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Prospects of oil and gas potential of the South Torgai sedimentary basin

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ABSTRACT

One of the main directions for assessing the prospects of oil production is the study of oils. In this regard, modern geochemical studies are widely used in forecasting the oil and gas potential of the subsurface, occupying an important role in the question of the origin and source of hydrocarbons. The study is aimed at a comprehensive analysis of the geochemical characteristics of the South Torgai sedimentary basin in order to identify and assess the prospects for oil and gas potential. Comparing the composition of oils from different deposits makes it possible to determine the oil source strata, zones of oil formation and oil accumulation. The compounds in oils that are most or least susceptible to changes under the influence of factors such as water leaching, biodegradation and thermal transformation are subject to comparison. The relative content of individual classes of compounds in the oils of the Aryskum trough, the geological characteristics of oil samples and the distribution of normal alkanes are presented. In this work, a comparative analysis of previously conducted geochemical studies was carried out to determine the composition and genesis of oils in the Aryskum trough. Biomarkers in oils, which make it possible to restore the genetic properties of oils and determine the conditions of sedimentation of oil-generating organic substances, indicate the presence of suboxidation conditions, redox potential and predominantly oxidative environment in the process of sedimentation of organic substances. The results obtained are important for understanding the processes of oil formation and generation, as well as for further forecasting the oil content of the South Torgai sedimentary basin.

Keywords: oil and gas content, organic matter, oil, biomarker analysis, graben-syncline, gorst-syncline.

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Introduction

One of the main directions for assessing the prospects of oil production is the study of oils. Modern geochemical studies are widely used in predicting the oil and gas potential of the subsurface, occupying an important role in the question of the origin and source of hydrocarbons. Comparing the composition of oils from different deposits makes it possible to determine the oil source strata, zones of oil formation and oil accumulation. The compounds in oils that are most or least susceptible to changes under the influence of factors such as water leaching, biodegradation and thermal transformation are subject to comparison.

Geochemical research methods, which are based on the analysis of the chemical composition and properties of oil and gas, as well as related rocks, play an important role in the study of the origin of oil. It is important to note that the effectiveness of geochemical methods can be significantly increased with their combined use. This allows to get a more complete and accurate solution to the task.

The data on the composition of hydrocarbon biomarkers represented in oils by such compounds as alkanes (n-alkanes, isoprenoids), arenes (naphthalenes, phenanthrenes, etc.) and polycyclic naphthenes (heylantanes, steranes, gopanes) allow us to judge the source of oils, the conditions of accumulation and transformation of the initial organic matter [1]. These biomarkers can provide valuable information about the origin of oil, including the types of organisms that were present during its formation and environmental conditions. They may also indicate specific geological processes that led to the formation of oil. All these data are important for understanding the processes of oil formation and can help in identifying potential oil deposits.

Thus, Botwe Takyi and others in their work, referring to the studies of the authors Alberdi M. [2] and Avbovbo A. [3], subjected saturated substances to gas chromatographic mass spectrometric analysis (GC MS) for the presence of steranes, isoprenoids and n-alkanes, as well as chromatograms of the biomarkers triterpanes and gopanes. The composition of the biomarkers of the studied oils indicates low-oxygen and lowering environmental conditions for the studied samples, which corresponds to the marine delta deposition environment. The study [4] shows that oils are associated with a mixture of terrestrial and marine organic substances with a relatively high content of terrestrial and a lower content of seaweed [4]. In the work of Rabiatu Abubakar et al. [5], gas chromatographic mass spectrometric (GC-MS) and gas chromatographic (GC) analyses were used to characterize biomarkers obtained from organic matter (oil and rock extracts) to determine the source of organic matter, deposition medium and maturity. 16 oil samples and 98 rock samples from 7 wells were examined. The study [5] showed that the distribution of these biomarkers suggests that the Cretaceous period oils were obtained from a mixed source of kerogen (marine and terrestrial) deposited in anoxic or suboxygenic conditions of paleodeposition. The ratios of CPI, Ts/Tm and C29 ββ/(ββ + αα) steranes, based on the ratios of C29 20S/(20S + 20R) steranes, indicate that the studied samples have a relatively low or medium maturity level [5]. In this regard, it is important to note the importance of a set of studies, which suggests that a more detailed understanding of the origin of oil can be obtained using the results of biomarker analysis of oil from all fields in combination with other methods such as carbon isotope analysis or oil fingerprinting.

Experimental part

According to the «Map of prospects for oil and gas potential of Kazakhstan», the South Torgai sedimentary basin belongs to the Eastern oil and gas geological region (Figure 1) and is part of the Turan epigercine plate [6].

The basin is the youngest sedimentary basin in Kazakhstan, it consists of three blocks: the Zhilanshik, Aryskum troughs and the Mynbulak saddle between them (Figure 2). Sandy-argillaceous Mesozoic deposits are one of the main oil and gas bearing complexes in the section, within which the Lower Cretaceous (Aryskum horizon), middle-upper Jurassic and Lower Jurassic complexes are distinguished, in addition to of which the Upper Paleozoic promising oil and gas complex has also been identified [7].

