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FACIAL-PALEOGEOGRAPHIC CONDITIONS OF ACCUMULATION OF THE LATE DEVONIAN SALIFEROUS STRATA OF THE SYRDARYA SEDIMENTARY BASIN

Abstract. At the end of the Devonian period (Famennian stage), a large carbonate platform began to form in the region, that developed until the beginning of the Pennsylvanian (Bashkirian stage). In the article all the standard facies zones characteristic of these structures are distinguished: the deep-water basin hollow, the slope of the carbonate platform, the edge of the platform, framed by a reef and/or organogenic structures, carbonate ramp, the inner platform zone (shelf lagoon, tidal zone, salt basin and continental carbonate formation zone in ancient karst zones). During the late Devonian period outside the platform and within the outer shelf in a deep-water basin isolated from the input of terrigenous material, it was formatted a saliferousstratum opened by the well Arys No. 1-G at the depth of 1757 and 4004 m. In the lower partthere are interlayers of terrigenous and carbonate rocks. According to seismic survey and GIS the salt base is presumably located at the depth of 4700-4800 m. Gravimetric anomaly Arys is a diapir dome with a height of at least 3 km. Geophysical studies have shown that the saliferous stratum has a wide development within the Aryskum and Bayyrkum troughs of the Syrdarya sedimentary basin. A wide range of presumably diapiric structures composed of salts has been discovered. For the Syrdarya sedimentary basin it is predicted the formation of structures of the 2nd type: buried diapirs with a depth of more than 3000 m of the batho-halite. On their steep slopes, multi-layered deposits of oil and gas can be formed with a steep, almost subvertical fit to the slope of the salt. Examples are the Kenkiyak and Kulsary deposits, where hydrocarbon deposits are found along steep slopes. Thus, these structures can be considered as promising for identifying oil and gas deposits.

Key words: Syrdarya SB, carboniferous, lithology, paleogeography, graben, salt, oil, gaz.

Syrdarya sedimentary basin is a transboundary basin located in the southern Kazakhstan and northern Uzbekistan. In the north-east, south and south-west it's surrounded bythe mountain structures of the Greater Karatau ridge, Chatkal and Kurama ranges, Bukantau and Nuratau respectively. It's borderwith the East Aral sedimentary basinlays on thesaddle of Akkyr and Kumkalinsk. The length of the Syrdarya basin is over 600 km, with a width of up to 350 km.

Its geological structure involves the rocks of Proterozoic, Paleozoic, Mesozoic and Cenozoic eras, forming three structural levels: foundation, intermediate (quasielectronic) and slabby. Saliferous formation sarerelated only to quasie-platform structural floor of the Upper Paleozoic age. According to geophysical data, partially confirmed results of deep drilling, its roof is immersed to a depth of 2500 m, while the sole is traced up to 6500 m, i.e., the capacity of this complex reaches 4,0 km

The most ancient formations, uncovered wells in this region are continental and marine red-colored terrigenous rocks of the middle and upper Devonian with a few layers of sulphate rocks. Up the slit they're overlapped by powerful carbonate-terrigenousstratum of Upper Famennian-Mississippi age. The slit is completed by the breakdown of fine-grained terrigenous stratum of Missisipi-Pennsylvania (including the Bashkirian stage). Younger Pennsylvanian (Moscow and other tiers) and Permian rocks arenot available.

It should be noted that almost all formations involved in the slit structure of the Upper Paleozoic of the Syrdarya SB and having different genesis and lithological constituent, contain more than 1% of organic matter and bitumoids. On this basis this sedimentary basin can be attributed to the prospective

category. However, the results of the researches of borehole cores showed low values of volume and reservoir properties of formations. A lack of reliable regional tire fluidorumraised a lot of questions as well.

First of all, it was associated with a weak drilling assessment of the basin. Drilled in different years by parametric and deep wells, quite powerful clay, sulfate and salt strata, and carbonate and terrigenous rocks which arethe best collectors were discovered.According to the outcome of geophysical survey, subsequently confirmed by drilling (ARIS No. 1-D) salt deposits can be regarded as the regional fluidorum which is capable of screening prospective oil and gas deposits.

Deposits of the Devonian and Carboniferous systems of the Syrdarya sedimentary basin correlate well with formations of this age in the region of the Greater Karatau mountains, where they're studied in-depth, both in terms of lithological composition and stratigraphy. The slits are fully described by a variety of fauna: corals, brachiopods, foraminifera, conodonts, crinoids, stromatoporoids, stacioni, sponges, algae, stromatolites, ortionately and cephalopods.

It was found that at the end of the Devonian period (Famennian stage) for the region of Karatauwithin the modern Karatau mountains, Ugam ridge, Shu-Sarysu, Eastern Aral and Syrdarya sedimentary basins it was started the forming of a large carbonate platform, which developed until the beginning of the Pennsylvanianage (Bashkirian stage). Model of this platform was developed in-depth on the materials of slit research of the Greater Karatau [1-5]. As a result of the studies it was proved that there are all the standard facies belts, typical of these structures: the deep basin trough, the slope of the carbonate platform, the edge of the platform framed by the reef and/or organogenic constructions, carbonate ramp, and inner platform area (shelf lagoon, tidal area halogen basin and zone of the continental ocean sourced carbonate production in ancient karst areas). Besides, slits of the Greater Karatauhad been studied: intervals of sedimentation and hidden disagreements with the developed karst, and "surfaces of Molter", floods in carbonate and terrigenous-carbonate facies zones. [1-5]. Model of the carbonate platform of the Greater Karataumay be applied with the certain assumptions to neighboring regions, including Syrdarya sedimentary basin.

It has been established that, in the middle of the Famennian there was a transgression of the sea, which moved from the south-west to the northeast, i.e. from modern Uzbekistan towards Bolshoi Karatau. The rise of water continued almost to the end of the Famennian, when the regressive stage came and the shoreline shifted to the southwest. This phenomenon – the regression of the sea at the end of the Devonian is noted in many regions of the globe. In the top of the Famennian in the Bolshoi Karatau lies the horizon of karst breccias (Balaturlan pack), which is the marking border between the Devonian sediments and the lower tour. As a result of migration of the shoreline to the southeast, the present Shu-Sarysu sedimentary basin area was sharply shoaled, where a fairly large semi-isolated lagoon formed within which intensive accumulation of evaporate layers occurred.

