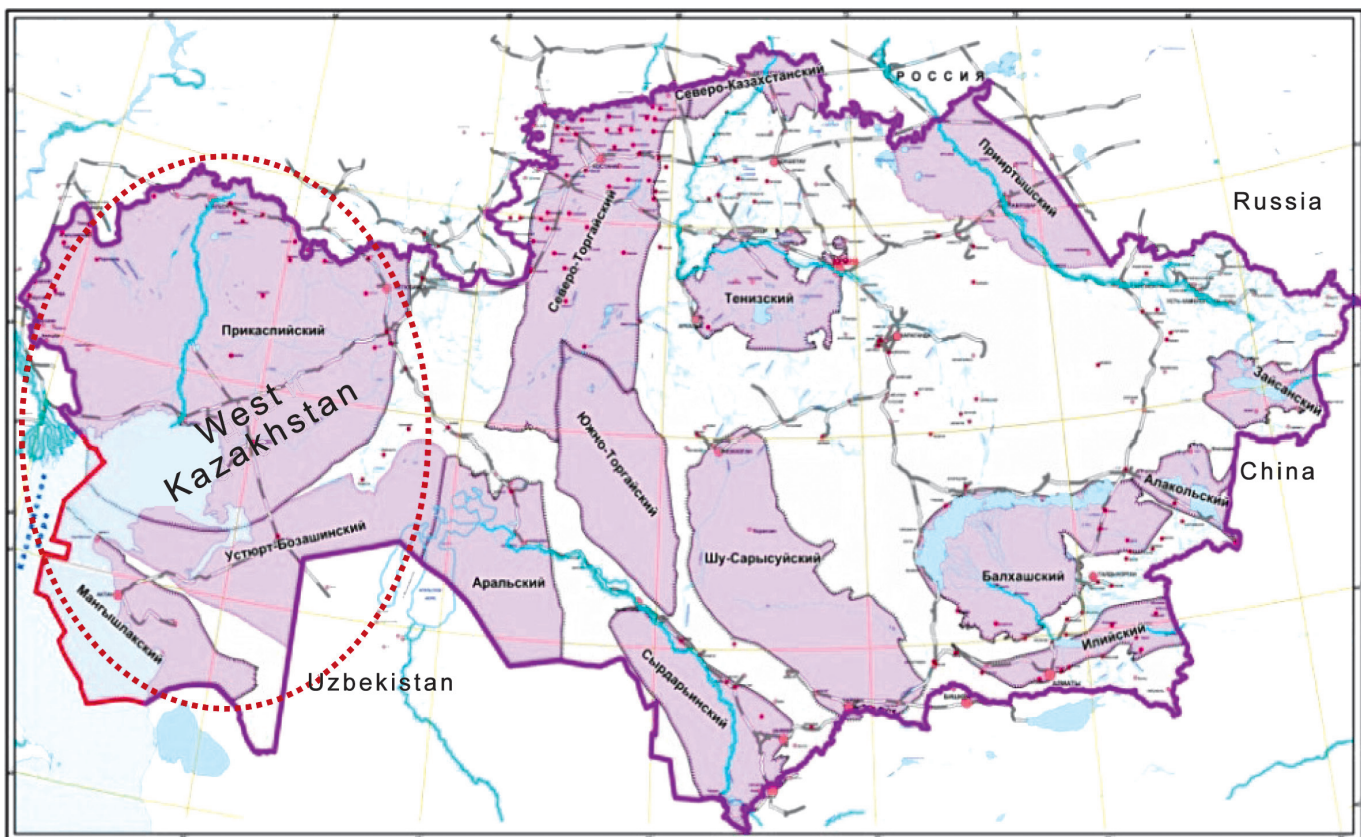


Figure 1. Scheme of sedimentary basins of the Republic of Kazakhstan (according to U.A. Akchulakov et al., 2009-2013)

Significantly increased technical capabilities and a qualitatively new level of data processing and interpretation were important arguments in assessing opportunities and justifying the ultra-deep well in the central part of the largest major promising Caspian Basin under the new regional Eurasia Project (Kuandykov, Volozh, 2015). Under these conditions, there is every reason to expect a high efficiency of research aimed at clarifying the concept of a section and a deep model of the structure of the Caspian Sea. Without a doubt, in this case, research should be coupled with the most detailed analysis and study of materials.