The prospects of pre-Mesozoic formations are based on the presence of manifestations of hydrocarbons from weathered basement rocks up to industrial oil inflows (Kyzylkiya, Karavanchi, Kenlyk).

To date, 52 oil and gas fields and structures have been discovered in the South Torgai basin in total (Figure 2), the depletion of the initial recoverable reserves of some of them is quite high, for example, the depletion of the Kumkol field is 83% [8]. Due to the decrease in the residual recoverable oil reserves of almost all fields, the determination of the origin of oil and the forecast of the direction of hydrocarbon migration are an urgent topic for justifying deep drilling to the Paleozoic.

Despite the fact that significant studies have been conducted in the South Torgai basin using various methods and exploration work continues [[8], [9], [10], [11]], there is no single agreed opinion on the origin of oil.

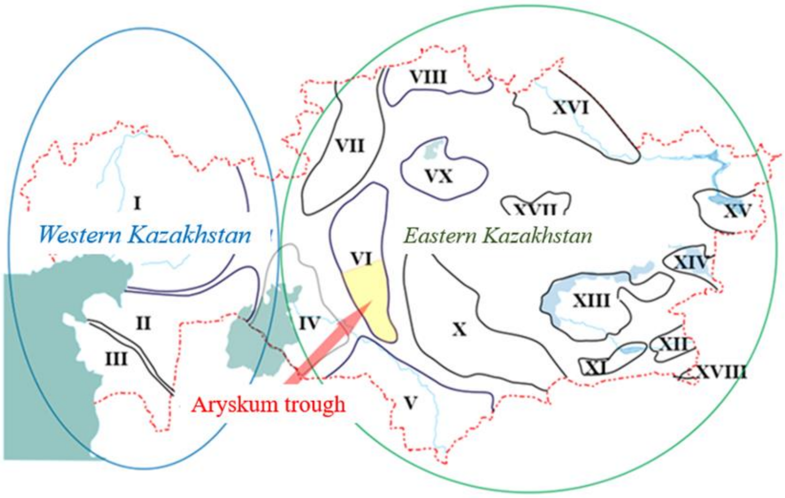

Figure 1 - The scheme of the position of sedimentary basins of Kazakhstan [6]
I – Caspian; II – Ustyurt-Bozashy; III – Mangystau; IV – Aral; V – Syrdarya; VI – South Torgai; VII – North Torgai; VIII – North Kazakhstan; IX – Teniz; X – Shu-Sarysu; XI – West-Ili; XII – East-Ili; XIII – Balkhash; XIV – Alakol; XV – Zaysan; XVI – Irtysh; XVII – Karaganda; XVIII – Tekesko-Karkarinsky

