MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

Kazakh national research technical university named after K. I. Satpayev

Institute of Geology, Oil and Mining named after K. Turysov

Department of Petroleum Geology

Orynbassarova Ainur

Tectonic structure, oil and gas potential and analysis of physicochemical properties of oil and gas of the Kara arna field.

DIPLOMA WORK

Specialty: 5B070600 – Geology and exploration of mineral deposits

Almaty 2020

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«____» ___________ 2020 .

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DIPLOMA WORK

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Made by: Orynbassarova A. A.

Scientific adviser: Master of technical science, lecturer

Urmanova D. E

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Task
for completing the work

Student: Orynbassarova Ainur Aganasovna
Title of the diploma work: Tectonic structure, oil and gas potential and analysis of physicochemical properties of oil and gas of the Kara Arna field
Approved by the №762-b order of the rector of the University from January 27, 2020
The deadline of the completed work is " 28 " may 2020.
Initial data of the work: materials collected from stock data, collected from pre-graduate industrial practice, obtained by “Maten Petroleum” JSC.
List of issues considered in the diploma work:

1. Geological section
2. Stratigraphic column
3. Composition and physical and chemical properties of oil, gas and water
4. Ecological section

List of graphic materials: Geological map and its cross section, stratigraphic column

THE TIMETABLE

for the preparation of the diploma work

Name of departments, list of issues under consideration	Terms of assistance to scientific supervisors and consultants	Note
Geological section	20. 02. 2020	
Stratigraphic column	11. 03. 2020	
Composition and physical and chemical properties of oil, gas and water	7. 04. 2020	
Ecological section	7. 05. 2020	

Signatures

of consultants of sections of the diploma project and

the controller of norms for the completed project

Name	Consultants	Date of signing	Signature
Geological section	D. E. Urmanova		
Stratigraphic column	D. E. Urmanova		
Composition and physical and chemical properties of oil, gas and water	D. E. Urmanova		
Ecological section	D. E. Urmanova		

Norm controller: 20.05.20 M. E. Sanatbekov

Head of the diploma work, lecturer D. E. Urmanova

The student who received the task to complete A. A. Orynbassarova

Date «25» May 2020

АҢДАТПА

Дипломдық жұмыс 3 бөлімнен тұрады. Бірінші геологиялық бөлімде Қара Арна кен орыны туралы жалпы мағлұматтар, геологиялық және тектоникалық құрылыстары, мұнайгаздылығы, литологиясы мен стратиграфиялық бағанасы жөнінде айтылған.

Келесі бөлімде кен орын мұнай-газының физикалық және химиялық қасиеттері, құрамы көрсетілген. Яғни мұнайдың қабаттық жағдайдағы қасиеттері, еріген мұнайдың қасиеттері және т. б. жазылған.

Үшінші экологиялық бөлімде кенорынның, яғни кәсіпорынның қоршаған ортасына деген көзқарасы және оны ластаушы ретінде сипаттамасы көрсетілген. Қоршаған ортаға, атмосфераға бөлініп шығарылған ластауыш заттарды есептеу жолдары және оны азайту шараларын қалай жүргізіп жатқандығы айтылған.

АННОТАЦИЯ

Дипломная работа состоит из 3 разделов. В первом геологическом разделе изложены общие сведения о месторождении Кара Арна, тектонические сооружения, нефтегазоносность, литология и стратиграфическая колонка.

В следующей части указаны физические и химические свойства, состав нефтегазового месторождения. В частности, речь идет о свойствах нефти в пластовых условиях, свойствах растворенной нефти и т. д.

В третьей экологической части указано отношение месторождения, то есть предприятия к окружающей среде и его характеристика как загрязнителя. В частности, были рассмотрены пути расчета выбросов загрязняющих веществ в окружающую среду, атмосферу и меры по их снижению.

ABSTRACT

The diploma work consists of 3 sections. The first geological section contains general information about the Kara Arna field, research conducted in the region, geological and tectonic structures, oil and gas content, lithology and stratigraphic column, and other general information.

The following part shows the physical and chemical properties and composition of the oil and gas field. In particular, we are talking about the properties of oil in reservoir conditions, the properties of dissolved oil and etc.

The third environmental part shows the relation of the deposit, i.e. the enterprise to the environment and its characteristics as a pollutant. In particular, ways to calculate the emissions of pollutants into the environment and atmosphere and measures to reduce them were considered.

CONTENT

INTRODUCTION

The aim of the diploma work is to identify tectonic structure, oil and gas potential and to analyze the physicochemical properties of oil and gas of the Kara Arna field

Maten petroleum JSC is the subsurface user of the Kara-Arna field. The Kara-Arna field was discovered in 1956. The first "Calculation of the oil reserves of the Kara-Arna field", compiled as of 01.09.1961, was approved by the state Committee of the USSR in 1961 (Protocol No. 3669 of may 15, 1962) on the basis of the approved reserves in 1962, the Central research Institute compiled a "Preliminary technological scheme for the development of the oil horizons of the Kara-Arna field".

Industrial oil content was established by structural prospecting drilling in 1956-1957. The Kara-Arna field was put into commercial development in 1974 on the basis of the technological scheme drawn up by the Central research Institute for Embaneft IN 1973. This technological scheme is based on the Aptian and lower Albian horizons of the southern and Northern fields.

In 1986, the "Kara-Arna field development Project" was developed for the approved reserves by the Kaznipineft Institute. There are 3 objects of development: the first-the Aptian horizon of the southern and Northern fields, the second-the lower Albian horizon of the southern field, the third-the Cenomanian horizon of the southern field. Since the Cenomanian horizon reserves were listed as off-balance sheet, oil production is not included in the planned indicators.

1 Geological section

1.1 General information about the field

The Kara-Arna oil field is located in the Karaton-Tengiz oil and gas zone, 150 km Southeast of Atyrau. According to the administrative division, it is located on the territory of Zhylyoysky district of Atyrau region of the Republic of Kazakhstan.

The nearest locality is the village of Karaton, located 30 km North of the Kara-Arna field. The regional center of Kulsary is located 90 km northeast of the field.

The connection of the Kara-Arna field with the localities of Kosshagyl, Kulsary and Atyrau is carried out on roads with asphalt and gravel-crushed stone pavement.

In orographic terms, the area of the Deposit is a semi-desert plain with absolute relief marks of minus 23.54 m and minus 26.8 m.the Western part of the area has a slight slope to the West towards the Caspian sea and is filled with sea water during the period of westerly winds. The cover layer of this area consists of limestone-shell rock. The Eastern part of the square is divided by numerous fights and quarrels into relatively elevated areas, stretched in a meridional direction.

The climate of the area is sharply continental Summer is dry, hot, the air temperature reaches plus 400C, winter is harsh, snow-white with strong winds, the temperature drops to minus 400C.

The vegetation cover is poor, typical for the semi-desert zone[2].