Traditionally, as known, there are two methods of studying oil and gas bearing structures: drilling and seismic exploration. At the same time in the Soviet era, the most important role was assigned to the integration of methods, which predetermined the stage and systemic nature of the preparation and justification of local search facilities. Taking into account the key research methods (gravimetric and aeromagnetic survey, electrical prospecting, geochemical studies, etc.), the preparation of structures from the regional stage to detailed work was more or less clearly monitored. By the combination of this large multi-stage work, a fund of prioritized and most prepared facilities was formed, and the possibilities of opening new fields and deposits were planned.

At the modern "transition" stage, the volume of research on the integration of methods has been sharply reduced. Accordingly, the effectiveness of prospecting and exploration has decreased significantly. Even in spite of the great prospects, marked by the results of the Comprehensive Study of the Sedimentary Basins of the Republic of Kazakhstan, the number of new discoveries has sharply decreased. If according to the statistics of the "pre-perestroika" period of work, an average of 2-3 fields were discovered each year with a fairly acceptable estimate of the recoverable reserves, now a decade is needed for their discovery. Thus, on the territory of activity of KMG as a whole in the period of 1999-2017 positive results were obtained (excluding the off-shore area) in 4 cases. However, given the quality and conditionality of the preparation of search facilities and the low assessment of these facilities in terms of reserves, which can be regarded as closely related factors, these discoveries can not be considered quite acceptable and cost-effective.

Therefore, based on the results of the Comprehensive Study of Sedimentary Basins of the Republic of Kazakhstan, the main program documents for the development of the mineral and raw materials complex have been adopted for the sectoral program of the CGSU for geological exploration for 2015-2019 and the Program of long-term development and replenishment of hydrocarbon reserves of KMG for the period up to 2020. They set the goal of forecasting the oil and gas potential

of new territories and expanding the resource potential by conducting a significant amount of prospecting work. One of the important reference points is the increasing depth of research and conducting prospecting at elevated depths (5.5-8.0 km), mainly associated with Paleozoic deposits.

As the studies and data of the last quantitative assessment for 2009-2013 have shown<sup>1</sup>, the Paleozoic sediment complex is the main research interval in a section that concentrates almost the entire volume of identified hydrocarbon reserves. In particular, the potential for the forecasted resources of categories  $D_1$  and  $D_2$  is very significant in this assessment. Within the Caspian region, the potential of the basin of the Caspian Basin for geological and recoverable resources is an order of magnitude greater than that of the rest of Kazakhstan, mainly due to Paleozoic deposits. Therefore, the updated quantitative assessment of the forecasted resources, which clarifies the prospects of oil and gas content, the directions for further prospecting and exploration, and the placement of research volumes are the main results of the integrated study of the basins.

Previously known and open giant and large reserves of hydrocarbon deposits in the Paleozoic complex are confined to the flanks of the Caspian basin at depths of up to 5.0 km in deposits of predominantly carbonate composition containing sulfur and hydrogen sulphide at elevated concentrations. In the relatively inland basin part, mainly smaller and insignificant hydrocarbon deposits are found. In recent years, data on the petroleum potential of Paleozoic deposits at depths of 6.0-7.0 km and more have been obtained. The technical level of processing and interpretation of geological and geophysical data (drilling and seismic data) and information on the composition of oil and gas-bearing strata and samples of gas, condensate and formation fluids has significantly increased. This makes it possible to highly estimate the prospects for the discovery of new large-scale hydrocarbon deposits throughout the Caspian Basin, including in the internal relatively submerged areas associated with terrigenous and carbonate-terrigenous sedimentation, favorable for operations, primarily in environmental terms.

In the context of the Ustyurt-Bozashi and Mangyshlak basins, the state of the Paleozoic complex has been studied at the initial stage. At the same time, deposits of industrial significance (Oymash, Karakuduk, Karachalakh, Urga and others) were found in some areas in the Paleozoic and favorable conditions allow us to outline and justify the high prospects of Paleozoic deposits in the context of these basins. Despite one

<sup>1</sup> Akchulakov U.A. et al. (2012). Kompleksnoe izuchenie osadochnykh basseynov Respubliki Kazakhstan. Prikaspiyskiy basseyn [Complex study of sedimentary basins of Republic of Kazakhstan. The Caspian basin]. Report JSC «Kazakhskiy institut nefti i gaza», TOO «Ak-Ay Konsalting». Astana.

of the serious objective factors, there is a lack of data completeness and very poor drilling of the lower part of the section (Paleozoic) of the western part of the Turan plate (Ustyurt-Bozashi and Mangyshlak).

