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*B.H. Hodzhanova, G.Zh. Abdusheva, D.B. Yakupova
M. Utemisov West Kazakhstan University (Uralsk, Kazakhstan)

FEATURES OF GEOGRAPHICAL DISTRIBUTION OF OIL AND GAS FIELDS IN THE WEST KAZAKHSTAN REGION

Abstract. The West Kazakhstan region is rich in oil and gas reserves due to its historical geological development factors. The purpose of the study is to study the geographical distribution of gas and oil fields in the West Kazakhstan region. The article provides locations, location, geological development, geological age, depth of occurrence, occupied territory, reserves and share in the development of the country's economy. The description of about twenty oil and gas fields in the region is given. The largest of them are the Karachaganak and Chinarevskoye fields. In the course of the article, based on the study of factual material, an attempt was made to provide an economic justification for the use of all types of material raw materials for the development of agriculture in the region, taking into account the integrated use of energy and mineral resources, their effectiveness.

Key words: oil, gas, salt, geology, Karachaganak, Chinarev, deposit, hydrocarbon, methane, resource.

Батыс Қазақстан облысы аумағында мұнай және газ кен орындарының географиялық таралу ерекшеліктері

Аннотация. Батыс Қазақстан облысы өзінің тарихи геологиялық даму факторларына байланысты мұнай және газ қорларына бай. Зерттеудің мақсаты Батыс Қазақстан облысы аумағында газ және мұнай кен орындарының географиялық таралуын зерттеу болып табылады. Мақалада Батыс Қазақстан облысы аумағында таралған мұнай және газ кен орындарының орны, орналасу ауданы, геологиялық дамуы, геологиялық жасы, орналасу тереңдіктері, алып жатқан аумағы, қоры қанша және ел экономикасының дамуындағы үлесі келтірілген. Облыс аумағындағы жиырмаға жуық мұнай және газ кен орындарына сипаттама берілді. Олардың ішінде ең ірілері Қарашығанақ және Чинарев кен орындары. Мақала барысында, нақты материалды зерделеу негізінде энергетикалық және минералдық ресурстарды кешенді пайдалануды, олардың тиімділігін ескере отырып, облыстың ел шаруашылығын дамыту үшін материалдық шикізаттың барлық түрлерін пайдалануға экономикалық негіздеме беруге әрекет жасалды.

Түйінді сөздер: мұнай, газ, тұз күмбездері, геология, Қарашығанақ, Чинарев, кен орны, көмірсутек, метан, ресурс.

Особенности географического распределения месторождений нефти и газа на территории Западно-Казахстанской области

Аннотация. Западно-Казахстанская область богата запасами нефти и газа благодаря своим историческим геологическим факторам развития. Целью исследования является изучение географического распределения газовых и нефтяных месторождений на территории Западно-Казахстанской области. В статье приводятся место нахождения, район расположения, геологическое развитие, геологический возраст, глубина залегания, занимаемая территория, запасы и доля в развитии экономики страны. Дано описание около двадцати месторождений нефти и газа на территории области. Наиболее крупными из них являются Карачаганакское и Чинаревское месторождения. В ходе статьи на основе изучения фактического материала была предпринята попытка дать экономическое обоснование использования всех видов материального сырья для развития сельского хозяйства области с учетом комплексного использования энергетических и минеральных ресурсов, их эффективности.

Ключевые слова: нефть, газ, соль, геология, Карачаганак, Чинарев, месторождение, углеводород, метан, ресурс.

Introduction

In the modern world, the dependence of the state economy on the oil industry is quite high. Due to the fact that MPC is the main type of energy raw material, its economic and political significance has increased. The availability of their own oil resources, the possibility of organizing the export of oil and petroleum products, various states achieve significant success in economic and social development. Fluctuations in world oil prices and the situation on the oil market lead to significant changes in the economic policies of both oil-producing countries and countries whose industry is based on oil imports [1].

The distribution and potential of world oil and gas resources are studied in the works [2, 3]. According to estimates and calculations, the world's extracted resources of conventional oil amount to $5350,0 \times 10^8$ tons, recoverable resources of condensed oil – $496,2 \times 10^8$ tons, and recoverable resources of natural gas – $588,4 \times 10^{12}$ m³. The remaining recoverable oil and gas reserves amount to $4,212.6 \times 10^8$ tons, and the increase in oil and gas field reserves amounts to $1,531.7 \times 10^8$ tons. Undifferentiated recoverable oil and gas resources amount to $3,065.5 \times 10^8$ tons [4].