Picture 1 – Overview map

1.2 Characteristics of the geological structure

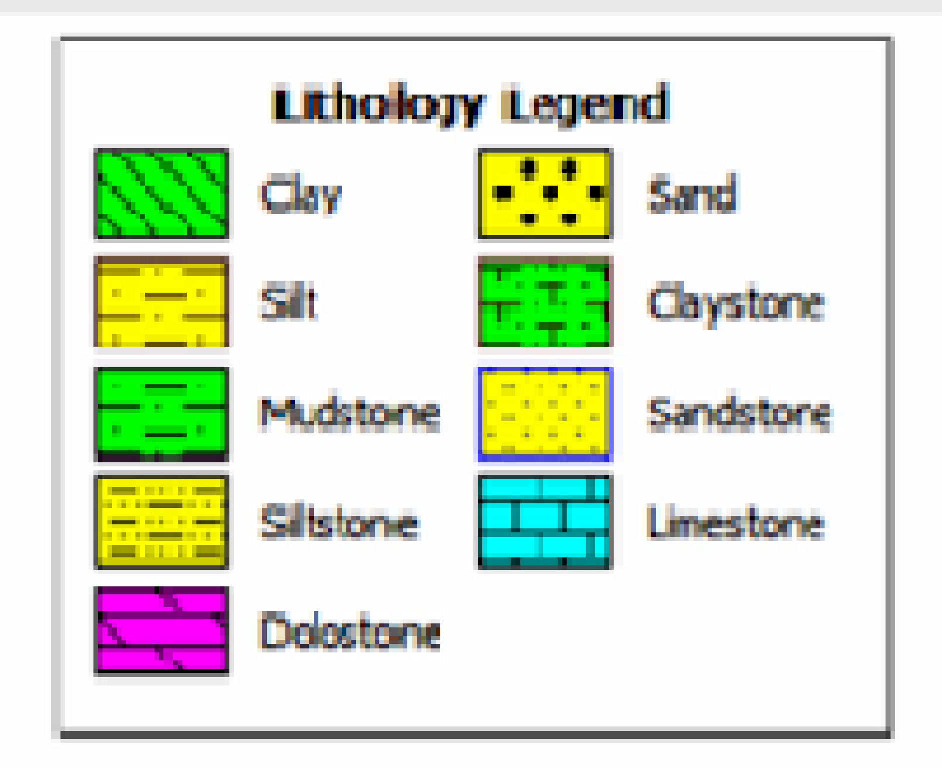
Lithological and stratigraphic characteristics

The complex of Paleozoic-mesocainozoic deposits represented by the Permian, Triassic, Jurassic, Cretaceous, Paleogene and Quaternary systems was discovered and studied by drilling search, exploration and production wells at the Kara-Arna field.

The deposits of the Kungursky tier are represented by a white, large-crystalline translucent rock salt, overlain by a relatively low-power thickness of carbonate-sulfate hydrochemical sediments.

Within the study area, the salt deposits of the Kungursky tier were opened by wells 1, 3 A and R3 with exposed thicknesses of 126, 94 and 78 m, respectively.

Legend to the stratigraphic column



Eon	Era	System/period	Series/Epoch	Stage/age	Lithological	Thickness	Lithological description
Phanerozoic	Cenozoic	Neogene-Quaternary N+Q	Pliocene N2			119-204 m	lithologically represented by weakly cemented, gypsum-covered Sands. In the lower part of the section, the sand gradually turns into a sandy clay and
			Miocene N1				
		Paleogene P	Eocene P2			20-32 m	Lithologically represented by clays with interlayers of marls. The Danish tier is represented by marls with layers of writing chalk and sandy clays with plant remains.
			Paleocene	Danish			
	Mesozoic	Cretaceous K	Upper K2	Cenoman		141-	represented by clays with layers of fine-
				Turon		50-87	composed of marls with clay layers
				cognac		50-87	composed of marls with clay layers
				Santon		33-48	represented by a bundle of marl, in the
				Campan		88-108	composed of thick clays and marls with
				Maastric		113 m	Lithologically represented by white
			Lower K1	Albian		338-	mainly represented by clays and siltstones
				Aptian		70-90	represented by Sands with layers of clays
				boremski		90-105	variegated clays with sand layers and
				Hoteru		90-105	variegated clays with sand layers and
				Valanzhi		29-37	interlayers of fine-grained sand with layers
				Berrias		238-	interlayers of fine-grained sand with layers
		Jurassic J	Upper			143-	limestone with layers of marls with thin
			Middle			678-	alternating sand and clay bundles with
			Lower			73-90	Sands with rare layers of gravelites,
		Triassic T				86, 72, 167 m	they are represented by the interbedding of sandstones, clays, and Sands

Picture 2 – Stratigraphic column

Triassic

The undifferentiated Triassic deposits were uncovered by wells 1, 3A, R2, and R3. Lithologically, they are represented by the interbedding of sandstones, clays, and Sands.

The thickness of the Triassic on the raised East wing in the arch is 86 m (well.3A), and on the lowered West wing of the South field – 72 m (well.1) and increasing northward to 167 m (well. R3), in the North field.

Jurassic system

Three wells 1, R2, and R3 were opened in the full Jurassic section on the West wing, and one well 3A was opened on the East wing, with a thickness of 923, 920, 825, and 876 m, respectively. Lagoon-continental deposits of the Jurassic system are represented by lower, middle, and upper divisions that are widespread.

Lower Jurassic (J1)

On the eroded surface of the Permian, sediments of the lower Jurassic lie with transgressive disagreement, represented mainly by Sands with rare layers of gravelites, conglomerates, sandstones and clays.

The thickness of the lower Jurassic within the southern field of the Western wing varies from 73 m (well. R2) to 90 m (well.1), and within the Eastern wing is 68 m (well.3A).

Middle Jurassic (J2)

The middle Jurassic deposits are mainly represented by alternating sand and clay bundles with layers of brown coal and are characterized by sharp lithological variability, both in area and in section. The full section of the middle Jurassic deposits with thicknesses of 678, 690, 599, 708 m was opened by wells 1, R2, R3, 3A, respectively.

Upper Jurassic (J3)

Upper Jurassic sediments are widespread and are represented by clay and carbonate rocks, which are the regional cover.

The upper part is composed of limestone with layers of marls with thin layers of sand. The thickness of the carbonate layer varies from 40 to 80 m.

The lower part of the section is represented by terrigenous rocks-alternating weakly cemented sandstones and clays. The lower part of the section is represented by terrigenous rocks-alternating weakly cemented sandstones and clays. The thickness of terrigenous deposits ranges from 60 to 80 m.

A complete section of the upper Jurassic sediments was opened on the West wing by wells 1, 1A, 2A, R2, R3 with a thickness of 143 to 161 m and on the East wing by well 3A with a thickness of 100 m.

Cretaceous system

The Cretaceous system is represented by all tiers of the lower Cretaceous (K1) and upper Cretaceous (K2) divisions.

Lower Cretaceous (K1)

The uncovered lower Cretaceous deposits are represented by the Valanginian, goteriv-Barremian tiers, which are combined into the Neocomian sub-division, as well as the Aptian and Albian tiers.