As noted above, in the long term, a significant part of the resources will be represented by hydrogen sulfide-containing subsalt deposits of the Caspian Basin, which will be associated with significant costs of oil refining and the use of equipment with high corrosion protection, as well as increasing environmental pressure on the environment. This is clearly demonstrated by the initial stage of the development of Kashagan. KMG and its partner companies are faced with a high degree of risk and, accordingly, the complexity of implementing the ultimate strategic goal of increasing the production volumes in a short time, traditionally due to deposits with a carbonate composition of reservoirs containing hydrogen sulphide and sulfur at elevated concentrations.

One of the effective and alternative directions of work in these conditions for replenishing the mineral resources sector is the search for and discovery of new large low-sulfur deposits in terrigenous and carbonate-terrigenous deposits, characterized by more favorable conditions of occurrence, which are safe for subsequent development in an ecological sense, since the expansion of the resource base through the search and exploration of new hydrocarbon fields is a key task of the country's oil and gas industry at present.

In comparison with the rest of Kazakhstan's perspective oil and gas bearing territory and in accordance with historical approaches and assessments, the whole territory of the Caspian region in Western Kazakhstan is the most studied, especially in the upper Mesozoic-Nosenian and partly sub-Paleozoic part of the Caspian basin section. At the same time, due to the data on the oil and gas content of the Paleozoic of the Caspian Sea at great depths, the increased level of data processing and interpretation, the possibilities of analysis and construction of volumetric three-dimensional models and basin modeling (within the framework of new methodological "approaches"), the assessment of the potential of the Paleozoic complex of the Caspian region was conducted to the full extent and in joint stance.

Earlier, the Paleozoic complex was relatively studied in local areas of the Caspian Basin mainly in the flank areas at depths accessible for drilling (Figure 2). In the inland regions, the study of drilling is much lower. With the appearance of new data on the Paleozoic productivity at depths of 6.0-7.5 km in recent years (2010-2015), the views on the conditions of occurrence and prospects of the oil and gas potential of this complex on the territory of all basins within the Caspian region are largely updated. Although in the flank zones of the Caspian basin the study of drilling and seismic prospecting is relatively high, mainly due to the concentration of

studies in individual local areas, the basin area in this respect remains practically unexplored<sup>1</sup> (Kuandykov, Volozh, 2015).

In general, the area promising in the oil and gas terms within the Caspian, Mangyshlak and Ustyurt-Bozashi basins has been expanded to a considerable extent. Thus, the territories of Mangyshlak and Ustyurt-Bozashi for the Paleozoic complex are included for the first time in the category of prospective ones, and also part of the Paleozoic section of the Caspian basin that is involved in the assessment and justified for this is below -7.0 km label<sup>1</sup> (Karabalin et al., 2013). Accordingly, the quantitative assessment has largely been improved by shifting the areas of research to the inner and central areas of the Caspian Basin and most of the off-shore of the Northern and Middle Caspian. As a result, and in accordance with the structural-tectonic zonation, prospective exploration blocks are identified with a preliminary assessment of the prospects in their composition of individual detailed priority areas and facilities.