Global oil and gas exploration field is composed of land, shallow water area and deepwater area in terms of landform, at present, a majority of countries define 300-500 m in water depth as lower limit of «deepwater area», for example, China and Brazil define sea area with water depth more than 300 m as deepwater area, the US defines sea area with water depth more than 305 m as deepwater area, France defines sea area with water depth more than 400 m as deepwater area, Mexico,

Australia and the UK define sea area with water depth more than 500 m as deepwater area, «deepwater» given in the paper means deepwater area in terms of oil and gas exploration [5].

Due to the history of geological development of the territory of the West Kazakhstan region, the distribution of oil and gas fields has its own characteristics. Based on the basic principles of geological zoning of oil and gas in the history of geological development, the state of geostructural elements, K.A. Li, S.M. Kamalov, O.N. Marchenko et al. conducted research on oil and gas fields in the West Kazakhstan region.

Materials and methods

The aim of the study is to study the geographical distribution of gas and oil fields in the West Kazakhstan region.

The main principles and methods of research, available geological documentation obtained during exploration and evaluation works, methods of their systematic and structural analysis, as well as the current information and empirical base on the geology and mining industry of Western Kazakhstan were used in the preparation of the article.

Since the beginning of this century, the continuous development of the world economy has resulted in a huge increase in the consumption of fossil fuels. The extensive use of fossil fuels all over the world has brought a series of environmental problems, such as acid rain, air pollution and global warming. These problems are especially serious in developing countries, such as China and India. To mitigate the energy crisis and environmental problems, it is highly important to develop clean and renewable energy sources. In recent years, low carbon

mode has been regarded as a key strategy for economic development in more and more countries. With respect to low carbon development, natural gas enjoys many advantages when compared with other fossil fuels and renewable energies [6]. Such renewable energy sources include the gasfields of Western Kazakhstan such as Auketaishagyl, Port Arthur, Karagai, Gremyachin, Ulyanovskk, Tsyganov, Teplov, Karachaganak, Kamensk, Darinsk, Chinarev gas fields. Deposits located on the right bank of the Urals.

1. Karachaganak oil and gas condensate is located at a distance of 23 km to the north of the city of Aksay, West Kazakhstan region. The field was discovered in 1979. Its area is 30,000 hectares, 1.2 billion tons of oil and condensate, more than 1.35 trillion m³ of gas. A pipeline with a length of 130 kilometers was laid to Russia at the Orenburg oil refinery, and due to the export of gas and condensate, its production began in 1984. In 1997, an agreement (PSA) was signed, which included the joint use of its products, the use of the field and future production, designed for 40 years. The agreement was signed between the joint venture companies with the Republic of Kazakhstan Sedgip (32.5%), British Gas International (32.5%), Texaco (20%), Lukoil (15%) [7].

In 1997, the partner companies held a joint meeting with the former Oil and Gas Commissioner of Kazakhstan to develop the territorial reserves of the Karachaganak field. The final production Sharing Agreement (ROC) defining the Karachaganak field production program until 2038 was signed. After this agreement came into force, about 14 billion was spent on the production and development of the Karachaganak field and the best technology was introduced for the extraction of the most complex reservoir formation in the world.

2. Chinarevskoye oil and gas condensate field-an oil and gas condensate field in the northern part of the Caspian Depression. It is located 40 km northeast of the city of Uralsk. The Chinarevskoye oil and gas condensate field is one of the last major discoveries of the Ural Geological Prospectors. It was discovered in 1991 in layers of carbonate sediments at a depth of 4300-5200 meters. The general partner of the company is Nostrum Oil and Gas Group Limited.

Geologists predict that natural gas reserves will amount to 49 billion m³ and oil reserves amount to 35 million tons.

Zhaiymunai LLP is an independent company engaged in oil and gas production, as well as exploration and development of the Chinarevskoye field on the basis of a contract between the State Investment Committee of the Republic of Kazakhstan and Zhaiymunai LLP for pre-exploration, production and distribution of hydrocarbon products at the Chinarevskoye oil and gas condensate field, signed on October 31, 1997.