Lower Cretaceous rocks with angular and stratigraphic disagreement lie on the upper Jurassic deposits and are opened by all wells.

Neocomian sub-division($К_1$ne)

Neocom consists of falangismo and hoteru-borrascoso tiers. The thickness of the neocome varies from 238 m (well.3A) on the raised East wing to 411 m (well.R2, R3) on the lowered West wing.

Valanzhinsky layer (К1v)

The deposits of the valanginsky stage are represented by interlayers of fine-grained sand with layers of sandstones, clays and limestone. The thickness of the valangin tier varies from 29 to 37 m, and there are no valangin deposits on the raised Eastern wing.

Hoteru + boremski tiers – K1 g+br

Deposits are represented by variegated clays with sand layers and alternating bundles of clays and Sands with low-power Sandstone and marl layers. The thickness of deposits varies from 90-105 m on the raised wing and up to 380 m on the lowered wing.

Aptian stage (K1a)

Deposits of the Aptian layer transgressively overlap Neocomian sediments, has a uniform area distribution and are represented by Sands with layers of clays, less often sandstones and marls. The Aptian oil-bearing horizon is confined to the lower part of the Aptian deposits of the Western wing.

The thickness of the Aptian deposits ranges from 70 m (well130) to 90 m (wellR3) on the West wing, and reaches 68 m (well3A) on the East wing.

Albian tier (K1al)

Deposits of the Albian stage have regional development and are mainly represented by clays and siltstones. At the base of the Albian tier lies a sand horizon with layers of clays, less often marl or Sandstone up to 20 m thick, which is associated with the oil Deposit of the southern field of the West wing.

The thickness of the Albian deposits of the southern field of the West wing ranges from 338 (well.85A) to 366 m (well.54).

Upper cretaceous (K2)

Cenomanian tier (K2c)

The Cenomanian tier is represented by clays with layers of fine-grained sand and Sandstone, strong, with plant remains. The West wing oil deposits are associated with the Cenomanian basal sandstones. The sediments of the Cenomanian stage have a uniform area distribution, the thickness ranges from 141 (well.R-3) to 168 m (well. 85a), averaging 155 m.

Turon-cognac tier ($К_2$t+cn)

Deposits of the (undifferentiated) Turon-Konyak tiers are composed of marls with clay layers. At the base of the section, in some wells, there is a conglomerate horizon represented by black and brownish-gray pebbles of phosphorite. The thickness of the Turon-Konyak tier ranges from 50 m (65,401well) to 87 m (R3 well), increasing to the North.

Santon tier (K2st)

In the upper part, the Santonian deposits are represented by a bundle of marl, in the middle part by white writing chalk with layers of marl and clay, in the lower part by clays with layers of marl. The thickness of the Santonian deposits varies from 33 m (well.451) to 48 m (well.49).

Campan tier (K2cp)

The deposits of the Campanian tier are composed of thick clays and marls with layers of white writing chalk. The thickness of the Campanian deposits varies from 88 m (well.419) to 108 m (well.401).

Maastricht tier (K2M)

Lithologically represented by white writing chalk with rare marl patches. The average thickness of the tier is 113 m.

Paleogene system-P

Sediments of the Paleogene system, transgressively deposited on the sediments of the Danish tier, are divided into the Paleocene - lower Eocene, middle-upper Eocene. Lithologically represented by clays with interlayers of marls.

Danish tier

The Danish tier is represented by marls with layers of writing chalk and sandy clays with plant remains. The thickness of the tier varies from 20 to 32 m.

The Neogene-Quaternary system of (N+Q)

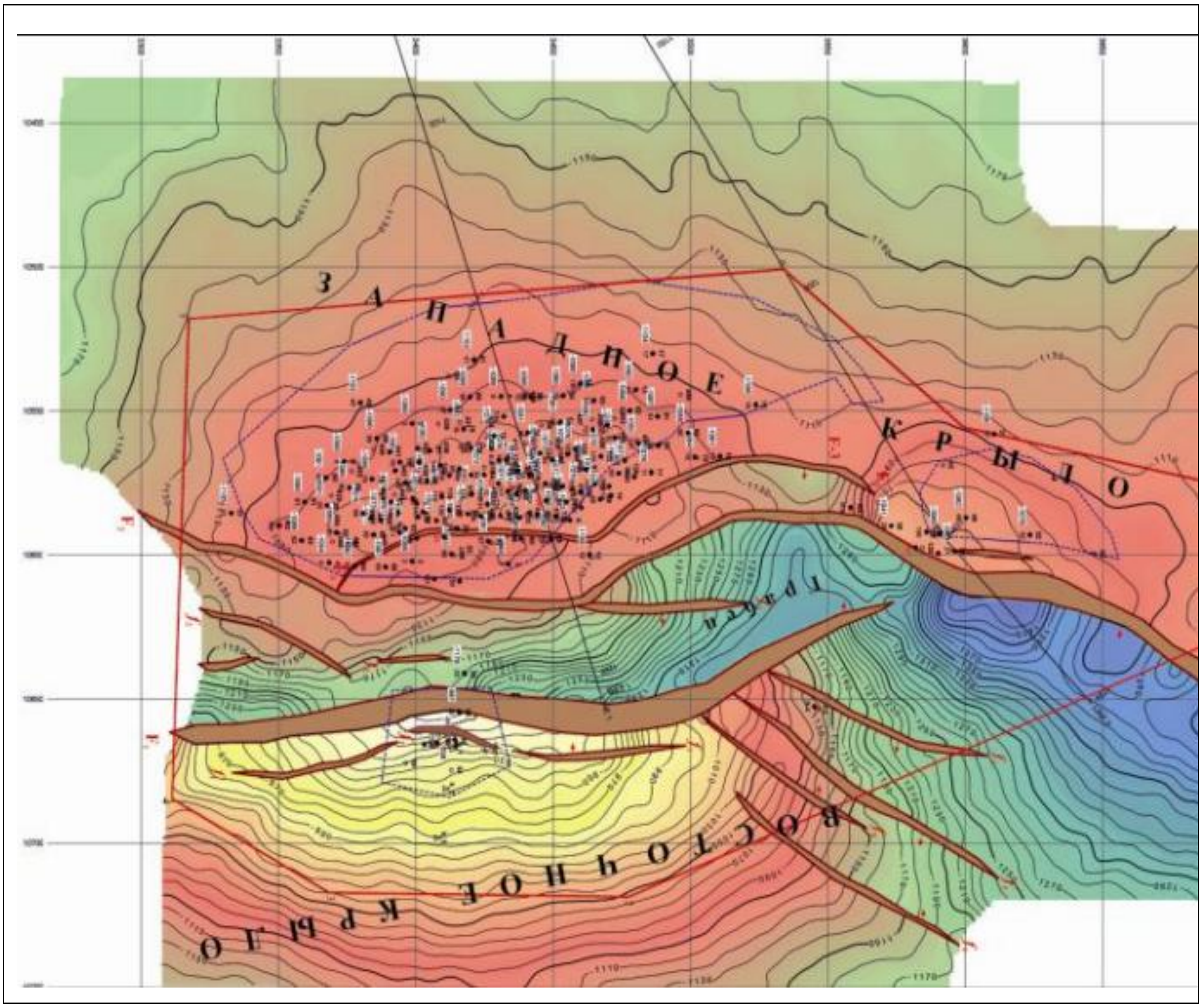
Deposits of the Neogene-Quaternary system (Caspian sediments)lie in a continuous cover on different stratigraphic zones of the Paleogene. In the upper part of the section, they are lithologically represented by weakly cemented, gypsum-covered Sands. In the lower part of the section, the sand gradually turns into a sandy clay and layers of ferruginous microcrystalline gypsum. Almost throughout the section there are fragments of broken shells. The total thickness of the Paleogene-Neogene-Quaternary sediment varies from 119 (well.409) to 204 m (well.R3) [2].