According to the results of high-precision aerial magnetometer survey performed within the framework of the KGaS RK Project, for the first time a preliminary scheme of a magnetic active surface (1:2000000) was prepared for western Kazakhstan, which is tied to the distribution areas of high magnetization of the basement rocks, which characterizes the behavior of the distinguished conditional surface<sup>1</sup> (Kiinov et al., 2014). At the same time, it allows to differentiate the territory into separate elements, to link the mutual location of large zones, and to clarify the nature of their mutual borders. This scheme is presented as one of the tools in the further more detailed study of the deep weakly explored part of the section. The complex consideration of the seismic, magnetic, and gravimetric measurements made it possible to substantiate one of the variants that justifies the geological nature and interpretation of the phenomenon areas associated with the Hobdin and Aralsor gravity peaks (Figure 2). For example, in the region of the Hobdin maximum, the value of the gravitational field is about 60 mGal, the magnetic field is characterized by the opposite behavior, which has a value of -20 nT and rises to +100 nT to the east of the maximum. A similar ratio of both fields indicates a high probability of the presence of carbonate rocks in the section. To this, according to the data of the KMPV (refraction correlation method), a sharp drop in the velocities above the level of the roof of the subsalt deposits is of the order of 3.4-5.4 km/sec. In accordance with these assumptions, in some parts of the central part of the Caspian the carbonate surface can lie at depths of the order of 4.0 km. Taking into account that the area of Hobdin and Aralsor maximum is about 22 thousand sq km and 6 sq km, respectively, further refinement and