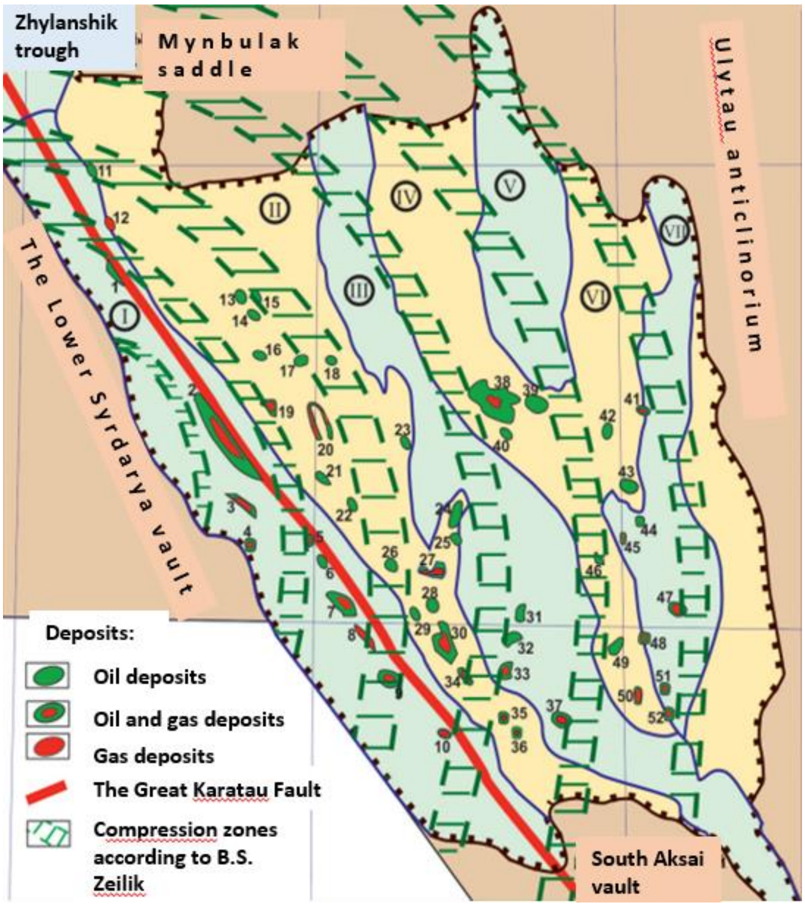

Figure 2 - Placement of oil and gas fields in the South Torgai oil and gas region [9]
Graben-synclines: I – Aryskum, III – Akshabulak, V – Sarylan, VII – Bozingen. Gorst-anticlines: II – Aksai, IV – Aschisai, VI – Tabakbulak. Deposits: 1 – Maybulak, 2 – Aryskum, 3 – Doschan, 4 – South Doschan, 5 – Southeast Doschan, 6 – North Konys, 7 – Konys, 8 – South Konys, 9 – Bektas, 10 – North Ketekazgan, 11 – Zhylankyr, 12 – South Rovnoye,13 – Bukharsai, 14 – South Karabulak, 15 – Karabulak, 16 – Eszhan, 17 – northwest Kyzylkiya, 18 – Kalzhan, 19 – Kenlyk, 20 – Kyzylkiya, 21 – Aktau, 22 – North Khairkeldy, 23 – Karavanshi, 24 – North Nuraly, 25 – Akshabulak North, 26 – Khairkeld, 27 – Nuraly, 28 – South Khairkeld, 29 – Taur, 30 – Aksai, 31 – East Akshabulak, 32 – Central Akshabulak,33 – Akshabulak, 34 – South Aksai, 35 – West Tuzkol, 36 – Zhanbyrshy, 37 – Tuzkol, 38 – Kumkol, 39 – East Kumkol, 40 – South Kumkol, 41 – Karakol, 42 – Tabakbulak, 43 – Maikyz, 44 – Sorkol, 45 – Kainar, 46 – Aschisai, 47 – Sarybulak, 48 – South Sarybulak, 49 – Blinovskoye, 50 – Arysskoye, 51 – North Priozernoye, 52 – South Arysskoye

The separation and identification of the alkane composition was carried out by gas-liquid chromatography on gas-liquid chromatographs «Chromatograph» (Model 3700) and Perkin-Elmer Sigma 2B using a flame ionization detector, helium was used as the carrier gas.In order to determine the genetic relationship between oils and the characteristics of their oil source rock, Seithaziev E. Sh. et al. [12] conducted a biomarker analysis on 39 oil samples on an Agilent 7890B chromatography-mass spectrometer in SIM mode.

The geochemical studies of oils carried out by different authors [[13], [14]] were carried out with an insufficient number of samples and less reliable methods. In this regard, it is important to combine and compare existing previously conducted studies and the results of their analyses. This will allow you to see the big picture, identify possible patterns and trends, and identify possible gaps in data or methodology. This approach can lead to a more accurate interpretation of the data, improved research methodology and, ultimately, a deeper understanding of the origin of oil.

Results and Discussion

In general, the relative content of individual classes of compounds in the oils of the Aryskum trough is presented in Table 1. Thus, the studied oils are represented by such compounds as alkanes (n-alkanes, isoprenoids), polycyclic naphthenes (heylantanes, steranes, gopanes) and arenes (naphthalenes, phenanthrenes, etc.).

Normal alkanes, representing one of the main classes of hydrocarbons, are one of the most common classes of biogenic organic compounds in oil (Figure 3) [[16], [17]], the content of which among the identified compounds in the oils of the Bosingen and Akshabulak graben-syncline is 92-94% and will increase in the oils of the Aksai mountain anticline to 98% (Figure 4) [15].

Source hydrocarbon rocks are deposited in different conditions (marine, lacustrine, deltaic), in which certain microorganisms and biomass exist [13], the comparison of which makes it possible to decipher the genetic properties of oils. Biomarkers in oil retain information about these source organisms, and their analysis is used to determine the conditions of sedimentation of source rocks [18].

It is known that the ratio of pristane/phytane increases from oils formed by marine sapropel organic matter to oils generated by mixed and continental humus organic matter. But first of all, the ratio of pristane/phytane depends on the redox conditions in the sedimentation basin, given in Table 2 [15].