1.3 Tectonics

Tectonically, the Kara-Arna Deposit is confined to the South-Eastern part of the Caspian basin. The structure is a two-winged anticline uplift with a deeply submerged salt core.

The result, completed in 2010 and interpretation of data of seismic survey 2D/3D and their integrated analysis with GIS data of drilled wells was refined structural-tectonic model fields Kara-Arna in the post-salt deposits that characterize the structural map constructed on the basic reflecting horizons - III (sole Cretaceous sediments), V (sole Jurassic sediments), V1 (sole Triassic deposits). In addition to these maps, structural constructions were made on the roofs of productive layers K1a (Aptian layer of the lower Cretaceous), K1al1 (lower Albian layer of the lower Cretaceous) and K2c (Cenomanian layer of the upper Cretaceous) (Appendix 2-4).

The above-salt complex of sedimentary deposits is divided by the system of discharges F1 and F2 into three main structural elements: the Western lowered, the Eastern raised and the Graben between them[1].



Picture 3 - structure map for the horizon K1A (roof manifold in the sediments of the Aptian lower Cretaceous tiers K1A)

The West wing is a semi-elliptical Meridian with two arches - South and North. The southern vault is larger than the Northern one and is located hypsometrically lower.

The Eastern wing is a semi-dome, shielded from the West by an F1 Graben drop. Relative to the West wing, it lies hypsometrically higher.

In the Northern part of the research area, the West wing is raised above the East wing. The discharge amplitude for Cretaceous deposits is about 120-180 m on the roof of the Cenomanian layer, 240-290 m on the Aptian layer, and 300 m on the Jurassic layer. Further, in the southern direction, in the lowered East wing, a network of feathering discharges f4-f9 is traced

The Central Graben is complicated by violations of f2, f2' and f3 of small extent, parallel to the main discharges of F1 and F2 .

In this paper, structural maps for the roof of deposits are constructed on the basis of the above-mentioned seismic structural maps, taking into account drilling data. Analysis of structural plans for horizons in the Cretaceous, Jurassic, and Triassic sediments indicates the inherited nature of the development of Mesozoic deposits.

1.4 Initial geological reserves of oil brought to the surface conditions

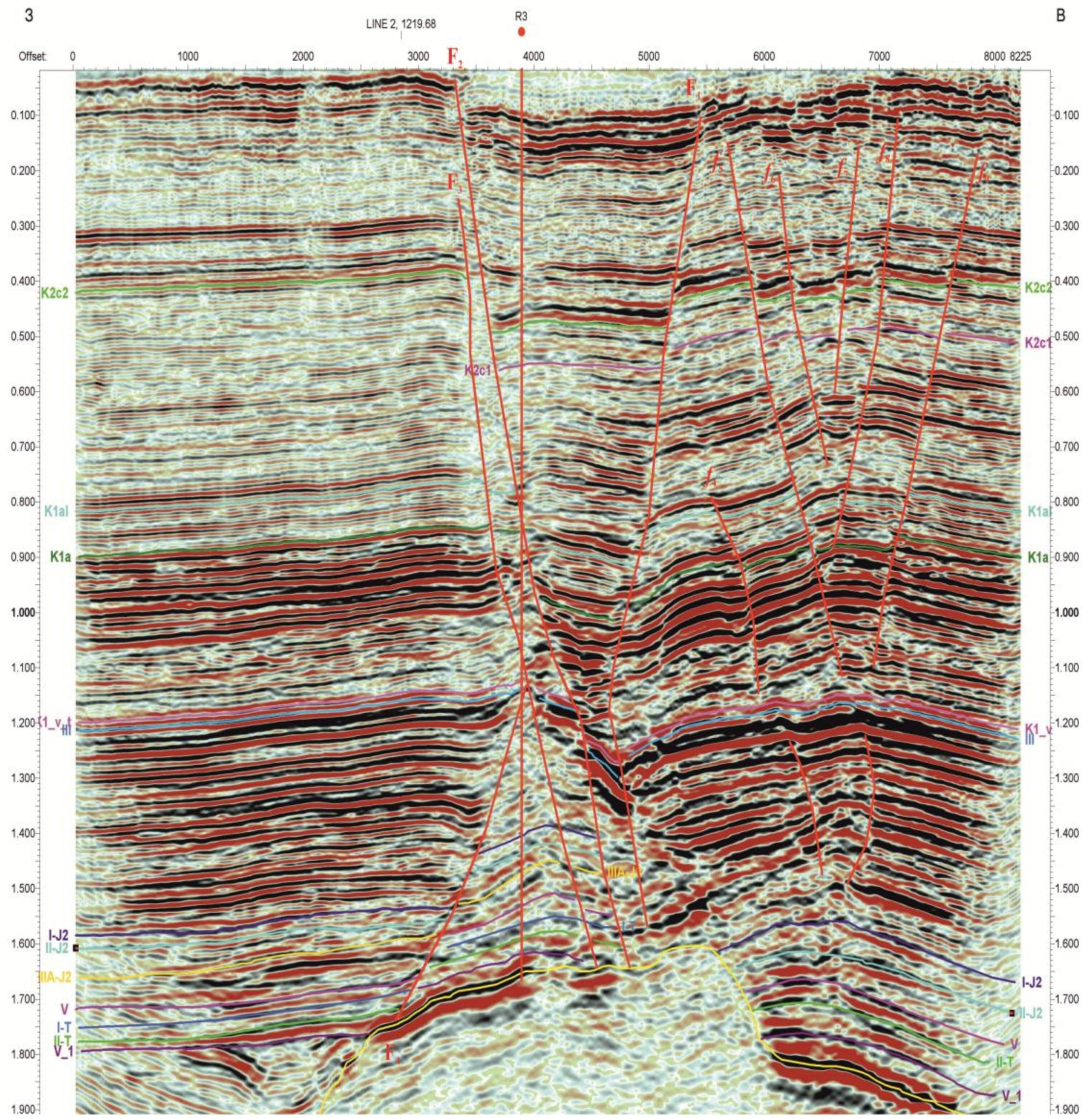
An audit of the oil reserves of the Kara-Arna field was conducted by analyzing structural maps obtained as a result of reinterpretation of 3D seismics, structural maps on the roofs of deposits, maps of effective oil-saturated thicknesses, geological profiles, correlation schemes, core data analysis, interpretation GIS of an open trunk, justification of levels of VNK taking into account testing data exploration wells and production data, analysis of deep and wellhead oil samples. It should be noted a fairly high degree of study and reliability of the calculated data parameters used for evaluation. On structural maps on roofs of deposits and maps of effective oil-saturated thicknesses are marked with category boundaries, and oil-saturated volumes and initial geological reserves were calculated.