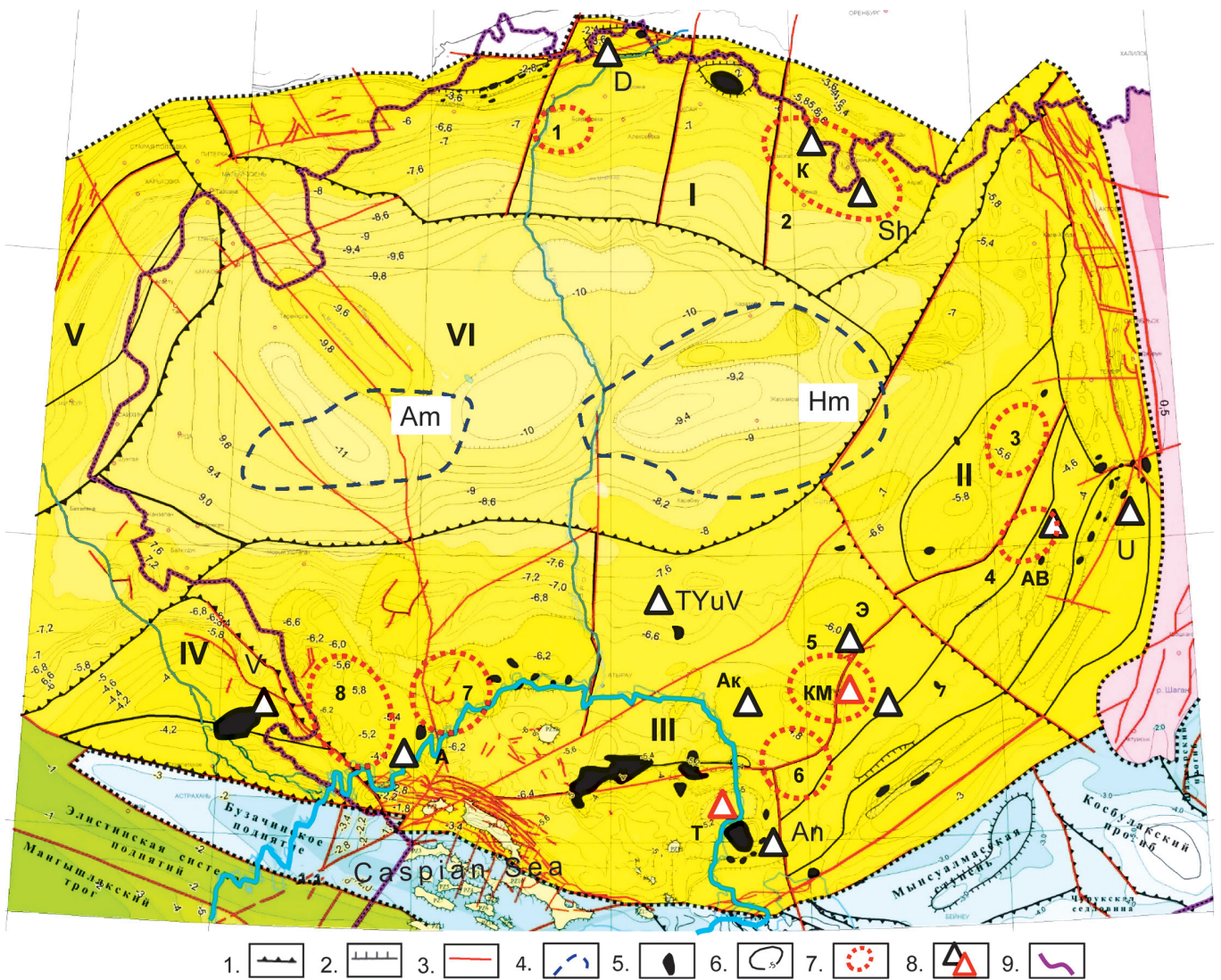


Figure 2. Scheme of the Paleozoic complex of the Caspian basin. Conventions: 1. Geoblocks: I – Northern, II – Eastern, III – Southern, IV – Astrakhan, V – North-West; 2. Contours of large structures of the upper order; 3. Regional faults; 4. Gravitational anomalies (maxima): Am – Aralsor, Hm – Hobdin; 5. HC fields; 6. Isohypes along the roof of Paleozoic deposits (OG P1), km; 7. Zones of development of large Paleozoic uplifts (protrusions of ancient formations): 1 – Zhelayevskaya, 2 – Koblandy-Shirak, 3 – Koskol-Shubarkuduk, 4 – Akzharskaya, 5 – Munayly-Adaiskaya, 6 – Kyzylkuduk-Matken, 7 – Zaburunye-Sazankurak-Oktyabrskoye, 8 – Alga-Kobyakovskaya; 8. Ultra-deep wells: a) the Paleozoic horizons that have opened at elevated depths (6.0 km and more): K – Koblandy K-3, D – Dolinskaya UGS-3, Sh – Shirak SR-1, AB – Akzhar Vostochny G-5, U – Urichtau U-5, B – Bikjal SG-2, E – Embinskaya P-1, Ak – Akatkol (Guryev arch) P-3, An – Ansagan G-2, TYuV – Tasim South-Eastern No. 1, A – Alga № 1, V – Volodarskaya №2; b) in drilling / in plan; 9. The border of the Caspian basin; 10. The border of neighboring states

detailing of their internal structure is one of the most urgent tasks.

In general, the results of the research on the CSSB RK Project provide analyzed and summarized data (text part, graphic and text applications) collected during the study period of 1990-2010 throughout the territory of Kazakhstan. All the data used in the process is digitized and presented in electronic form, convenient if necessary for operational and practical use in the analysis.

As a result of the strategy of searching for oil and gas fields at the turn of the 20th and 21st centuries, the central ones, the most submerged zones of the Caspian Basin, remain unexplored. The number of wells that have exceeded the depth mark of 6.0 km is currently limited,

they are of the order of ten and are mostly drilled on the Paleozoic in the side zones (Figure 2).

Significant “headstart” for the subsequent detailed research has been carried out in the part of exploratory drilling in recent years. On the rise of Uricketau on the eastern edge of the Caspian basin in 2014-2015 drilling of the well with a design depth of 6000 m was carried out (Azhgaliyev, 2015). However, due to the complication of the technical condition of the wellbore, a depression below the 5374 m mark was not possible. Despite this, according to the results of drilling on the area of Uricketau, a fundamentally important result is obtained, confirming the productivity in the context of the Devonian deposits, the study of which, moreover, was the main purpose

of the conduct of this well. In the south-east of the Caspian basin in the first half of 2017, the drilling of a super deep well 7.0 km deep on the Kyrykmergen-Munayly North uplift (the northern part of the Matken-Bikjalsky step) was started. A preliminary assessment and justification for the 8.0 km deep exploration well of Tengiz Glubokiy on the area of the same-named field was carried out in order to clarify the geological structure and the oil and gas content of the lower (middle – upper Devonian) level of productivity. Thus, the low values of the gravitational field in the Tengiz field, in contrast to all other major uplifts of the southern frame, allowed us to assume the oil contour mark below the presence of a strong decompaction zone and, correspondingly, their saturation of the hydrocarbon. In addition, the possibilities and preliminary data for the exploration well of a depth of 4.5 km on the Uzen-Karamandybas (Mangyshlak) ridge to study the structure and possible oil and gas potential of the promising Paleozoic strata were considered.