The section from the Middle Visean to the lower Bashkir reaches of the carbonate platform of Greater Karatau is divided into three parts on the basis of belonging to different parts of this structure, and accordingly having a different genesis. Its structure includes deep-water carbonates of the Baktysay Formation, carbonates of the platform's margins and the shelf lagoon of the Maydantal Formation, separated by the Akuyk reef complex. Deep water turbidites are widespread over a vast territory and are associated with a major transgression of the sea to the Kazakhstan continent, which occurred from the southwest to the northeast, i.e. from the side of the modern Syrdarya sedimentary basin [1-5].

Within the limits of the last Serpukhovian-Bashkirian strata, the middle Syr Darya No. 2-P was penetrated in the interval 3070-3757 m (687 m open capacity) and represented by dark gray, almost black fine-grained and pelitomorphiclimestones (mastouns) analogous to these differences in the rocks of the Baktysay Formation. In limestones, foraminifers are found among which predominate: Archaediscuscf, Convecxus Cr, et Leb., A. Karresi Brady, Neoarchaediscusincertuset Lebed., N. paraovoides (Brasch). The foraminiferal complex is identical to the Karatau complex (Serpukhovian stage) and, possibly, the lower part of the Zhertansay (bottom of the Bashkirian stage) of the Bolshoi Karatau Formation.

In his works, Davydov N.G., Paragulgov, Kh.Kh and others [7-10] have shown that the salt-bearing sequences are fairly widespread within the Syr Darya sedimentary basin, and primarily in the modern Arys and Baykum troughs, which in the Upper Paleozoic times were a single tectonic structure. According to seismic data, uplifts of isometric shape, having an amplitude of up to 800–1000 m, which are also characterized by minima of detailed gravity prospecting, are detected within their limits (Figure 1). The

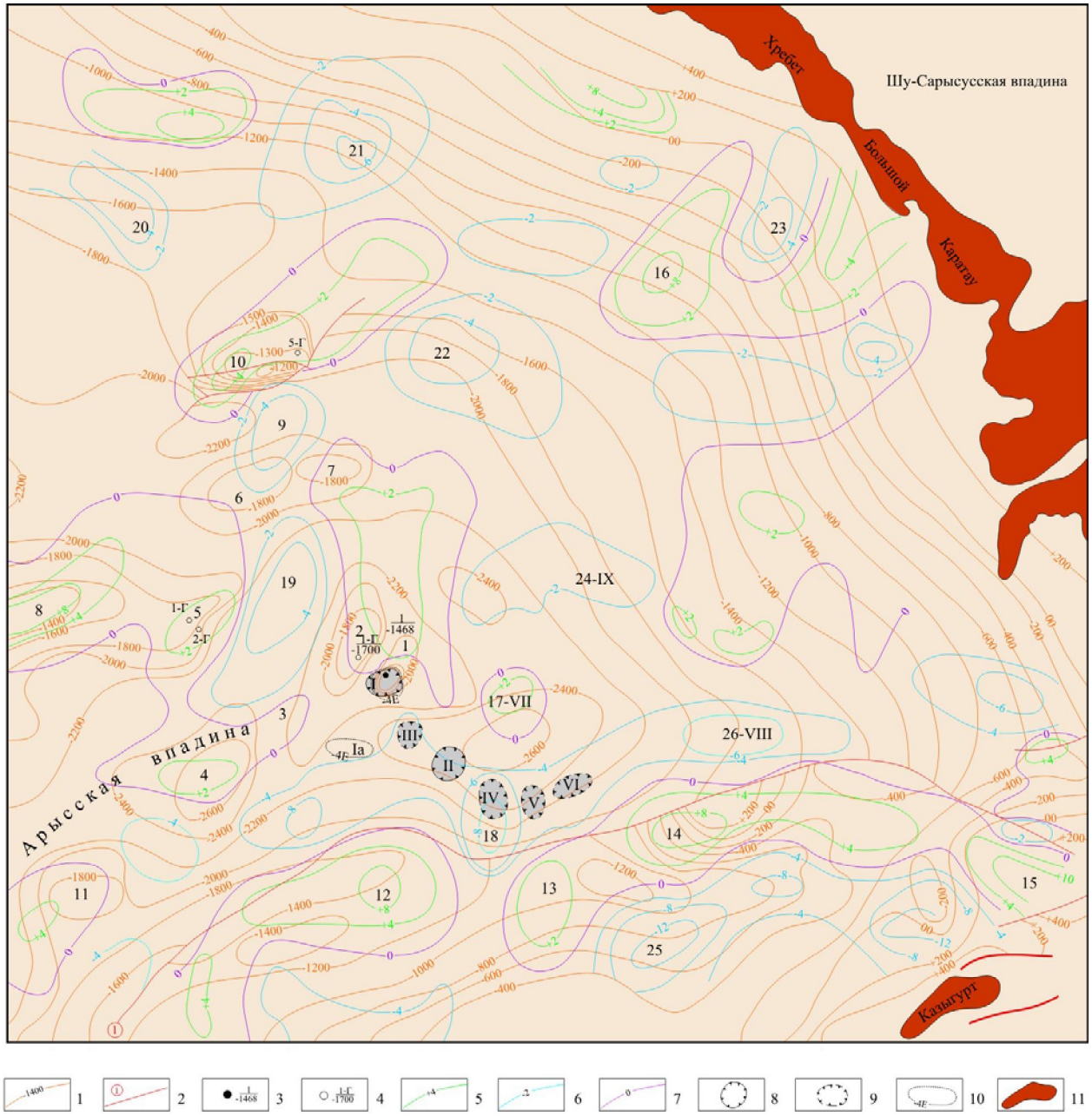

Figure 1 – Map of the location of the salt domes in the Arys-Bayyrkum trough [10]

1 - isohypses along the roof of Paleozoic deposits; 2 - tectonic disturbances; 3 - well No.1 Arys (in the numerator the number of the well, in the denominator - the mark of the depth of the Paleozoic roof, 4 - drilled deep wells: in the numerator - the number of the well, in the denominator - the mark of the depth of the Paleozoic occurrence, 5 - local anomalies of searching gravity gradiometry. Isolines of positive residual gravitational field in milligalls, 6 - the isolines of the negative residual gravitational field in milligalls, 7 - isolines of the zero residual gravitational field of gravity gradiometry of scale 1: 200 000, 8 - Local anomalous zones (salt domes) recommended for drilling by gravity gradiometry (Kaldybay II dome), 9 - local anomalous zones recommended for seismic survey of CDPM on search for salt domes, 10 - isolines of negative second derivatives of the gravitational field in etviesh (local graviminimums) in gravity gradiometry, (-3 km) - depth of the lower edge of salt in the epicenter of the anomaly according to gravity gradiometry interpretation on the sea level. 11 - outcrops of Paleozoic rocks to the surface.