In accordance with the analysis of the development of reserves to proved reserves P1 reserves of deposits of the South field of the West wing (K2c, K1al1, K1A), North field of the West wing (K2c, K1A), East wing (K1al3), Graben (K1al3-A, K1al3-B). In turn, the areas of deposits where the object was or is being operated, moreover, the period of operation of each well was taken into account, and accordingly accumulated production for it is defined as proven developed produced.

Reserves of areas of the Deposit where subsequent production is expected to be projected wells, reserves are estimated as proven undeveloped by the category of probable P2, the reserves of the southern Deposit sites were calculated fields of the West wing (K2c, K1al1, K1A), the North field of the West wing (K2c), which adjacent to areas of proven reserves. Probability of retrieving the calculated data the volume of reserves on them is slightly lower than that of proven reserves (small thicknesses, increase in area due to structural constructions, and it is possible economically unprofitable extraction).

The reserves of the K2T Graben Deposit were also calculated by the probable category.
Looking for reliable determination of neptunerising thicknesses of the geophysical curves at the time of evaluation tests not confirmed, and subsequent probability of their extraction is very low, given the long preservation of the wells and low inflows in the test period.

Category probable reserves P3 was calculated stocks of deposits of the Graben, where stocks at the time of evaluation determined by seismic data (picture 3)[2].



Picture 4 – Cross section INLINE 3560 (the Central part of the area of Kara-Arna)

1.5 Oil and gas potential

The industrial oil content of the Kara-Arna field was established by structural prospecting drilling in 1956-1957.

The field was put into commercial development in 1974.

In 2012 LLP "Project Institute "OPTIMUM" was made "Conversion of oil field "Kara-Arna" on the state of knowledge on 01.01.2012 oil Reserves was included in the State balance of RK.

In 2012, the project "Supplement to the updated project for the development of the Kara-Arna field "(Protocol No. 30 of 12.12.2012) was completed and approved on the approved reserves of OPTIMUM Design Institute LLP

As of 01.07.2018, the Author's supervision over the implementation of the Supplement to the updated project for the development of the Kara-Arna field was compiled.

After the Author's supervision, 17 production wells were drilled at the field 142, 147, 152, 153, 154, 155, 156, 157, 410, 423, 428, 460, 461, 462, 463, 464, 465 and one R-8 search well. Of these wells were drilled on the Cenomanian Deposit 410, 423, 428, 460, 464, 465 West wing of the South field, wells 461, 462, 463 – the West wing of the North field. Well 147 was drilled into the upper Albian Deposit of the Eastern wing. On the Aptian reservoir and the wells drilled 142, 153, 154, 155, 157 West wing of the South field wells 152, 156 – West wing North field.

In the southern field of the Graben, the R-8 search well revealed for the first time oil deposits in the section of the upper Albian deposits. As of the date of this project, as of 01.06.2015, the number of deposits has increased by 2 more than in terms of reserves [7] and is nine. Of these, three deposits (Aptian, Cenomanian and nizhneilimsky) are confined to the southern field, West wing two (Aptian and Cenomanian) to the North field, one (verhnelensky) - the East wing, one (Turonian), to the Graben, and two new deposits to the South field of the Graben in the center of the well R-8. When compiling the report, all available geological and geophysical information on the entire well stock (198 wells) of the field was taken into account. Based on the results of drilling new wells, the geological structure of the field has been clarified.

Correlation of the section of newly drilled wells with the section of previously drilled wells allowed us to confirm the presence of already established horizons and trace them by area. Roof marks and reservoir soles, General and effective thicknesses, porosity and saturation parameters were determined by the GIS complex. In substantiating the contacts, we used the results of well testing during drilling, results of testing during exploration, and results of perforation and production in production wells, as well as GIS interpretation data. Table 1 shows the characteristics of the deposits of the Kara-Arna field (size, type, saturation pattern, and absolute levels of oil and water contact(OWC)). Within the fields newly drilled production wells 147, 154, 157, 410, 423, 428, 460, 461, 463, 464 according to the GIS interpretation data in the section deposits of the Paleogene system are allocated to the reservoir with unclear saturation patterns. Oil was obtained in well 428 during the perforation of Paleogene deposits in the depth range of 124-125, 127-131 m. a sample was taken to determine the physical and chemical properties and fractional composition of oil and dissolved gas.

The Cenomanian productive horizon is opened by all the wells drilled. The eponymous oil field is associated with this horizon. Oil content is associated with basal sand beds at the base of the Cenomanian tier of the upper Cretaceous within the southern, Northern and Western wing fields. The cover of the Deposit is dense Cenomanian clays aged over an area of.

Cenomanian oil field of the South field of the West wing.

On the structural map on the roof of the reservoir, the Deposit is a brachianticlinal fold, elongated in the meridional direction and bounded from the East by discharges F3, F2.

Reservoirs are almost ubiquitous, with the exception of some areas where there is a lithological replacement of sandstones with impermeable rocks in the North (area well.23), North-West (area well.13, 15, 17), North-East (area well. 14, 127).

The oil content of the Cenomanian horizon at the exploration stage was determined based on the results of testing 8 wells (1, 3, 4, 7, 8, 22, 24, 26), in which waterless oil inflows were received. Oil production rates ranged from 0.61 to 5.6 m^3 / day.

Operation of the Cenomanian horizon of the southern field began on January 3, 1994.

In 2005, an updated development project was drawn up, and in 2007, a project for additional exploration of the field was drawn up. According to these projects, 48 wells were drilled for the Cenomanian Deposit within the oil content contour.

For production wells 438 and 427, the maximum average daily oil flow rates were obtained-10.5 m^3/day and 10.3 m^3 / day, while the water cut was 21.6% and 40.1%, respectively.

In the South of the Deposit, according to GIS data in well 61, the sole of the perforated oil-saturated reservoir is recaptured at -542.2 m, and the roof of the water-saturated reservoir at -546.8 m. in well R2, the water-saturated reservoir begins at -544 m.

In the South-West of the Deposit in wells 441, 438 in the perforated formation, according to GIS data, the water-oil section was recaptured at the level of -545.2, -545.0 m, respectively. In well 40, the water-saturated reservoir starts at -545.2 m.

In the North-West of the Deposit in wells 407, 401 in the perforated formation, according to GIS data, the water-oil section was recaptured at the level of -544.9, -545.0 m, respectively.