Today, the Company is among the large-scale social projects that are of great importance for the region, for five years it supplies gas at a fixed price for a gas turbine power plant with a capacity of 54 kW [7].

3. The Zapadny Teplov field is located 40 kilometers north-east of Uralsk. It borders the Orenburg Region to the north. The Mangalak-Kuibyshev oil pipeline passes through the territory. The Orenburg-Western Border gas pipeline runs from the south. Oil and gas reserves have been determined. The total reserves are 785 million tons [8].

4. The Teplov structure was discovered in 1962-1964 as a result of seismic studies. At the P-1 field at a depth of 4562 m, oil was extracted by drilling. Deep drilling revealed that there is a brachanticlinal layer between the structures of the G-1 and G-2 deposits. The layered core structure was excavated from a depth of 110-1200 m from north to east and from south to west. It is also asymmetrical: the northern slope is flat, while the southern slope is pointed. Two wings (north, north west and south, south east), formed in the Cenozoic and Permian eras, are separated by hills. The northern and Northwestern wings underwent a leaching process, rising to the Lower Triassic.

5. The territory of the Daryinsky deposit Ois located in the Priuralsky district of the Ural region. It occupies an area 25 kilometers southeast of the village of Darinsk. It is located 30 kilometers north-east of the city of Uralsk. The deposit corresponds to the reef structure scheme. The nearest villages to the territory are: Darinsk, Furmanov, Chuvashinsk, Chapov, and Trekin.

The shape of Darinsk is domed. The isogyps size is 5400 m 4x3 kilometers, with an amplitude of 360 m. The shape of the Southern The southern Chagan is also shaped like a dome. Salt piles consist of a mirror row of salts in a structure of 200-400 m. The salt ranges are 7-21 x 3-4 kilometers in size. The structure of the salt series originated in the Triassic period.

The Daryinskoye field was discovered in 1989. Oil reserves are 3452 million tons [8].

6. The Tsyganovskoye field is part of the Baiterek district of the West Kazakhstan region. The district is located 30 kilometers from the village of Peremetnoye, in the south-eastern part of the village of Tsyganov, and 60 kilometers from the city of Uralsk.

The structure is distinguished by artin mounds. The isogypsum size is 300 m. The size of the layers is 13-1.8 km, and the amplitude is 170 m. The initial layers are located at a depth of 2900 m.

The layer under the salt of sawdust is distinguished by salt anticlinal and local dome-shaped salts. The structures of the Western and central parts of the structure resist Tokarev tectonic tremors and rise up with an amplitude of 200-400 m.

Lower artinian salt structures correspond to an increase in the surface salt layer of the Mesozoic era. Gas reserves amount to 1 billion m³, oil reserves From 1-266-266 million m³, from 2-511 million m³, condensate – C_1 and C_2 to 15 million tons [8].

7. The Ulyanovsk territory is located in the Baiterek District of the West Kazakhstan region. The district center is located 20 kilometers from the village of Peremetny and 60 kilometers to the eastern part of Uralsk. The field was discovered in 1976. The Ural-Saratov railway passes through the territory.

Gas reserves were estimated at 1427 million m³ in category C_1 and 831 million m³ in category C_2 . Condensate $C_1 + C_2$ amounted to 92 million tons.

8. The territory of Kamensk is part of the Taskalinsky district of the West Kazakhstan Region. The Orenburg-Western Border railway and gas pipeline run from the south, and the Mangyshlak-Kuibyshev oil and gas pipeline runs from the east. It is located 80 kilometers northeast of Uralsk.

According to the geological district, the Kamensk structure is located within the oil/gas layer region of the North-Caspian

region, which tectonically corresponds to the northern rim region of the Caspian lowland [8].

According to the MEMR data, as of 01.01.1997, the forecast resources of the Kamensk structure of category C_3 are estimated as follows: for gas – 400 billion m^3 , for condensate – 450/150 million tons of oil – 100/50 million tons of oil. The resources are mainly associated with salt deposits. According to the data of seismogeological analysis, the Kamenskaya structure is represented by four types of hydrocarbon ores.

Estimated reserves Kamensk estimated geological reserves of category C_3 hydrocarbon raw materials for all parts of the studied structure (salt deposits) are more than 1 billion tons of conventional lubricants.