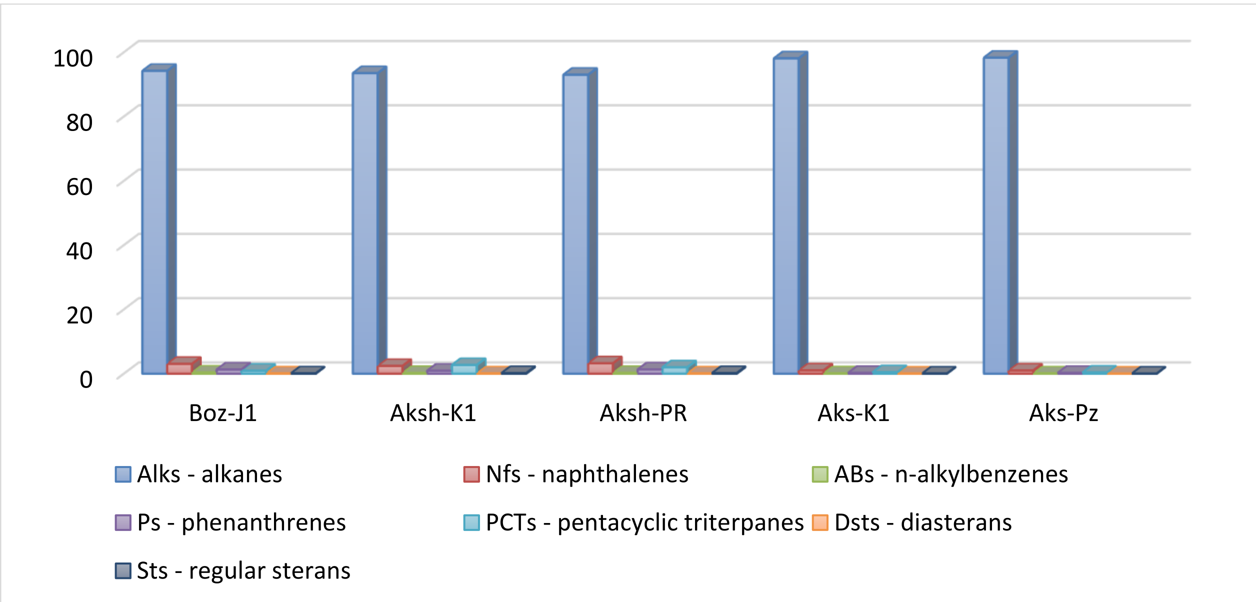

Figure 3 – The relative content of certain classes of compounds in the oils of the Aryskum trough

Table 1 - The relative content of certain classes of compounds in the oils of the Aryskum trough [15]

Oil Index	Boz-J1	Aksh-K1	Aksh -PR	Aks-K1	Aks-Pz
Group of compounds *	***Content, % relative***				
Alks (m/z 57)	94.2	93.5	93.0	98.1	98.3
ABs (m/z 92)	0.35	0.22	0.24	0.11	0.09
Nfs (m/z 128 +142+156+170)	3.05	2.40	3.24	1.01	0.97
Ps (m/z 178 +192+206+220)	1.27	0.91	1.29	0.23	0.24
PCTs (m/z 191)	0.93	2.70	1.98	0.44	0.35
Dsts (m/z 217)	0.08	0.09	0.09	0.04	0.03
Sts (m/z 217)	0.09	0.18	0.17	0.04	0.03

** Alks – alkanes, ABs – n-alkylbenzenes, Nfs – naphthalenes, Ps – phenanthrenes, PCTs – pentacyclic triterpanes, Dsts – diasterans, Sts – regular steranes.*

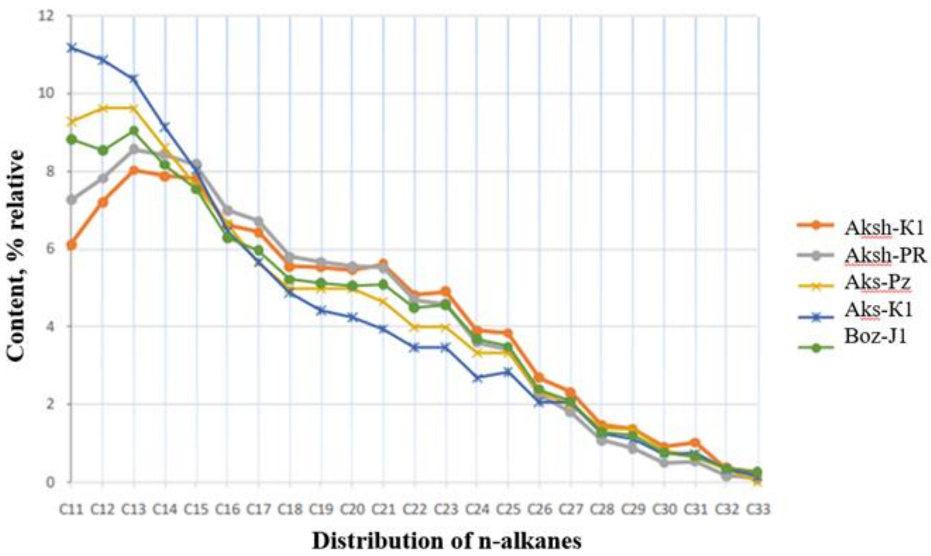

Figure 4 – Distribution of normal alkanes [13]

Table 2 - Dependence of the pristan /phytane ratio on redox conditions

The pristan /phytane ratio	Redox conditions
Pr/Ph <1.0	Sharply reducing sedimentation environment
Pr/Ph 1.0 – 1.5	Reducing environment
Pr/Ph 1.5 – 2.0	Weakly reducing environment or sub-oxidative sedimentation conditions
Pr/Ph >2.0	Oxidizing conditions

According to biomarker analysis [12], to determine the conditions of sedimentation of organic matter, a graph of the dependence of the ratio of pristan to phytane on the ratio of C29 sterane/ C30 gopan (Figure 5) and a trigonogram of terpane was used, according to the results of which it was found that sedimentation of organic matter of the studied oils occurred in a predominantly oxidizing environment.