During the period from 2012 to 01.07.2014 6 wells were drilled at the field 137, 138, 144, 146, 150, 151. In well 138, according to GIS data, the bottom of the oil-saturated reservoir reaches -542.5 m, and the water-saturated reservoir begins at -545.7 m. Wells 137, 150, 151 opened only water-saturated layers and are located behind the oil-bearing contour.

In this work, after the Author's supervision, 6 production wells were drilled in the southern field according to the Updated project for the Cenomanian Deposit 410, 423, 428, 460, 464, 465. In these wells, when testing this horizon, oil inflows with a density of 0.96 g/cm3 were obtained.

In well 428 with perforation of the interval 505-508 (- 528.4-531.4) m, the oil flow rate was 10.8 t/day, water-4.8 m3/day, in well 460 from the perforation intervals 506-508,5, 510,2-512,2 (-528,8-531,3, -533-535) m received oil with a flow rate of 13.3 t / day, water with a flow rate of 7.1 m3 / day. at a speed of 60.

In well 464 with perforation of the interval 514-521 (- 534-541) m, the oil flow rate was 5.9 t/day, water-4.4 m3/day, in well 465 from the perforation intervals 519-522, 523-526 (-539,4-542,4, -543,4-546,4) m at 20 revolutions obtained oil 6,3 t / day., water 1,1 m3/day.

In well 410, with perforation of the interval 512-515 (- 533.7-540.7) m, the oil flow rate was 8.8 t/day, water – 6.8 m^3/day, in well 423, oil 3.2 t/day was obtained from the perforation interval 510-514 (-531.5-535.5) m, and water 7.7 m^3 / day.

The Deposit was additionally opened by 5 production wells 142, 153, 154, 155, 157 drilled to the aptsky horizon.

According to GIS data, all wells are located in the oil content contour. In wells 153, 410, 423, 428, the soles of oil - saturated reservoirs were repelled at -540.2, -542.8, -544.7, -542.9 m, and the roofs of water-saturated reservoirs-at -541.1, -546.4, -547.7, -546.9 m, respectively. In wells 142, 155, 460, 464 and 465, the oil-water section is set at -546.7, -544.8, -546.8, -543.8 and -546.9 m, respectively.

Taking into account these data, the position of the OWC was clarified and the range of changes in the marks was-541-547 m, which in was adopted at -545 m

The Cenomanian oil reservoir of the North field and the West wing. On the structural map along the roof of the reservoir, the Deposit is a brachianticline fold bounded to the East by the F2 discharge.

The productivity of the Deposit was established by exploration wells 32, 33, 49.

In well 32, when testing the interval 491-494 (-512.4-515.4) m, an inflow of pure oil with a flow rate of 7.2 m^3/day was obtained. According to the GIS interpretation, the bottom of the oil-saturated reservoir is marked at the absolute level of -525 m.

In well 33, when testing the interval 499-502 (-520.1-523.1) m, an inflow of water with oil was obtained. According to the GIS reinterpretation, the oil – saturated reservoir in the well was recaptured to the level of -527.6 m, and the water-saturated reservoir-from the level of -533.1 m.

Well 49 at the perforation of the interval 497-499 (- 518.6-520.6) m began to work with water and oil. At an excess pressure of 7.5 atmosphere, the daily oil flow rate was 0.73 m^3. According to GIS data in the well, the bottom of the oil-saturated reservoir is repelled at the level of -524.4 m.

In the work on the Cenomanian horizon of the Northern field, the initial position of the WNC was justified at -528 m, along the bottom of the tested formation in well 33.

According to production wells 461, 462, and 463 were drilled at the ISP (K2c) development facility and are located in the oil zone.

In well 461, with perforation of the interval 495-504 (- 516.5-525.5) m, the oil flow rate was 13.2 t/day, water – 3.2 m^3/day. (speed 42), in well 462 from the interval 493.5-501 (-514.7-522.2) m, oil was obtained with a flow rate of 2.8 t / day. water – 13.1 m^3/day. (speed 30). In well 463, with a perforation interval of 491.5-500 (-511.6-520.1) m, the oil flow rate was 9.2 t / day, water-2.4 m^3 / day. (speed 30). All three wells were commissioned in January 2015.

According to GIS data in wells 461, 462 and 463, the bottom of the oil-saturated reservoir is repelled at -529.8, -529.4 and -528.2 m, respectively. Taking into account these data, the OWC is taken at the level of -530 m, which is 2 m lower than the previous OWC in the work.

The reservoir type is Plast, arched, and tectonically shielded from the East.

Table 1 – Characteristics of the Kara-Arna Field.

Horizon	Wing	Type of reservoir	The character of saturation reservoir	OWC at the absolute mark, M	Height of the reservoir, m	Productivity area, thousand m^2
K_2c (cenomanian)	West wing, South field	waterflow, tectonically shielded	Oil	-541-547	27	6380
K_2c (cenomanian)	West wing, North field	Plast, vaulted, tectonically shielded	Oil	-530	17	1291
K_1al_1 (lower Albian)	West wing, South field	Plast, vaulted, lithologically and tectonically shielded	Oil	-1007-1013	27	3668
K_1al_3 (upper Albian)	East wing	waterflow, tectonically shielded	Oil	-503	16,4	277
K_1al_3 -A (upper Albian)	Graben, South field	Plast formation, tectonically screened	Oil	-730,6	-	-
K_1a (Aptian)	West wing, South field. The main body	Plast, arched, tectonically screened	Oil	-1101-1104	35	6491
	West wing, South field Eastern block	plast, arched, tectonically - shielded	Oil	-1099	16	891
K_1a (Aptian)	West wing, North field	Plast, vaulted, tectonically shielded	Oil	-1058-1064	19	475
K_2t (Turanian)	Graben	underlying water, lithologically, tectonically - shielded	Oil	-660,4	50,4	123

Albian productive horizons. The lower Volga oil field within the southern field of the Western wing and the upper Albian deposits within the Eastern wing and the southern field of the Graben are confined to this horizon (well.R-8).

The lower Albian oil field of the South field of the West wing is confined to the brachianticline fold, stretched in the meridional direction, and shielded from the East by F3 and F2 discharges.

Based on the results of GIS interpretation in wells 55, 74, 124, 92, 123, 91, 122, 115, 90 the layers are replaced by clay rocks, and the Deposit is divided into two parts by the zone of absence of reservoirs. In addition, the zones of absence of reservoirs are allocated in the North-Eastern part of the Deposit in the area of well 11 and in the southern part - the area of well 79.

The productivity of the Deposit was established by testing exploration wells 1, 2, 4, 5, 6, 10, 16, 30. When testing these wells, the flow rate of anhydrous oil at the 7 mm fitting varied from 12.1 (well.30) to 59.5 m^3/day. (well. 6).

In wells 15, 16, 140, 141, 143 and 145, according to GIS data, the oil-water section is recaptured at -1007.7, -1009.5, -1009.1, -1007.4, -1008.1 and -1007.9 m, respectively.

Taking into account these data, when recalculating reserves, the OWC was taken in the range of marks-1107-1111 m.

Exploitation of the lower Albian horizon of the southern field began in 1972 with a single well 4. More intensive development of the Deposit began in 1987.