It is at the contract site that the production layers of hydrocarbons have not yet been discovered, but the Kamensk gas condensate mine has been discovered in the volume of this site. The approved balance sheet fund of this mine as of 01.01.1996 amounted to 7.5 billion m^3 of gas ($A+B+C_1$) and 1.5 billion cubic meters of gas (C_2).

Only for the only discovered and studied structure «Kamensk», the forecast geological reserves (C_3) are approximate: for gas condensate – 240-280 million tons. For free gas, 300-350 billion m^3 .

Estimated estimated oil reserves are about 65-80 million tons. Date of the company's first registration – 24.10.2003.

The Kamensk structure was formed from fragments of the Permian period of the Caspian lowland. The Earth's crust, including Devonian and carboniferous dumps, penetrates the Caspian lowland by 5-7°. A primary salt layer formed in the north-west direction at a depth of 1000-1200 m, oil C_1 is 3651 million m^3 , oil C_2 is 3059 million m^3 , and condensate $C_1 + C_2$ is 200 million m^3 .

9. The Gremyachinskoye, Vostochno-Gremyachinskoye, and Yuzhno-Gremyachinskoye fields are located in the Baiterek region, in the north-east of the West Kazakhstan Region, bordering the eastern part of Teplov and are its continuation. The eastern part of Teplov is divided into Teplov-Gremyachin; the center is Ulyanov, and the western part is Tsyganov-Tokarev. The size of the Gremyachin structure is 5.5x2.1 kilometers, and the Eastern Gremyachin structure is 1.2x5 kilometers. The structures are oriented from the north and northeast to the south and southwest. The north is flat, and the south is fortieth. Refers to a tectonic structure, depending on its origin.

In 1974, an oil field was discovered. At a depth of 2823-2825 m, a water oil layer was found. The Vostochno-Gremyachinskoye field was discovered in 1976. The water oil layer was monitored at the established depth of 2837-2840 m. Category C reserves of 3.4 million tons.

The Yuzhno-Gremyachinskoye oil field is located in the northern part of the Caspian lowland, 35 kilometers northwest of the city of Uralsk. The share of methane in Gas mixed with oil is 55, ethane – 10, propane – 3.8, butane – 1.9, nitrogen – 19.7.

The field is one of the fields that has not been fully explored. However, the location is favorable due to the location, productive habitat, and high-quality oil reserves. Deposits located on the left bank of the Urals.

10. The bekot field is located in Karatobe district. It consists of very deep salt domes. West wing of the salt dome surface. It is divided into the east wing and the north block.

The West Wing is semi-hilly. The size of the rocks formed during the Triassic period in the hills is 400 m, the amplitude is 5x2 kilometers. The eastern wing consists of rocks from the Jurassic and Triassic periods. The northern block is 350m lower than the western wing and 150 m higher than the Eastern one. The Triassic rocks formed a semi-anticlinal formation. Oil reserves amount to 724 thousand tons of oil equivalent.

11. The Kubasai field was discovered in 1977 in the Karatobinsk district. It consists of thick salt domes extending in the direction of the meridian. The salty core of the formation lies at a depth of 700 m. The structure consists of two layers: east and west. The thickness of the layer is 7x25 kilometers with an amplitude of 250-450 m.

The western wing was divided into several blocks as a result of tectonic faults. During drilling, an oil reservoir was discovered. Category C_2 reserves are 702.9 thousand tons [8].

12. Chingiz field is located in Karatobe district. It consists of a salt core 300 m deep, extending in the direction of the meridian. The building has 2 wings: east and west. The northern part of the western wing consists of a salt marsh with a height of 300 to 4000 m. And the salt in the southern part forms a large terrace, extending to a depth of 1900 m.

The oil reservoir is partially blocked. Initial reserves amount to 165.4 thousand tons. Interfluvium of the Urals and Volga.

13. Deep drilling operations in the Auketaishagyl structure took place in 1960. The structure consists of salt domes. Between 1960 and 1961, 11 deep wells were drilled. As a result, 110 million rubles the m^3 gas reserve has been developed. The Auketaishagil dome was first discovered in 1934 on the basis of a gravimetric survey. As a result of the research, a three-channel salt dome was discovered. In the south-eastern part of the territory, a gas reservoir with reserves of 110 million tons was discovered. Currently, research on the territory of Auketaishagil is suspended.