The structures of the types of salt domes: I - Arys, Ia - South Arys, II - Kaldybay. Abnormal zones: III - North Kaldibay, IV - Neozhidannaya, V - Kabulsay, VI - Amanzhar, 26-VIII - Badam, 24-IX - Ermolovka-Tamerlanovka. Positive: 1 - Arys, 2 - Koskungur, 3 - Akdalin I, 4 - Akdalin II, 5 - Karakungur, 8 - Asarchiks, 10 - Bayyrkum, 11 - Zhanakuduk, 12 - Kempirsai, 13 - Ordabas, 14 - Lenger, Kyzylaryk, 17-VII - Kaldybai-2. Negative: 19 - Taskuduk, 25 - Akzhar, 15 - North-Kazygurt.

discrepancy between gravity and seismic models, as well as calm magnetic fields that exclude the influence of intrusive bodies of acidic composition, made it possible to assume that these structures are salt domes [7-10]. In the Arys trough, such several structures were mapped: Arys (Figures 2, 3), Kaldybay, North-Kaldybay, Neozhidannaya, Kabulsay, Amanzhar, Badam, Ermolivka-Tamerlanov and others (Figure 1). Some of them gravitate towards the Shulinsky fault, which is traced from the Chatkalo-Kuraminmountains towards the central part of the Syr Darya basin.

In the arch of the Arys structure to confirm the salt-dome nature of the local negative gravity anomalies in 1992–1994, Well Arys No. 1-G was drilled with a depth of 4004 m (Figure 4). During the drilling in the interval of 1698-1757m, the Upper Paleozoic limestones were discovered. Further, from the depth of 1757 m to the bottom (4004 m), the well crossed the salt-bearing thickness, from which it did not leave. The passed section, starting from a depth of 1757 m to 3099 m, turned out to be a folded pure salt (according to N. G. Davydov's interpretation) [8]. Even deeper, from a mark of 3099 m in a section, carbonate and terrigenous rocks with thickness from 5 to 70 m were encountered, which can be traced to the bottom of the well (4004 m). The salt base according to seismic and GIS data is presumably located at a depth of 4700–4800 m [7-10]. Below the development of carbonate-terrigenous rocks of the Upper Devonian and Lower Carboniferous is assumed. According to the definitions of M. M. Marfenkova (1994), on the microfauna of foraminifera from the limestones in the interval of 3098-3173 m, the age of the entire sequence and the salt itself in the interval of 1800-3200 m was dated by Serpukhovian-Bashkirian (C1s-C2b).

It should be noted that the well Arys No. G-1 was passed without core sampling, with the exception of the intervals of 2100–2121, 2121–2131 and 3100–3110 m. In addition, from a depth of 3175 m, an incomplete GIS complex was made. In the interval of 3790–4004 m, the rock composition is not exactly defined, since the calculated parameters are close to both salt and anhydrite, and to carbonates. Therefore, today, there is no complete picture of the lithological composition of the saline sequence.

Based on the results of drilling, the diapiric nature of the gravimetric anomaly of the same name was confirmed. It was found that the upper part of the section of the Paleozoic sediment complex and the lower section of the Lower Cretaceous stratum were broken as a salt rod.

On the seismic profile (Figure 2) and the geological-geophysical section (Figure 3) it is clearly visible that the Arys Salt-Dome structure breaks the deposits of the bashkir-serpukhs to the full thickness, i.e. the

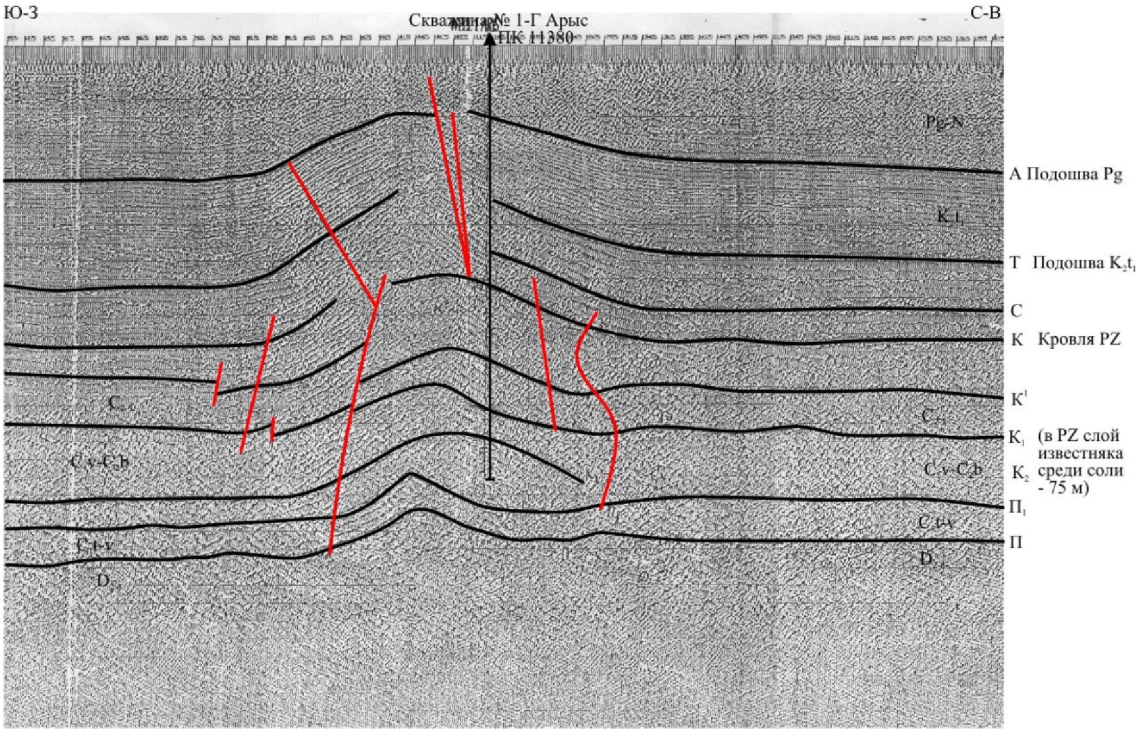

Figure 2 – Fragment of the seismic profile No. 9207170, intersecting the Arys dome structure (by N. G. Davydov)