In the study [19], the same signals indicated in the previous work were used to diagnose saturated hydrocarbon fractions [12], and for aromatic fractions, the signals m/z 178, 184, 192 were selected to detect phenanthrenes, dibenzotifenes and methylphenanthrenes. This analysis was performed to characterize the oil source rocks of the studied oils: sedimentation conditions, lithology, thermal maturity and age of the oil source rocks.

According to the graph of the dependence of the ratio of pristan to phytane on the ratio of C29 sterane/ C30 gopan, which determines the conditions of sedimentation, the organic matter of the oils was formed in a lacustrine and oxidizing environment (Figure 6).

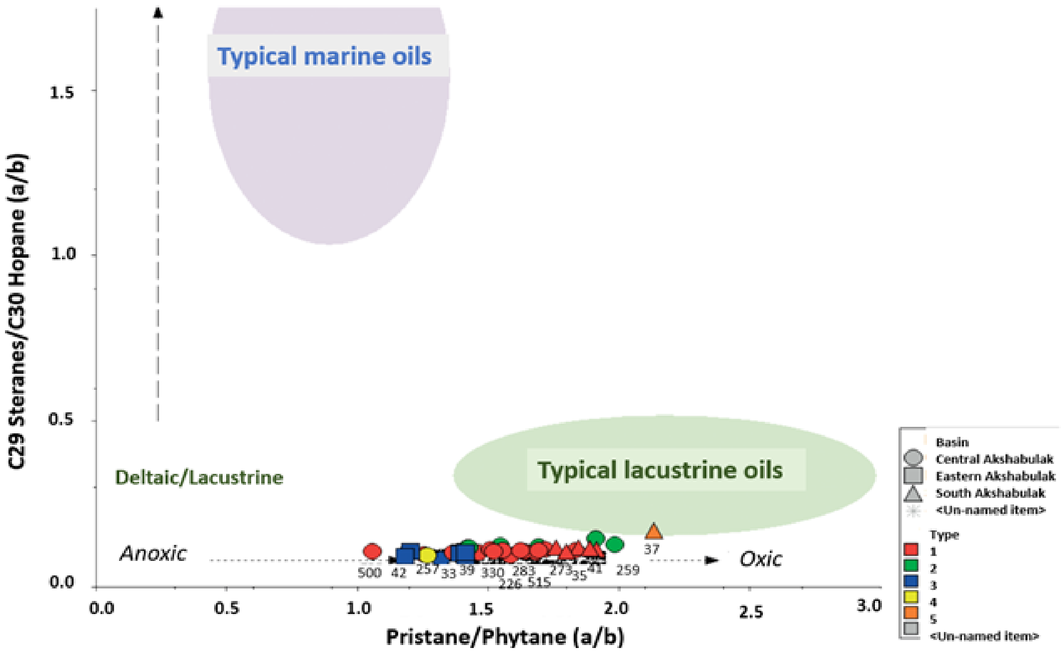

Figure 5 – Graph of the dependence of pristan/phytane (Pr/Ph) on sterane C29/ gopan C30 [12]

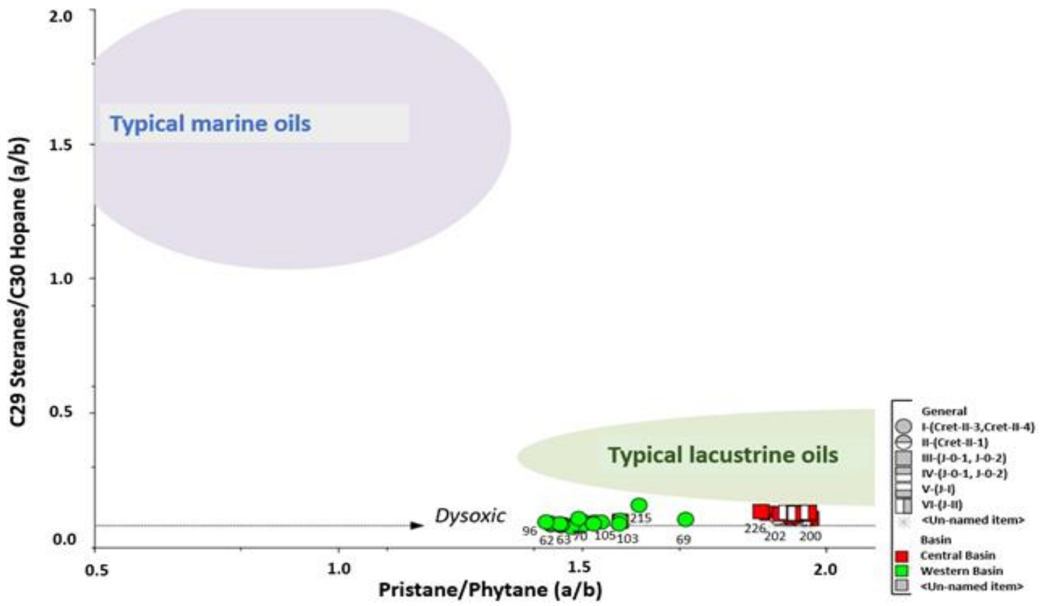

Figure 6 – Comparison of the ratio of pristane/phytane (Pr/Ph) with the ratio of C29 sterane / C30 gopan (according to Seithaziev E.Sh. et al.) [12]