Production wells 137, 138, 144, 146 were drilled according to the work on the II - object of development. Of these, wells 137 and 146 are located in the pure oil zone, wells 138 and 144 are located in the water-oil zone.

In well 138 from 19.02-22.02.2013, when perforating the interval 981-986 m (-1000.3-1005.3), an oil inflow was obtained with an initial flow rate of 7.1 t/day. According to GIS data, the oil-water section was recaptured at -1008.2 m.

In well 144, the oil-water section is recaptured at the level of -1012.7 m, which is almost 2 m lower than the accepted OWC.

In wells 137 and 146 located in the pure oil zone, the bottom of the oil is recaptured at -1007.5 m and -1007.2 m.

Wells 150, 151 drilled after work on the third object of development, were behind the oil content contour, according to GIS data, the roof of the water-saturated reservoir is marked at -1009.7 m and -1016.8 m, respectively.

After the Author's supervision production wells 142, 153, 154, 155, 157 drilled at III(K1A) - the object of development, opened the lower Albian Deposit.

According to GIS data, wells 154, 155, and 157 are located in the pure oil zone, and the bottom of oil-saturated reservoirs is repelled at -1006.4, -1006.5, and -1007.9 m, respectively. In well 153, the oil-water section is set at -1009.8 m, in well 142, the bottom of the oil-saturated reservoir reaches -1011.4 m, and the roof of the water-saturated reservoir begins at -1014.5 m[3].

2 Composition and physical and chemical properties of oil, gas and water

The depth of the roof of productive horizons is in the range of 467-1046 m (according to other data, the dome is submerged at 1800 m). The height of the deposits is 15-30 m. Deposits are Plast, vaulted. The section of the productive reservoir thickness is pore. Open porosity of 27.2-30.2 %, permeability of 0.215-1.605 mm^2, oil-saturated thickness of 3.5-8.5 m, oil-saturation coefficients vary from 0.72 to 0.95. The gas factor is 7.4—9.8 m^3/t. Initial reservoir pressure is 5.0-11.5 MPa, temperature is 32.5-40°C. The density of oil is 964 kg / m^3. Sulphurous oil 2.28-2.8 %, low-paraffin oil 0.18-0.61 %. Associated gas contains methane-88.9 %, pentane-1.3 %, nitrogen-8.65-12.2 %, carbon dioxide-0.41 %. The mode of operation of deposits is water-pressure. Formation chlorocalcium waters with a density of 1078-1105 kg / m^3 and a mineralization of 104-156, 2 g / l.

The highest-grade, heavy oil in the Ural-Emben region of Kazakhstan.

Table 2 -Physical and chemical properties and fractional composition of oil

Name		West wing. South field			
		Paleogene horizon	Cenomanian horizon	Upper Albian horizon	Lower Albian horizon
		Average	Average	Average	Average
Dynamic viscosity, MPa*s					
At 20 ^{o}C		535,47	587,25	328,19	406,66
50 ^{o}C		-			-
Kinematic viscosity, mm^2/s					
At 20 ^{o}C		555,93	610,31	345,19	421,81
50 ^{o}C		74,74	78,86	52,85	55,90
Density, kg/m^3		963,2	962,1	950,8	962,5
pour point, ^{o}C		ниже -20	-24	-21	-28
Mass content, %	Sulfur	2,37	2,56	2,21	2,42
	Silica gel resins	12,42	23,19	19,11	10,09
	Sulphuric acid resins	-	39,39		41,04
	Asphaltenes'	1,45	3,71	1,60	2,03
	Paraffins'	1,06	0,54	0,51	0,57
	Water	3,60	38,60	16,92	37,00
	mechanical Mixtures	Отс	0,12	0,01	0,23
Salt content, мг/л		84,70	20474,30	186,23	1648,85
Melting point of paraffin, ^{o}C		-	55	56	58
Volume output of fractions, %		-	244	249	185
	up to 250 ^{o}C	-	1	1	4
	up to 300 ^{o}C	21	16	18	23
	up to 350 ^{o}C	-	-	-	46

Continuation of the table

Name		West wing. North field			East wing
		Aptian horizon	Cenomanian horizon	Aptian horizon	Upper Albian horizon
		Average	Average	Average	Average
Dynamic viscosity, MPa*s					
at 20 °C		437,38	582,64	529,15	570,14
50 °C					-
Kinematic viscosity, mm^2/s					
at 20 °C		454,40	605,67	547,70	630,18
50 °C		61,29	74,14	72,63	77,97
Density, kg/m^3		961,1	961,9	965,2	966,3
pour point, °C		-22	-23	-20	-27
Mass content, %	Sulfur	2,48	2,22	2,95	2,51
	Silica gel resins	6,92	11,17	19,24	-
	Sulphuric acid resins	41,17	44,00	34,00	24,80
	Asphaltenes'	2,06	1,54	3,78	-
	Paraffins'	0,75	1,32	0,88	0,39
	Water	16,20	0,48	31,48	-
	mechanical Mixtures	0,15	0,24	0,36	-
Salt content, мг/л		3609,01	328,01	25945,05	-
Melting point of paraffin, °C		54	-	55	54
Volume output of fractions, %		228	252	247	240
	up to 250 °C	2	3	0	5
	up to 300 °C	21	19	17	20
	up to 350 °C	45	41	-	-

Data on studies of the composition and properties of reservoir fluids were previously summarized in. After compiling this report, three depth samples were taken from the R-8 well from depths of 300 m, 350 m and 400 m. Samples characterize the reservoir oil of the upper Albian horizon of the southern field of the West wing, which was not previously sampled. The sample from a depth of 400 m contained water with traces of oil, the other two samples were examined. They were used to determine the parameters of reservoir oil, properties and composition of degassed oil, as well as the composition of the released gas. The research was carried out in the research Institute "Kaspioilandgas"LLP.

The properties of degassed oil were supplemented with data on 23 samples from 21 wells. Of these, 22 samples were taken from the wellhead and one was obtained after degassing a deep sample from the R-8 well (the lower Albian Deposit of the South field of the West wing). The new samples allowed us to determine the properties of previously unexplored deposits of the Paleogene and upper Albian horizons of the southern field of the West wing and to Supplement the previously available data on the remaining horizons. Surface oil samples were studied in the organizations of "SPC ECO Analyst" LLP, "Kaspioilandgas" research Institute LLP and "Kaznigri" LLP in accordance with the General technical conditions for oil

The composition of the oil gas was supplemented with two samples from the R-8 well (the lower Albian Deposit of the South field of the West wing).

Also, one sample of reservoir water was taken from the R-8 well, which also characterizes the lower Albian Deposit of the South field of the West wing. The water sample was examined in Kaznigri LLP according to the current methods[2].