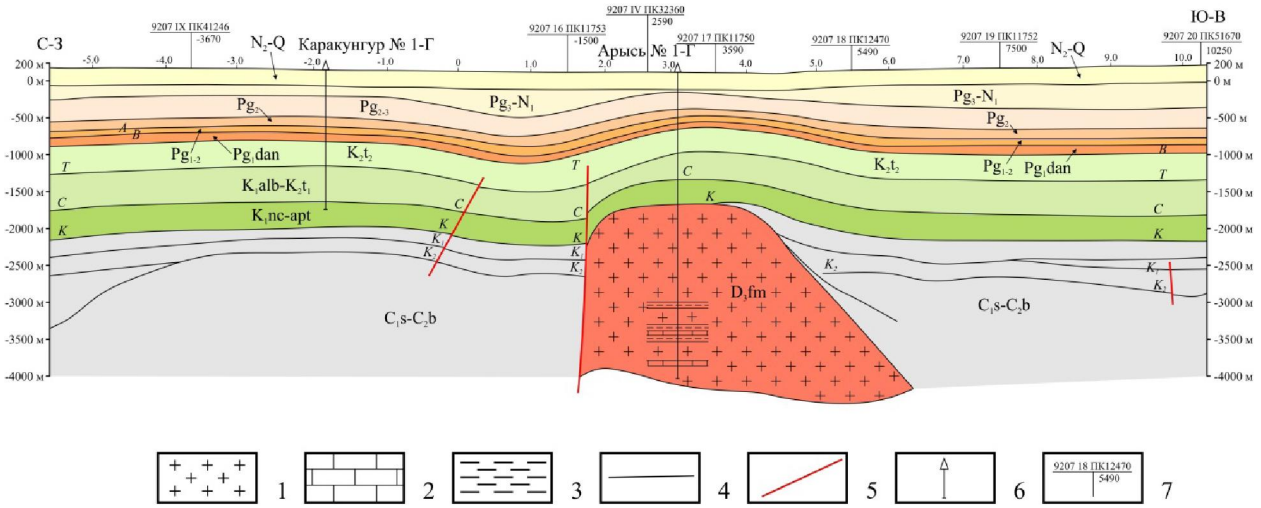

Figure 3 – Geological and geophysical section through the Arys salt dome.

Lithological types of rocks: 1 - salt (halite), 2 - limestones, 3 - clays and argillites. 4 - borders of stratigraphic subdivisions. 5 - tectonic disturbances. 6 - boreholes. 7- places of intersection of seismic profiles.

age of the salt is clearly older than the host rock. According to the geophysical data below the soles of the salt lie the carbonate-terrigenous rocks of the Upper Devonian and the Tournaisian and visean stages of the mississippi. Based on the analysis of the paleotectonic and paleogeographic environments of the formation of the stratigraphic strata of the upper paleozoic of the Syrdarya, Shu-Sarysu sedimentary basins and the Greater Karatau Mountains, it is possible to assume with reasonable certainty about the Upper Devonian (late Femenian) age of the salt-bearing stratum, discovered by the Arys No. 1-G well. In the adjoining areas, two levels of salt accumulation are established: Upper Devonian and Lower Permian, which is apparently acceptable for the Sirdarya sedimentary basin.

The theory of the mechanism of the formation of salt domes suggests that the movement of salt upwards does not occur evenly throughout the mass, but in several separate zones. This is evidenced by their internal structure consisting of individual spike-like zones. The whole structure moves upwards due to the fact that these zones do not rise simultaneously ("jerkily") relative to each other. With such a differentiated movement inside the salt dome, probably, zones of crushing and breaking disruptions are formed, which then again flow and deform. The surrounding dome sedimentary layers rise upwards and bend under the action of salt movement, and sometimes they can deform to such an extent that they become vertical or in some places they fall over. Deformations are developed only around the dome's top border, their scale and shape are determined by the size of the dome. Apparently, when the salt was moving upwards, crushing of carbonate and terrigenous rocks of serpukhov-bashkirian age, capture, flow and dragging them inside the evaporite layer occurred. The opening of such exotic blocks during the drilling of the well led to an incorrect age dating of the salt-bearing section.

Similar structures were found in the Bayyrkum trough: Bayırkum, North Bayyrkum, South Baykurm and East Bayyrkum, which are located on its northern outskirts, in conjunction with the zone of articulation with the Arys trough (Figure 1). A small number of identified structures can be explained by the very weak geological and geophysical study of this deflection. The Baykurm group of structures, in its gravimetric characteristics, is close to the salt-dome structures of the Arys trough, but is likely to exceed them considerably in salt bodies. To assess the prospects of oil and gas potential of this group of structures, it is extremely important to establish the character of a wide-scale development of salt formations, which are ideal tires for hydrocarbon accumulations.

In these strata, both stratified and massive hydrocarbons, isolated by the salt thickness, and ring and semi-ring domes shielded with salt rods can be contained.

From the theory of sedimentogenesis it is known that the most powerful strata of pure halite are formed in deep-water conditions, where the waters are too deep and where light does not penetrate almost, which makes the accumulation of bottom carbonates impossible. Here, under certain conditions, there are