Table 3 - Geological characteristics of oil samples

Oil Index	**Boz-J1**	**Aksh-K1**	**Aksh -PR**	**Aks-K1**	**Aks-Pz**
Structural element	Bosingen graben-syncline	Akshabulak graben-syncline		Aksai graben-syncline	
Age	J1-2 kr, J1-2ds	K1nc1ar	PR	K1nc1ar	Pz
Deposit	Sorkol	Akshabulak	Akshabulak	Kenlyk	Kenlyk
Pristane/phytane	3.1	1.6	1.8	2.6	2.7

According to the data in Table 3, it is known that in the oils of the Aryskum deflection, the value of the pristane /phytane ratio is higher than 1 and varies slightly within individual structures. In the Akshabulak graben-syncline, the values range from 1,6 to 1,8, while in the Aksai gorst-anticline from 2,7 to 2,6, which may indicate the formation of the initial organic matter that produced the oils of the Akshabulak oils under suboxidizing conditions, and the Aksai gorst-anticline under oxidizing conditions. The relatively increased value of pristan/phytane (3,1) in oil from the Lower Jurassic of the Bosingen graben-syncline indicates a higher redox potential [20].

Lithological studies of Jurassic sediments [11] indicate a lacustrine environment for the Aryskum graben-syncline. The lithology of source rocks also affects the composition of biomarkers in oil during its formation. No biomarker parameter is able to accurately identify the type of lithology of source rocks, however, it allows us to distinguish between clay or carbonate source rocks. Low C29/C30 gopan (29H/30H), low values of the homogopan index on the mass fragments of terpanes (m/z 191) of all studied oils [11] indicate the clay content of their source rocks [19].

Conclusions

In this work, a comparative analysis of previously conducted geochemical studies was carried out to determine the composition and genesis of oils in the Aryskum trough. Studies have shown that the oils of this region are represented by the main classes of hydrocarbons, such as alkanes, polycyclic naphthenes and arenes. The content of normal alkanes in the studied oils ranged from 92% to 98%.

According to the analysis, it is known that biomarkers in oils, which allow to restore the genetic properties of oils and determine the conditions of sedimentation of oil-generating organic substances, indicate the presence of suboxidation conditions, redox potential and predominantly oxidative environment in the process of sedimentation of organic substances. The results obtained are important for understanding the processes of oil formation and generation, as well as for further forecasting the oil content of the South Torgai sedimentary basin.

Conflicts of interest. On behalf of all authors, the corresponding author states that there is no conflict of interest.

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Оңтүстік Торғай шөгінді алабының мұнайгаздылығының болашағы

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ТҮЙІНДЕМЕ
Мұнайлылықты бағалаудың негізгі бағыттарының бірі мұнайды зерттеу болып табылады. Осыған байланысты қазіргі геохимиялық зерттеулер көмірсутектердің шығу тегі мен қайнар көзі туралы мәселеде маңызды рөл атқара отырып, жер қойнауының мұнайгаздылығын болжауда кеңінен қолданылады. Зерттеу мұнайгаздылықтың келешегін анықтау және бағалау мақсатында Оңтүстік Торғай шөгінді алабының геохимиялық сипаттамаларын кешенді талдауға бағытталған. Әртүрлі кен орындарының мұнайларының құрамын салыстыру мұнай көздерінің қабаттарын, мұнай түзілу аймақтарын және мұнайдың жинақталуын анықтауға мүмкіндік береді. Салыстыруға судың шайылуы, биодеградация және термиялық түрлендіру сияқты факторлардың әсерінен өзгерістерге ең көп немесе ең аз ұшырайтын мұнайдағы қосылыстар жатады. Бұл жұмыста Арысқұм иілісі мұнайындағы қосылыстардың жекелеген кластарының салыстырмалы құрамы, мұнай үлгілерінің геологиялық сипаттамасы және қалыпты алкандардың таралуы ұсынылған. Және Арысқұмдағы мұнайдың құрамы мен генезисін анықтау үшін бұрын жүргізілген геохимиялық зерттеулерге салыстырмалы талдау жүргізілді. Мұнайдың генетикалық сәйкестігін қалпына келтіруге және мұнай түзетін органикалық заттардың шөгу жағдайларын анықтауға мүмкіндік беретін майлардағы биомаркерлер органикалық заттардың тұндыру процесінде субтотықтырғыш жағдайлардың, тотығу-тотықсыздану потенциалының және басым тотықтырғыш ортаның болатынын көрсетеді. Алынған нәтижелер мұнайды қалыптастыру және өндіру процестерін түсіну үшін, сондай-ақ Оңтүстік Торғай шөгінді алабының мұнайлылығын одан әрі болжау үшін маңызды.

Түйін сөздер: мұнайгаздылық, органикалық заттар, мұнай, биомаркерлік талдау, грабен-синклиналь, горст-синклиналь.