On the objects of research, based on the generalized and analyzed material, digital volumetric geological and basin models have been compiled, which in the future are expected to be transferred to the category of permanently operating basin models. The corresponding updated geological and geophysical data base was compiled on them. The work on the integrated study of basins was associated with a lack of full access to the accumulated geological and geophysical information, which represented an objective difficulty in achieving full-scale analysis and maximum coverage of the area for research.

At the same time, along with important results obtained, **a number of problematic issues of regional geology of sedimentary basins are identified**, which are of fundamental importance and require further solutions through a series of regional geological and geophysical studies that form the basis of the recommended and proposed Regional Research Program. The planning and staging of a large-scale regional study of the Caspian basin and the west of the Turan plate, along with the other sedimentary basins of the country, is based on the recommendations of the CSSB RK Project for 2009-2013. The basic stages of this program were previously detailed in the work (Akchulakov, 2015). With this in mind, the author in this article focuses on the basins of Western Kazakhstan with a broader argument regarding the need to drill abnormal depths (6.0 km and more). Thus, the ideological basis and focus of the **Program for the regional study of the basins of Western Kazakhstan for the period up to 2030** constitute the following principal provisions.

a) Until now, there is no well-founded, more accurate geodynamic model for the development of the entire territory of Kazakhstan and its constituent tectonic ele-

ments. Current models of development and structure are based on fragmentary and incomplete data, lower in terms of measurement technologies compared to those currently available to researchers.

b) The obtained results of magnetometric and gravimetric measurements indicate the presence of additional features in the behavior and tracing of the surface of the foundation, which makes it necessary to refine and determine the morphology and depth of the roofing of the foundation. We have to state that the data currently available do not allow us to solve these problems.

c) Almost in all the basins the main work in the study of shallow strata has been performed, mainly in the Meso-Cenozoic time complex. However, the present stage of geological exploration characterizes the transition to the study of the structure and oil and gas content of the intermediate complex of sediments and deep-lying sequences of Paleozoic age and older. Previously conducted studies at this time have solved this problem incompletely. Essentially, in the study of the deep structure of the basins, the work to solve this and other problems is at the initial regional stage.

d) The study of the oil and gas potential peculiarities of the basins made it possible to draw a definite conclusion about the deep source of hydrocarbon fluids for practically all basins. This determines, in turn, the need for systematic studies aimed at identifying the cause and effect relationships of oil and gas content of both the basins as a whole and their individual elements, with the features of geological development and the structure of deep horizons (up to the Moho surface). Because these aspects determine the tectonics and, accordingly, the deep processes controlling oil and gas accumulation and oil and gas generation.

The aim of the regional study program is to study the internal structure of sedimentary basins with the involvement of a complex of geological and geophysical methods. In this case, it is necessary to clarify the history of basin formation on the basis of data on the behavior of the main physical surfaces, starting from the Moho surface and above. It is necessary to study the material composition of the rocks composing the crystalline basement and the overlying deposits of the sedimentary cover, correcting the depths of the roofing of the foundation and the main seismic surfaces, clarifying the nature of the tectonic disturbances and the correlation of the main seismic surfaces with the aim of substantiating large tectonic sedimentation objects and zones within the basins.

The complex of regional methods includes carrying out magnetometric and gravimetric measurements of increased accuracy in the variant of area mapping at a scale of 1:50000, the analysis of space observations data, and the conduct of regional seismic studies in the Geotraverse variant, including the CDP method in the

DSS and RCM (deep seismic sounding and refraction correlation method) complex and the development of regional seismic 2D profiles (Figure 3). The Geotraverse profile system assumes measurements of magnetic, gravimetric, electric fields, and geochemical surveys.

For the purpose of studying the rock composition of previously undiscovered deep-lying complexes, the stratification of seismic reflecting horizons, the study of reservoir properties at great depths, and the geochemical features of individual sections, drilling of superdeep search (parametric) wells is planned. The scope and objectives of the regional basin study include the conduct of gravimetric, seismic (geotraverses and 2D area) works, aeromagnetic surveys and superdeep (exploratory, parametric) drilling.

**Gravimetric studies.** Within Kazakhstan so far, gravimetric studies have been carried out within the framework of the Federal Program for Geological Studies. At present, gravimetric works of scales of 1:1 000 000, 1:200 000, and 1:100 000 have been completed. Large-scale studies have been carried out

on a scale of 1:50 000. It is necessary to supplement and complete the gravimetric studies of this scale. It is planned to carry out works within the Caspian and Ustyurt-Bozashi basins in the period up to 2025.