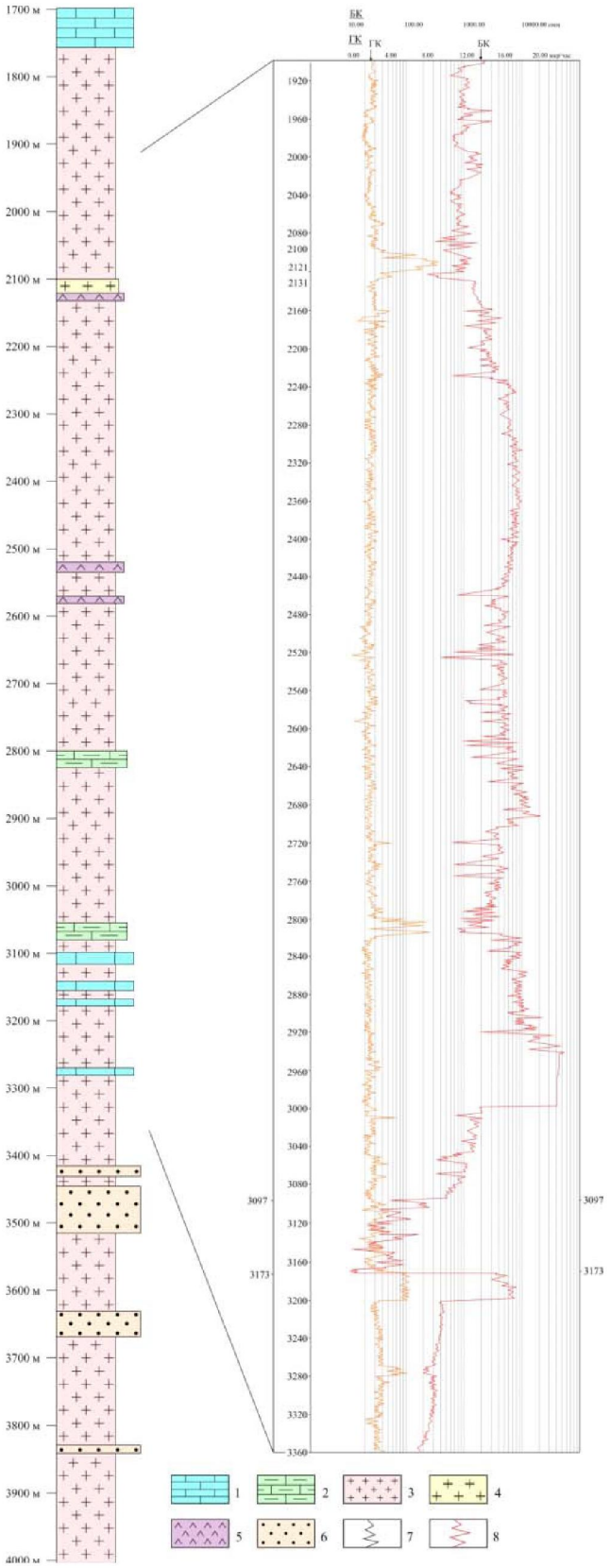

Figure 4 – Lithologic-stratigraphic column of the salt-bearing stratum, opened by the well Arys No. 1-G.

Lithological types of rocks: 1 - limestones, 2 - marls, 3 - salt (halite), 4 - gypsum, 5 - anhydrite, 6 - sandstones. Logging curves: 7 - gammaraylogging, 8 - LL(Lateral logging).

euxin or stagnant conditions, as well as a sharp increase in salinity [11]. According to the standard facies identified by J. Wilson.

All the largest formations of evaporit of the world were formed in deep-water conditions in the central parts of basins on the borders of the cratons remote from coasts and from influence of shelf areas. On such sites the deficiency of sedimentary material is observed. Sedimentation happens in the euxinic conditions, it is lower than the levels of oxidation, carbonaceous compensation and below basis of action of waves. Water depth in such basins reaches tens and hundreds of meters and even the first kilometers. The benthonic waters which are flowing down from adjacent shelves can be oversaturated by salts and have larger density that complicates the free water exchange. In the conditions of a sharp lack of oxygen there are congestive conditions with the reduction environment here. The prevailing lithologic type precipitating is the halite forming potent layers at late stages of filling of the settling basin [11].

Big power and extent on lateral (to hundreds of kilometers) are characteristic of deep-water evaporit This results from the fact that in big reservoirs considerable variations of composition of waters aren't observed as a result of short-term and minor changes due to inflow of waters or evaporation.

The formation of the evaporit minerals happens thankfully to the evaporation of the surface waters, and further minerals plunge and settle at the floor of the basin.In process of increase in salinity the mineralogical composition of salt also changes. It is as a result the section is formed, which consists of various lithologic differences of evaporits. (figure 5).

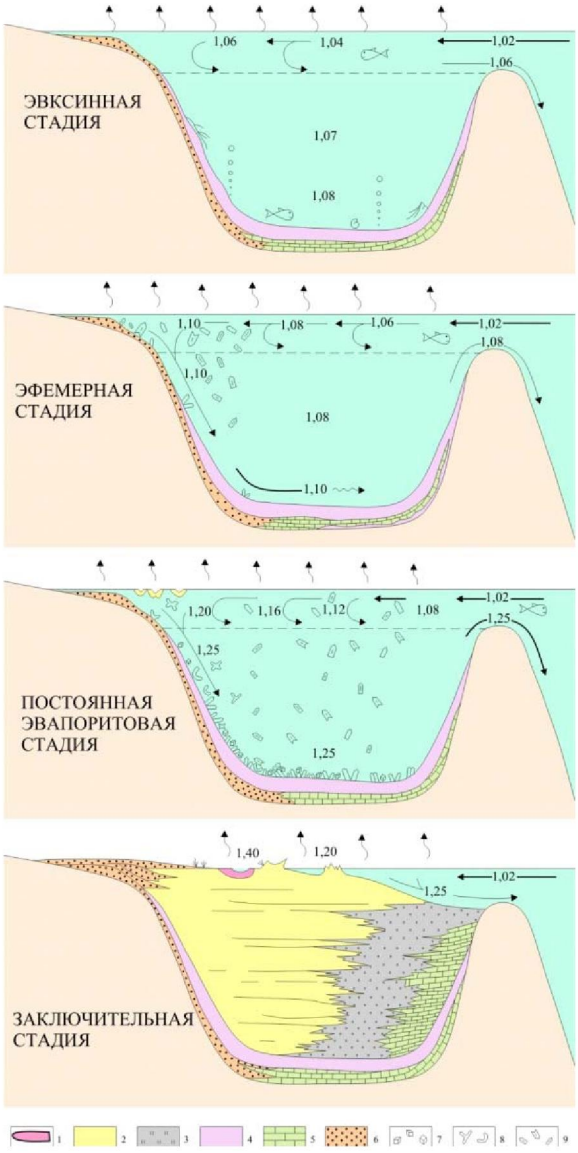

Figure 5 – Model of formation of deep-water evaporite deposits. Four stages of filling the basin are shown [12]

1) Euxine stage: evaporation exceeds atmospheric precipitation + precipitation; stagnation at a depth below the threshold; bottom waters are depleted in oxygen; benthos anaerobic; nekton is normally marine; sapropelfacies. Ephemeral stage: constant stagnation at the bottom; salts that precipitate in surface waters dissolve at depth; the fauna is rare or absent. Permanent evaporitic stage: evaporation exceeds atmospheric precipitation + precipitation; bottom brine is saturated with halite; halite and gypsum, formed in surface waters, are preserved at depth; bottom brine is replaced by salts. Final stage: evaporation exceeds atmospheric precipitation + precipitation; the pool is filled with salts; oxidizing conditions on the surface, salt ponds, eolian sediments and fading of salt crusts; potassium salts are forming. 1 - potassium salts; 2 - halite;, 3 - gypsum, anhydrite; 4 - euxine precipitation; 5 - dolomitized carbonates; 6 - sandstones; 7 - cubic halite; 8 - funnel-shaped halite; 9 - gypsum. The numbers in the figure indica-te the density in g/cm^3.