14. The Bolganmola oil field is located in the Zhangalinsky district of the West Kazakhstan region, it is located 240 km south, southwest of the city of Uralsk. The field was discovered in 1969. The structure was located in the north-eastern part of the Dunbeek dome. The productive sedimentary layer 1828 m occurs at a depth of 1828 m. The reservoir consists of sandstone and siltstone rocks of the Lower Triassic. The thickness of the effective oil-saturated layer is 3 m. As a result of drilling operations, the distribution of Meso-Cenozoic and Permo-Triassic rocks was established. Drilling also revealed a layer of gas from Upper Triassic rocks. Formation is associated with the formation of oil. Oil and gas reserves. As a result of research activities on the territory of Bolganmola, reserves amounted to 425 million tons [8].

15. Port Arthur is located in the immediate vicinity of Akpater rural district of Kaztalov district. It is located 300 kilometers southwest of the city of Uralsk. As a result of the work carried out, the contour of the Absheron gas field was determined. Gas reserves are estimated at 100 million m^3 [9].

16. The Karagai field is located on the border of Atyrau region, 60 kilometers southeast of the village of Taipak. The pine structure is located in the eastern part of the Koktau salt dome zone. According to tectonics, the salt dome rise consists of a body. It is associated with a salt structure facing south from

the dune dome. The salty core of this structure extends in the direction of the meridian. The angle of incidence of its slope 60 is from 45 to 60°C. Salt in the most elevated part lies at a depth of 515 m. Saline rocks consist of 3 different structural elements: Southwest, East, and North. Total gas reserves amounted to 234.9 million m³ [10].

Results and discussion

The results of the study showed that, taking into account the above data, the deposits distributed on the territory of the West Kazakhstan region are the Karachaganak and Chinarev oil and

gas fields of great importance in the Republic. These two deposits are effectively used in the country's farms. Identified oil and gas fields in the West Kazakhstan region are shown in Table 1.

Currently, the Karachaganak enterprise is one of the leading oil and gas companies in the Republic of Kazakhstan, which has a record performance in gas and condensate production, accounting for about 45 percent of total gas production and 16 percent of liquid hydrocarbon production. In 2020, the company produced 12.1 million tons of oil condensate and 20.2 billion m³ of gas.

Zhaiykmunai LLP is a Kazakhstan oil and gas company engaged in the production, transportation, primary processing

Identified oil and gas fields in the West Kazakhstan region

Батыс Қазақстан облысындағы анықталған мұнай және газбен орындары

*Выявленные месторождения нефти и газа
в Западно-Казакстанской области*

Table 1

Кесте 1

Таблица 1

Location #	Field	Geotectonic state	Of wells year of discovery depth	Of deposits, m state of geological age	State of the field
1	Auketaishagyl (gasfield)	Central Caspian Depression	1960/G-12	50-140/Neogene (Apsheron level)	Preliminary exploration
2	Port Arthur (gas field)		1961/P-27	202-222/Neogene (Absheron level)	
3	Bolganmola (oilfield)		1963/G-3	1835-1844/Lower Triassic	
4	Karagai (gasfield)		1968/G-3	910-915/Nizhny Bor (Barremian level)	In conservation
5	Beket (oilfield)		1972/G-1	1179-1185/Lower Triassic	In development
6	Chingiz (oilfield)		1973/G-8	559-1748/Lower Triassic	
7	Zapadno-Teplovskaya (oil and gas field)	Northern side zone of the Caspian basin. Lower Permian lateral carbonate berm	1973/G-5	2715-2995/Lower Perm	In development
8	Gremyachin (gasfield)		1974/G-2	2695-3030/Lower Perm (Artin Level)	
9	Ulyanovskk (gasfield)		1976/P-47	2735-3020/Lower Perm (Artin level)	
10	Tsyganov (oil gas field)		1977/G-24	2820-2925-Lower Perm (Artinsky Level)	
11	Teplov (oil and gas field)		1979/G-43	2826-3028/Lower Perm	
12	Karachaganak (oil and gas condensate field)	Inner side part of the Caspian depression	1979/P-10	3640-5270/Lower Perm-Fake developed since	1984
13			1988/G-15	5470-6270/Devonsky, Franco-Eiffel reservoir productivity	In preliminary exploration
14	Kamensk (gas condensate field)	Intermediate control North side zone of the Caspian depression	1986/G-2	2640-3182/Upper Perm(Kazan stage)	In development
15	Darinsk (oil and gas condensate field)	North-side zone of the Caspian basin	1989/G-1	4218-4270/Medium-carbon (Bashkir formation)	Preliminary exploration
16	Chinarev (oil and gas field)	At the outer margin of the Caspian lowland	1991/Zh-4 1993/Zh-10	2770-5300/Lower Permian-Middle Devonian (Eiffel level)	Developed since 1991

and sale of oil and gas in the contract area of the Chinarev oil and gas condensate field.