**Aeromagnetic survey.** Magnetometric studies covered almost the entire territory of Kazakhstan. Aeromagnetic studies, conducted in 2011-2012 in the Caspian Basin, showed significant differences with earlier studies. In this regard, it is necessary to continue similar studies on all sedimentary basins, including in the west of the Turan plate (Mangyshlak and Ustyurt-Bozashi). The volume of work is preliminary 140 thousand sq km. The survey, similar to the Caspian basin, is conducted over a network of 2 km x 10 km, with thickening of the network to 1.0 km x 10.0 km. The work is planned in the period until 2020 in stages.

Regional seismic studies include work on the study of deep-lying sequences of the Paleozoic complex within the prospective areas and suggest the development of regional (geotraverse) and regional (zonal) seismic profiles.

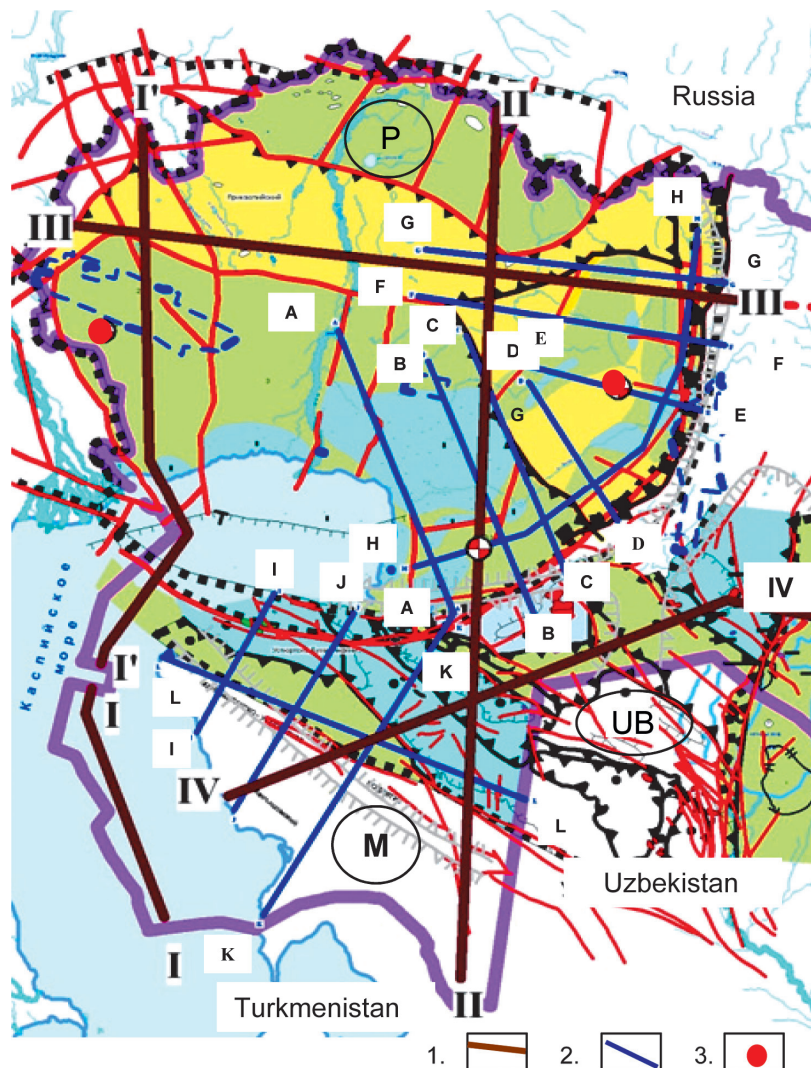


Figure 3. Western Kazakhstan (the Caspian basin and the west of the Turan plate). Scheme of geotraverse location and regional seismic 2D profiles. Conventions: 1. Geotraverse; 2. Regional 2D seismic profiles; 3. Preliminary position of design parametric wells; Basins: P – Caspian, UB – Ustyurt-Bozashi, M – Mangyshlak.