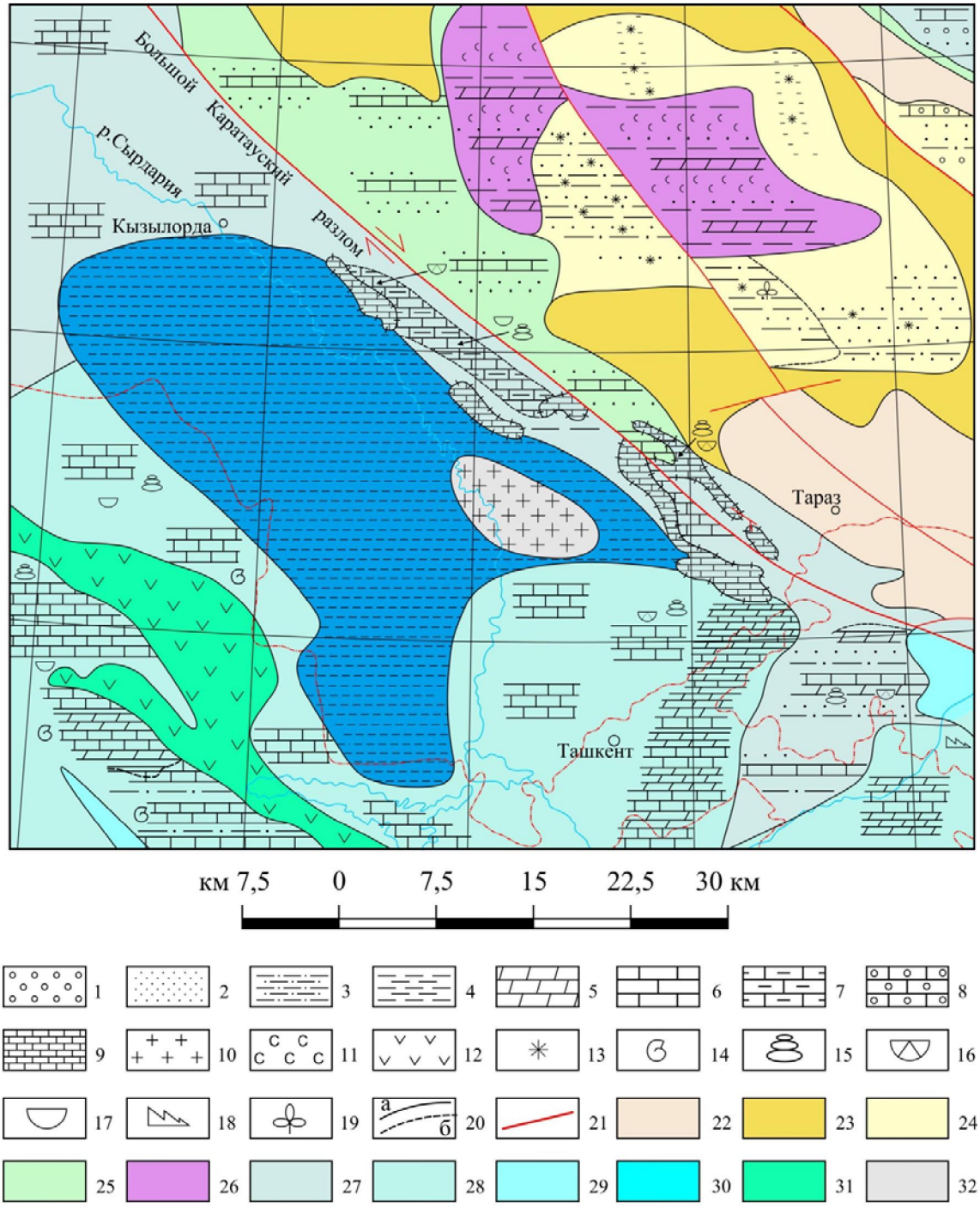

Figure 6 – Lithological-paleogeographic map of the Syrdarya sedimentary basin for the Visean-Serpukhovian time.

Lithological types of rocks: 1 - conglomerates, 2 - sedimentary breccias, 3 - sand and gravel deposits with pebbles, 4 - sand, sandstones, 5 - silts, siltstones, 6-argillites, clays, 7 - phtanites (black siliceous rocks), 8 jasper, siliceous rocks, 9 - dolomites, 10 - dolomitic limestones, 11- limestones, 12 - coquinas, 13 - clay limestones, marls, 14 - ooliticlimestones, 15 - brecciated limestones, 16 - carbonate constructions, 17 - gypsum, anhydrite, 18 - rock salts, 19 - lava and tuffs of calc-alkaline composition.

Organic residues: 20 - gastropods, 21 - bryozoans, 22 - conodonts, skolecodonts, 23 - foraminiferas, 24 - brachiopods, 25 - trilobites, 26 - hyolites, 27 - terrestrial flora (without specification). 28 - The main Karatau fault.

Geological boundaries: 29 - paleogeographic situation; 30 - facies complexes. 31 - underwater alluvial fans. Paleogeographic conditions: 32 - lowland lacustrine-alluvial plains, 33 - inland shelf with hindered water exchange (lagoons with increased salinity), 34 - inland shelf with free water exchange, 35 - barrier reef of edge of carbonate platform, 36 - slope of carbonate platform, 37 - shelf external, 38 - deep-water depressions of the outer shelf, 39 - deep-sea salt basin of the outer shelf, 40 - continental slope, foot, 41- contrast relief of young island arcs.

The characteristic feature of deep-water evaporit is their thin lamination of millimetric or centimetric scale caused by alternation of a halite and anhydrite, or evaporit and carbonates.

We allocates four stages of adjournment of deep-water evaporit on the basis of model of the pool filled with a brine in which there is a continuous inflow of ocean water (figure 5) [12].