In 2019, the company implemented a project for the construction of GKDS – 3. The launch of this project will allow the company to increase the volume of gas treatment by 2.5 billion cubic meters per year. Thus, the dependence of the West Kazakhstan region on the supply of blue fuel from other regions will significantly decrease. 15% of oil goes to the domestic market, while condensate is mainly exported to European countries. 2300 tons of liquefied petroleum gas are sent to the needs of the region.

Where the remaining oil and gas fields are located, how much territory is known, but still does not apply to the country's economy. There are several conclusions about the reasons for the incomplete development in the national economy of more than 20 oil and gas ores, the location of which is determined on the territory of the region:

- the deposits are located very deep, covered with salt layers with a thickness of 3 thousand sometimes up to 5-8 thousand meters. The upper part of the salt beds is covered with sand pebbles, clay, and limestone;

- a small reserve of discovered deposits;

- very expensive development;

- taking into account the harmful impact on the environment, it becomes economically and environmentally inefficient.

Conclusion

Oil and gas are the least valuable industrial raw materials. Probably, there is not a single branch of the national economy

that does not consume oil and gas and its refined products. The widespread use of oil and gas in the national economy is justified by effective economic indicators of use. Discovery of the Karachaganak and Chinarev oil and gas condensate fields allowed us to develop the oil-producing industry in our region.

The location of oil and gas fields distributed in the West Kazakhstan region, location area, geological development, geological age, depth of location, occupied territory, what are the reserves and their share in the development of the country's economy are given. On the territory Karachaganak, Chinarev, Teplov, Zapadny Teplov, Ulyanovsk, Darinsk, Kamensk, Gremyachinskaya group of formations, post, Kubasay, Chingiz, Auketaishagyl, Bolganmola, Port Arthur, Karagay regions with berildi oil and gas reserves description. The largest of them are the Karachaganak and Chinarevskoye fields. Based on the study of specific material, an attempt was made to give an economic justification for the use of all types of material raw materials for the development of the country's economy of the region, taking into account the integrated use of energy and Mineral Resources, their effectiveness.

The development of new capital construction fields is crucial for the accelerated development of the oil and gas industry. Currently, all previously discovered fields explored by single wells and imperfect seismic surveys need to be considered and revised not from the point of view of the total volume, but from the point of view of economic factors.

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Information about authors:

Hodzhanova B.H., Senior Lecturer, M. Utemisov West Kazakhstan University (Uralsk, Kazakhstan), hodzhanova.b@mail.ru; <https://orcid.org/0009-0007-7475-3960>

Abdusheva G.Zh., Senior Lecturer, M. Utemisov West Kazakhstan University (Uralsk, Kazakhstan), abdusheva72@bk.ru; <https://orcid.org/0009-0003-9412-9277>

Yakupova J.B., Lecturer, M. Utemisov West Kazakhstan University (Uralsk, Kazakhstan), yakupova_j@mail.ru; <https://orcid.org/0000-0003-3875-1224>

Авторлар туралы мәліметтер:

Ходжанова Б.Х., аға оқытушы, М. Өтемісов атындағы Батыс Қазақстан университеті (Орал қ., Қазақстан)

Абдушева Г.Ж., аға оқытушы, М. Өтемісов атындағы Батыс Қазақстан университеті (Орал қ., Қазақстан)

Якупова Д.Б., оқытушы, М. Өтемісов атындағы Батыс Қазақстан университеті (Орал қ., Қазақстан)

Сведения об авторах:

Ходжанова Б.Х., старший преподаватель Западно-Казахстанского университета им. М. Утемисова (г. Уральск, Казахстан)

Абдушева Г.Ж., старший преподаватель Западно-Казахстанского университета им. М. Утемисова (г. Уральск, Казахстан)

Якупова Д.Б., преподаватель Западно-Казахстанского университета им. М. Утемисова (г. Уральск, Казахстан)