In total, according to the program of seismic surveys, it is necessary to conduct a minimum amount of research on the Geotraverse system, which is aimed at studying first-order facilities (oil and gas basins and areas) and their conjugation zones. In this case, the recording length is about 20 seconds.

The program of geotraverses includes the implementation of DSS-KMPV (on the basic profiles), high-precision profile gravity prospecting, magnetic prospecting, 2D-CDP method work with a recording length of up to 20 seconds, electrical exploration (MTS profiling, resistance method, VES) and geochemical surveys. Seismic work with geotraverses is planned in the future for all sedimentary basins and is calculated for the period up to 2025.

At the same time, the Caspian, Ustyurt-Bozashi, and Mangyshlak basins are the priority ones based on the results of the integrated assessment. Conducting regional works on the Geotraverse system in them is foreseen primarily; the **volumes are five geotraverses** with a total length of 2970 lin km (Table).

The system of regional 2D profiles is aimed at studying the structural features of large second-order zones within first-order objects with the purpose of studying their structure and detecting large local objects

No.	Geotraverse	Basin/Area	lin km	Term, years
1.	I-I	Mangyshlak, Ustyurt-Bozashi, the Caspian Basin	310	1
2.	I'-I'		730	2
3.	II-II		1100	3
4.	III-III		830	2
5.	IV-IV	Mangyshlak, Ustyurt-Bozash and Aral basins	900	2
5 profiles in total, lin km			2970	
Basin, zone		2D profiles	lin km	Years
The Caspian basin (the south-eastern side zone)		A	390	2018-2019
		B	350	
		C	335	
		D	210	
		E	220	
		F	380	
		G	370	
		H	640	
Mangyshlak, Ustyurt-Bozashi, the Caspian basin (the southern flank zone)		I	200	2019-2020
		J	290	
		K	450	
		L	480	
Total volume of 12 profiles (lin km)			4315	

Table. The program of regional study of the basins of Western Kazakhstan (geotraverses and 2D profiles) for the period up to 2020

corresponding to the level of reservoirs with possible large and giant volumes of hydrocarbons (Figure 3). The volume of profiles is 4315 lin km.

To date, geotraverse work has already begun and is being systematically carried out within the basins in the south-south-east of Kazakhstan.

The actual materials and available substantiating data make it possible to recommend and determine the drilling of superdeep (up to 8.0 km) prospecting wells at priority local Paleozoic structures (Azhgaliyev, 2015). The south-eastern, southern (interfluvium of the Urals-Volga), the eastern, and northern instrument areas of the Caspian basin, as well as the Mangyshlak (Uzen block), are of primary importance in this regard. In the south-eastern frame, large uplifts are marked on the Matken-Biikjal and Namzhtakyr stages, and the Kulsar zone of uplifts. In the interfluvium of the Urals-Volga, promising areas of the Kum Severny-Kobyakovskaya-Alga and Zaburunye-Sazankurak-Oktyabrsky uplifts are highlighted (Figure 2). The lower Devonian-Lower Carboniferous floor in the Karaton-Tengiz zone of uplifts (the structure of Tengiz Glubokiy) is of great interest. In the north-north-east of the basin, the Koblunda-Tamdy, Chirac and Zhelayevsky uplift zones are of prime importance. In the east of the Caspian, large prospects for large objects in the Zhanazhol-Tortkolsky, Temir and Shubarkuduk-Koskol zones of valleys are grounded.

Ten drilling wells are top priority in the drilling program, in each of them, a full range of studies is mandatory, including an optimal list of GIS methods, core sampling, reservoir fluids and lateral soils. The period of work is until 2022.

The systematic implementation of the Program of regional study of sedimentary basins of Western Kazakhstan will undoubtedly accompany other important projects of global importance, including the Eurasia Project, which provides the drilling of an anomalous depth in the well (14-15 km) in the center of the Caspian (Kuandykov, Volozh, 2015). One of the main tasks in this case will be the optimal determination of the location of the superdeep "Prikaspiy" well. Together with this, the Program will provide new material and factual data on the deep structure and tectonics of the central areas of the Caspian Basin, which in turn will be additional material for assessing the structure and formation, especially in the Paleozoic and older stage of development, adjacent to the south basins Ustyurt-Bozashi and Mangyshlak.

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