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Перспективы нефтегазоносности Южно-Торгайского осадочного бассейна

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АННОТАЦИЯ

Одним из главных направлений оценки перспектив нефтеносности является изучение нефтей. В этой связи широкое практическое применение при прогнозировании нефтегазоносности недр находят современные геохимические исследования, занимая важную роль в вопросе о происхождении и об источнике углеводородов. Исследование направлено на комплексный анализ геохимических характеристик Южно-Торгайского осадочного бассейна с целью выявления и оценки перспектив нефтегазоносности. Сопоставление состава нефтей из различных залежей дает возможность определить нефтематеринские толщи, зоны нефтеобразования и нефтенакопления. Сравнению подлежат соединения в нефтях, которые наиболее или наименее подвержены изменениям под влиянием таких факторов, как вымывание водой, биодеградация и термическое преобразование. Представлено относительное содержание отдельных классов соединений в нефтях Арыскумского прогиба, геологическая характеристика образцов нефтей и распределение нормальных алканов. В данной работе был проведен сравнительный анализ ранее проведенных геохимических исследований для определения состава и генезиса нефтей в Арыскумском прогибе. Биомаркеры в нефтях, позволяющие восстановить генетические принадлежности нефтей и определить условия осадконакопления нефтегенерирующих органических веществ, свидетельствуют о наличии субокислительных условий, окислительно-восстановительном потенциале и преимущественно окислительной среде в процессе осадконакопления органических веществ. Полученные результаты имеют важное значение для понимания процессов формирования и генерации нефти, а также для дальнейшего прогнозирования нефтеносности Южно-Торгайского осадочного бассейна.

Ключевые слова: нефтегазоносность, органическое вещество, нефть, биомаркерный анализ, грабен-синклиналь, горст-синклиналь.

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References

[1] Peters KE, Walters CC, Moldowan JM. The biomarker guide I. Biomarkers and isotopes in the environment. 2nd ed. Cambridge: Cambridge University Press. 2005; 1:474.

[2] Alberdi M, Lopez L. Biomarkers 18(H)-oleanane: A geochemical tool to assess Venezuelan petroleum systems. Journal of South American Earth Sciences. 2000; 13(8):751–759. https://doi.org/10.1016/S0895-9811(00)00055-9

[3] Avbovbo AA. Tertiary Litho-stratigraphy of Niger Delta. American Association of Petroleum Geologists Bulletin. 1978; 62:295-300.

[4] Botwe Takyi, Selegha Abrakassa, Udom GJ, Koffi Eugene Kouadio, Frederick k. Bempong & Eric Brantson Thompson. Source of organic matter and paleoenvironment of deposition of crude oils from the Niger Delta Basin. Petroleum science and Technology. 2022; 40(12):1479-1491. https://doi.org/10.1080/10916466.2021.2024229

[5] Rabiatu Abubakar, Kofi Adomako-Ansah, Solomon Adjei Marfo, Judith Ampomah Owusu & Clifford Fenyi. Origin and depositional environment of oils and sediments in the Cretaceous Deep-Water Tano Basin, Ghana: Constraints from biomarkers. Petroleum science and Technology. 2022. https://doi.org/10.1080/10916466.2022.2143804

[6] Fishman IL. Geodinamicheskiye modeli Aralo-Kaspiyskogo regiona [Geodynamic models of the Aral-Caspian region]. Almaty. 2016, 156. (in Russ.).

[7] Ozdoyev SM, Madisheva RK, Seylkhanov TM, Portnov VS, Isayev I. O neftegazonosnosti kory vyvetrivaniya skladchatogo fundamenta Aryskumskogo progiba Yuzhno-Torgayskogo basseyna [On the oil and gas content of the weathering crust of the folded basement of the Aryskum trough of the South Torgai basin]. Neft i gaz = Oil and gas. 2020; 1(115):17-32. (in Russ.).

[8] Aydarbekov KD. Istoriya otkrytiya i osvoyeniya mestorozhdeniya Kumkol [The history of the discovery and development of the Kumkol deposit]. Neft i gaz = Oil and gas. 2020; 3-4:(117-118, 180-186). (in Russ.).

[9] Turkov OS. K voprosu o glubinnoy nefti Yuzhno-Torgayskogo basseyna [On the issue of deep oil in the South Torgai basin]. Neft i gaz = Oil and gas. 2020; 5(119):70-83. (in Russ.).

[10] Zholtayev G, Zhylkaydarov SE. Otsenka prognoznykh resursov uglevodorodnogo syria. Respubliki Kazakhstan v 3-kh knigakh. Kniga II. Tekst otcheta (neft, gaz, kondensat), otchet po Programme 46 [Assessment of the projected hydrocarbon resources of the Republic of Kazakhstan in 3 books. Book II. Text of the report (oil, gas, condensate), Program Report 46]. Almaty. 2003. (in Russ.).