- Euxinic stage: evaporation exceeds the atmospheric precipitation + a deposition; stagnation at a depth below a threshold; benthonic waters are poor of oxygen; the benthos is anaerobic, necton is normal, sea; sapropelicfacies.
- Ephemeral stage: continuous stagnation at the bottom; the salts which are settled in the surface waters are dissolved at the depth; the fauna is rare or is absent.
- Constant evaporit stage: evaporation exceeds an atmospheric precipitation + a deposition; the ground brine is sated with a halite; the halite and plaster which are formed in the surface waters are kept at the depth; the ground brine is replaced with salts.
- Closing stage: evaporation exceeds an atmospheric precipitation + a deposition; the pool is filled with salts; on a surface oxidizing conditions, the hydrochloric ponds, aeolian settlings and vytsveta of the hydrochloric crusts, potassium salts are formed.

Summarizing the above it is possible to assume that in a late famen on the place of the modern Syrdrya settling basin the border sea with the developing large carbonaceous platform was situated. The climate was warm, tropical.On the average to the famena near the modern all Southern Kazakhstan there was a transgression of the sea [1-5]. On the region of the shelf the reef complex which is studied in cuts of Big Karatau in detail, presented by silt hills of waltsorr type, the base of which is put by thin crinoids, sponges, and to a minor extent branching pearlweed was created, and the free space between them is filled with a sea needle spathic calcite. There was an accumulationof turbidites and thin lamination madstones of the basal-zhanakurgan B-series of the lateDevonianto the West and the southwest from outside the carbonaceous platform within the central part of the modern Syrdarya settling basin into the deep-water hollows of the border sea.

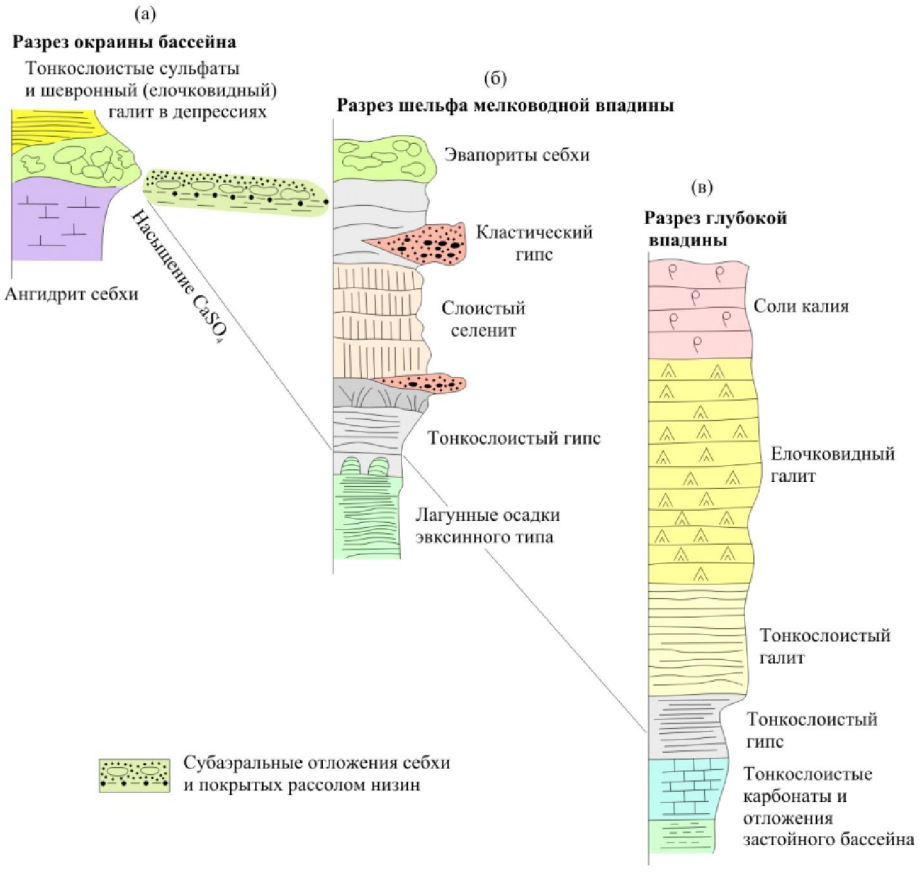

Figure 7 – Hypothetical sections (extra-scale) of evaporite complexes for various parts of evaporite basins [13]

From the West this hollow was limited by the Southern-Tien Shan volcanic arch. Therefore the pool of a sedimentation of the central part of the Syrdarya basin represented the reservoir which was settling down between the region of the carbonaceous platform and an island arch. In its middle deep decrease – the Aryss-Bayrkum deflection remote from sources of demolition of terrigenous material in which in late-famen time the conditions favorable for a salt deposition were formed. It was the classical halogenic basin which description of typical model is given above and illustrated in the figure 6. The standard section of saliferous thickness of the deep-water basin is given in the figure 7 in which its difference from cuts of a shelf zone and the borderof the basin is shown [14].

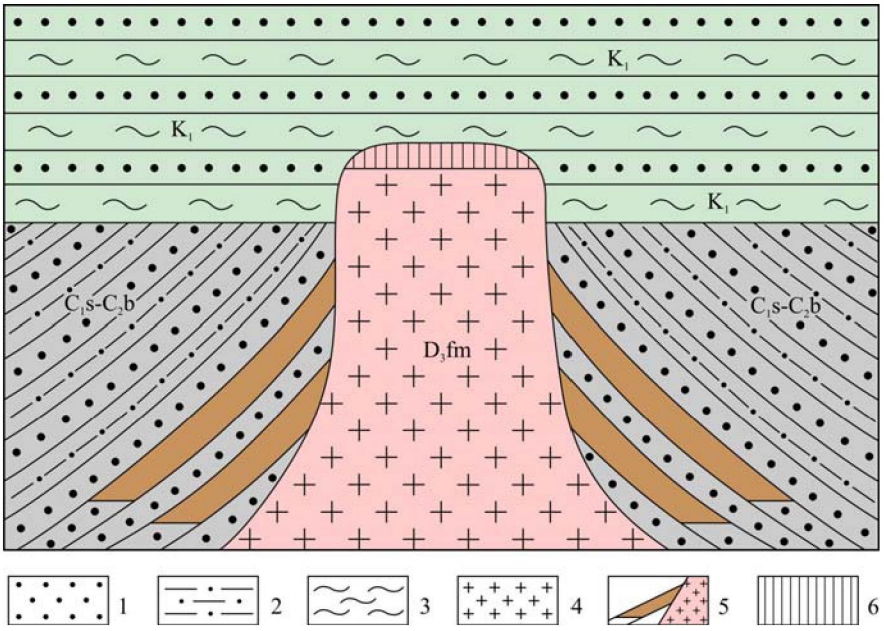

Figure 8 – Probable model for the location of the expected hydrocarbon deposits associated with the salt-dome structures of the Arys-Bayyrkum deflection.

Lithological types of rocks: 1 - sandstones and gravelites. 2 - siltstones, 3 - clays and argillites, 4 - salt (halite). 6 - the expectedhydrocarbon deposits, 6 - caprock.

Upper Paleozoic thicknesses of the region were deformed as a result of manifestation the of the Late Hercynian tectonic processes which led to a contortion and an orogenesis. In the Jurassic time the fissile tectonic movements brought to the extruding of salts into overlying terrigenous deposits and to the formation of the hydrochloric domes. In literature there are five allocated genetic types of the hydrochloric domes [15]. For the Syrdarya settling basin the formation of these structures 2 types is predicted: batogalit type buried diapirs with depth more than 3000 m. On their steep slopes multisheeted deposits of naphtha and gas with steep almost subvertical adhering to a slope of salt (figure 8) are always formed. It is possible to give fields as examples Kenkiyak and Kulsara where along steep slopes 4-7 deposits of hydrocarbons are revealed [16]. Such structures well beat off at combination of detailed anomalies of a gravimetry with seismicity of MOGT 2D and 3D. For this purpose like the fissile or buried diapirs the gravimetric minimum represents a funnel of big amplitude.

Thus, these structures can be considered as perspective on identification of oil and gas fields.

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СЫРДӘРИЯ ШӨГІНДІ АЛАБЫНЫҢ КЕШ ДЕВОННЫҢ ТҰЗАЙДАҒЫШ ҚАБАТТАРЫНЫҢ ФАЦИАЛ-ПАЛЕОГЕОГРАФИЯЛЫҚ ЖИНАЛУ ЖАҒДАЙЛАРЫ

Аннотация. Аймақта Пенсильваниянің (башкир қабаты) басына шейін жетілдірілген ірі карбонатты платформа девон дәуірінің (фамен қабаты) соңында қалыптаса бастады. Бұл жерде осы құрылымға тән барлық стандартты фациалық белдеулер бөлінеді: тереңсулы алапты ойыс, карбонаттық платформаның баурайы, риф және/немесе органогендік құрылыстармен жиектелген платформа шеті, карбонатты рампа, платформаның ішкі аймағы (қайраң лагуна, көтерілу аймағы, тұзтудыру бассейн және көне карст аймақтардағы континенттік карбонат қалыптасу аймағы). Кеш девон кезінде платформадан тыс, сыртқы жер бедері шегінде теригендік материалды ендіруден оқшауланған тереңсулы ойыста, 1757–4004 метр аралығында Арыс № 1-Г ұңғымамен ашылған тұзайдағыш қабаттың қалыптасуы болған. Төменгі жағында теригендік және карбонаттық жыныстарының қабатшалары кездеседі. Тұз етегі сейсмикалық барлау және ҰГЗ деректері бойынша болжамды 4700–4800 м тереңдігінде орналасады. Арыс гравиметриялық аномалиясы биіктігі 3 км кем емес диапирлік күмбезді білдіреді. Геофизикалық зерттеулер тұзайдағыш қабат Сырдәрия шөгінді алабының Арыскүм және Байырқүм майысулардың бойында зор дамуда екенін көрсетті. Тұздармен жиылған, болжамды диапирлік құрылымдардың бүтін қатары табылды. Сырдәрия шөгінді алыбы үшін 2-ші типті құрылымдардың қалыптасуы болжамдалады: батогалит типті тереңдігі 3000 м-ден астам көмілген диапирлер. Бұлардың тік біткейлерінде тұздың баурайына субвертикалды жанасуына жуық көпқабатты мұнай мен газдың кендері қалыптасуы мүмкін. Тік баурайларының бойында көмірсутек кендері табылған сияқты, Кенқияқ пен Құлсары кен орындары үлгі болып табылады. Осылайша, берілген құрылымдар мұнай мен газ кендерін табуға келешегі зор ретінде қарастырылуы мүмкін.

Түйін сөздер: Сырдәрия ША, карбон, литология, палеогеография, грабен, тұз, мұнай, газ.

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ФАЦИАЛЬНО-ПАЛЕОГЕОГРАФИЧЕСКИЕ УСЛОВИЯ НАКОПЛЕНИЯ СОЛЕНОСНЫХ ТОЛЩ ПОЗДНЕГО ДЕВОНА СЫРДАРИИНСКОГО ОСАДОЧНОГО БАССЕЙНА

Аннотация. В конце девонского периода (фаменский ярус) в регионе начала формироваться крупная карбонатная платформа, которая развивалась вплоть до начала пенсильвания (башкирский ярус). Здесь выделяются все стандартные фациальные пояса, характерные для данных структур: глубоководная бассейновая впадина, склон карбонатной платформы, обрамленная рифом и/или органогенными постройками окраина платформы, карбонатная рампа, внутренняя зона платформы (шельфовая лагуна, приливная зона, солеродный бассейн и зона континентального карбонатообразования в древних карстовых зонах). За пределами платформы, в пределах внешнего шельфа в глубоководной впадине, изолированной от привноса терригенного материала, в позднефаменское время происходило формирование соленосной толщи, которая была вскрыта скважиной Арыс № 1-Г на глубине от 1757 до 4004 м.В нижней части встречаются прослои терригенных и карбонатных пород. Подошва соли по данным сейсморазведки и ГИС предположительно располагается на глубине 4700–4800 м. Гравиметрическая аномалия Арыс представляет собой диапировый купол высотой не менее 3 км. Геофизические исследования показали, что соленосная толща имеет широкое развитие в пределах Арыскумского и Байыркумского прогибов Сырдариинского осадочного бассейна. Выявлен целый ряд предположительно диапировых структур, сложенных солями. Для Сырдариинского осадочного бассейна прогнозируется формирование структур 2 типа: погребенные диапиры с глубиной более 3000 м типа батогалит. На их крутых склонах могут формироваться многопластовые залежи нефти и газа с крутым почти субвертикальным прилеганием к склону соли. Примерами являются месторождения Кенкияк и Кулсары, где вдоль крутых склонов выявлены залежи углеводородов. Таким образом, данные структуры могут рассматриваться как перспективные на выявление залежей нефти и газа.

Ключевые слова: Сырдариинский ОБ, карбон, литология, палеогеография, грабен, соль, нефть, газ.