[11] Bolat E. Usloviya formirovaniya i zakonomernosti razmeshcheniya skopleniy nefti i gaza v Yuzhno-Turgayskom basseyne [Conditions of formation and patterns of placement of oil and gas accumulations in the South Turgai basin] Dissertatsiya na soiskaniye uch. st. kand. geologo-mineral. nauk, Rossiyskiy Gosudarstvennyy geologorazvedochnyy universitet imeni Sergo Ordzhonikidze = Dissertation for the degree of Candidate of Geological and Mineral Sciences, Sergo Ordzhonikidze Russian State Geological Exploration University, Moskva. 2020, 1-97. (in Russ.).

[12] Seytkhaziyev Esh, Uteyev RN, Mustafayev MK, Lyu Sh, Sarsenbekov ND, Dosmukhambetov AK. Fingerprinting i biomarkernyy analiz nefti Akshabulakskoy gruppy dlya opredeleniya tipov neftey [Fingerprinting and biomarker analysis of oil of the Akshabulak group to determine the types of oils]. Vestnik neftegazovoy otrasli Kazakhstana = Bulletin of the oil and gas industry of Kazakhstan. 2021; 4(9):93-110. (in Russ.).

[13] Madisheva RK. Issledovaniye geodinamicheskoy obstanovki osadkonakopleniya i formirovaniya neftegazonosnosti doyurskogo kompleksa Aryskumskogo progiba [Investigation of the geodynamic situation of sedimentation and formation of oil and gas potential of the pre-Jurassic complex of the Aryskum trough]. Dissertatsiya na soiskaniye stepeni doktora filosofii, Karagandinskiy tekhnicheskiy universitet = Dissertation for the degree of Doctor of Philosophy, Karaganda Technical University, Karaganda. 2020, 1-68. (in Russ.).

[14] Golyshev SI, Padalko NL, Madisheva RK, Ozdoyev SZh, Portnov VS, Isayev VI. Izotopnyy sostav neftey Aryskumskogo progiba (Yuzhnyy Kazakhstan) [The composition of biomarkers and the origin of oils of the Aryskum trough (South Kazakhstan)]. Izvestiya Tomskogo politekhnicheskogo universiteta, Inzhiniring georesursov = Proceedings of Tomsk Polytechnic University, Georesource engineering. 2020, 80-89. (in Russ.). https://doi.org/10.18799/24131830/2020/3/2533

[15] Madisheva RK, Serebrennikova OV, Isayev VI, Portnov VS, Ozdoyev SM. Sostav biomarkerov i proiskhozhdeniye neftey Aryskumskogo progiba (Yuzhnyy Kazakhstan). [The composition of biomarkers and the origin of oils of the Aryskum trough (South Kazakhstan)]. Izvestiya Tomskogo politekhnicheskogo universiteta, Inzhiniring georesursov = Proceedings of Tomsk Polytechnic University, Georesource engineering, 2020; 331(7):116-130. (in Russ.). https://doi.org/10.18799/24131830/2020/7/2724

[16] Tissot BP, Welte DH. Petroleum formation and occurrence. NewYork: Springer-Verlag. 1984, 699. http://dx.doi.org/10.1007/978-3-642-87813-8

[17] Murillo WA, Horsfield B, Vieth-Hillebrand A. Unraveling petroleum mixtures from the South Viking Graben, North Sea: a study based on δ13C of individual hydrocarbons and molecular data. Organic Geochemistry. 2019; 137:103900. https://doi.org/10.1016/j.orggeochem.2019.103900

[18] Seytkhaziyev Esh, Uteyev RN, Mustafayev MK, Lyu Sh, Sarsenbekov ND, Dosmukhambetov AK, Dzhumabayev TE. Primeneniye biomarkerov i fingerprintinga nefti dlya rasshifrovki geneticheskoy prinadlezhnosti nefti i prognozirovaniya puti migratsii nefti na mestorozhdenii Nuraly [The use of biomarkers and oil fingerprinting to decipher the genetic affiliation of oil and predict the

migration path of oil at the Nuraly field]. Vestnik neftegazovoy otrasli Kazakhstana = Bulletin of the oil and gas industry of Kazakhstan. 2021; 2(7):61-75. (in Russ.). https://doi.org/10.54859/kjogi89490

[19] Seytkhaziyev ESh, Dzhumabayev TE, Latipova AM, Dosmukhambetov AK. Otchet geokhimicheskiye issledovaniya prob nefti mestorozhdeniya Nuraly (v ramkakh proyekta «Pereschet zapasov nefti, gaza, kondensata i poputnykh komponentov mestorozhdeniya Nuraly) [Report on geochemical studies of oil samples from the Nuraly field (within the framework of the project "Recalculation of oil, gas, condensate, and associated components of the Nuraly field)]. Atyrauskiy filial TOO KMG Inzhiniring = Atyrau branch of KMG Engineering LLP. 2021, 1-88. (in Russ.).

[20] Madisheva RK, Portnov VS. O neftegazonosnosti Aryskumskogo progiba Yuzhno-Torgayskogo osadochnogo basseyna [On the oil and gas potential of the Aryskum trough of the South Torgai sedimentary basin]. Neft i gaz = Oil and gas. 2022; 5(131):65-76. (in Russ.). https://doi.org/10.37878/2708-0080/2022-5.04