2.1 Analysis of reservoir fluids

The properties of oil in reservoir conditions were studied using 16 deep samples oil, selected from 12 wells, of which 14 were selected for the southern field, 1 for North field of the West wing and 1-on the East wing of the structure. South field of the West wing. The properties of reservoir oil are determined by Cenomanian, upper Albian, lower Albian, and Aptian horizons. Their gas content was 3.02-8.04 m^3/ t, saturation pressure 0.59-2.99 MPa at reservoir pressures of 5.25-11.30 MPa. Volume coefficient on average for horizons changes from 1.018 to 1.043 d. units. The density in reservoir conditions was 926.9-936.0 kg / m^3, the viscosity is 56-356 MPa*s. On the North field and the West wing are investigated oil Aptian horizon at one sample. The gas content and saturation pressure are slightly lower than for Aptian deposits of the southern field and are equal to 5.80 m^3/t and 2.10 MPa. The volume coefficient is 1.022 d. units, density-938.0 kg / m^3, viscosity – 89 MPa*s.

On the Eastern wing, one sample was taken from the upper Albian horizon. Oil it differs from other oil deposits by an even lower gas content (1.30 m^3/t) and saturation pressure (0.22 MPa), as well as higher density and viscosity in formation conditions (956.0 kg / m^3 and 373 MPa*s). The volume coefficient was only 1,011 d. units.

For all deposits, reservoir oils are under-saturated with gas, heavy and high-viscosity with low values of gas content and volume coefficient. The physical and chemical characteristics of oil under surface conditions were studied by

110 samples from 74 wells, of which 93 samples were taken from the South field of the West wing, on the North field of the West wing-12 samples, on the East wing-3 samples and on

The Graben – 2 samples.

South field of the West wing. Paleogene, Cenomanian oil, the upper Albian, lower Albian and Aptian horizons are bituminous, with a density of 950.8-963.2 kg / m^3 , high-viscosity – 328.19-592.38 MPa*s at 20oC. Paraffin content low and is only 0.51-1.06 %. Resin content above: silica gel resin – 7.51-22.73 %, sulphuric acid-39.39-41.17 %, the content of asphaltenes was 1.45-3.60 %. The content of sulfuric acid resins is higher than that of silica gels. By mass the content of oil components is high-sulfur (2.21-2.56%).

Cenomanian and Aptian oil was studied in the Northern field of the West wing horizons. Both oil horizons are similar in their characteristics: bituminous (according to ST RK 1347-2005 " Oil. General specifications») and high-viscosity, he density at 20 ^oC was 962.2 kg / m^3 and 965.2 kg / m^3 accordingly, dynamic the viscosity at 20 ^oC is 567.26 MPa*s and 529.15 MPa*s. By mass content oil components are high-sulfur (2.33-2.95%), resinous according to Cenomanian (resin silica gel 11.86 %, asphaltenes 1.61 %) and high-resinous on the Siberian horizon (silica gel resins 19.24 %, asphaltenes-3.78 %), low-paraffin (1.52 % and 0.88 %). The pour point is -21 ^oC and -20 ^oC. Oil of the North field of the West the wings are characterized by a high boiling point-247-252 ^oC, at 17-20% boil up to 300 OS and 41 % - up to 350 OS.

The degassed oil of the upper Albian horizon of the Eastern wing is similar to West wing oil and is also bituminous (according to ST RK 1347-2005) at a density of 966.3 kg / m^3 and high-viscosity at a dynamic viscosity of 570.14 MPa*s. The content of paraffins is slightly lower and amounted to 0.39%, the content of silica gel resins and asphaltenes are not defined, sulfuric acid resins-24.80%. Mass the average concentration of sulfur is 2.51%, and the pour point is 27^oC. The point of beginning the boiling point corresponds to 240 ^oC. The yield of fractions boiling up to 300 ^oC was 20% by volume. Low-paraffin oil, high-sulfur.

The oil properties of Graben deposits were studied by two deep samples from the deposits K1al3-A and K1al3-B. The properties of oil are similar to those of the Western and Eastern wings, it belongs to bituminous, with an average density of 947.9 on the upper Albian horizon kg / m^3. The dynamic viscosity at 20^oC was 314.58 MPa * s, the oil is highly viscous. The content of paraffins was 1.15 %, resinous substances-10.65 %, sulfur-2.0 %. the fractional composition of oil is slightly lighter than the oil of other deposits. Temperature the boiling point is equal to 246 ^oC, the content of fractions boiling up to 300^oC was 26 %.

The study of the properties of gas dissolved in oil was carried out on 6 samples, from of which one is selected from the Cenomanian, one from the lower Albian, two each from the Aptian and upper Albian horizons of the South field of the West wing. On the North field

The West wing, East wing, and Graben were not examined for gas.

The gas in all the studied deposits is characterized by a light composition, and in it is mainly composed of methane, and all samples have a noticeable content nitrogen. Concentrations of ethane and heavier components vary from insignificant until you're completely absent. The lightest was the dissolved gas of verkhnealbsky horizon, consisting of 93.69% methane and 5.32% nitrogen, relative density by air was 0.590 d. units. The Cenomanian horizon contains methane, nitrogen, and the relative densities were 91.31%, 8.09% and 0.592 d. units, respectively, according to lower Albian horizon-82.60%, 12.20% and 0.596 d. units, on the Aptian horizon-88.86% , 8.74% , and 0.647 ad units[1].

2.2 Properties of oil in reservoir conditions

At the time of writing, the number of deep oil samples is 16 samples from 12 wells, of which 14 were selected for the South field, 1 for the North field of the West wing, and 1 for the East wing of the structure. For the first time, the characteristic of reservoir oil of the upper Albian horizon of the southern field of the West wing is given.

The average reservoir properties of reservoir oil are shown in.

For all deposits, reservoir oils are similar in properties and are under-saturated with gas, heavy and high-viscosity with low values of gas content and volume coefficient.

South field of the West wing. The properties of reservoir oil are determined by the Cenomanian, upper-Albian, lower-Albian and Aptian horizons. The gas content for them was 3.02-8.04 m^3 / t, the saturation pressure was 0.59-2.99 MPa at reservoir pressures measured at the sampling depth equal to 5.25-11.30 MPa, that is, the oil is under-saturated with gas. The volume coefficient on average over the horizons varies from 1.018 to 1.043 d. units. The density in reservoir conditions was 926.9-936.0 kg / m^3, the viscosity was 56-356 MPa*s. At the same time, the highest gas content and saturation pressure is found in the oil of the Aptian horizon, and the lowest – in the upper Albian. The oil of the Aptian horizon is also the least viscous, and the Cenomanian horizon has the highest viscosity. Thus, the gas content increases with the depth of occurrence, the other properties change in accordance with the gas content. The dependence of the properties of reservoir oil on the area of deposits is not traced.

The North field of the West wing was used to study the oil of the Aptian horizon in one sample. The gas content and saturation pressure are slightly lower than for the aptskaya Deposit of the southern field and are equal to 5.80 m^3 / t and 2.10 MPa. The volume coefficient was 1.022 d. u., density-938.0 kg / m^3, viscosity-89 MPa*s.

On the Eastern wing, one sample was taken from the upper Albian horizon. It differs from other oil deposits by its even lower gas content (1.30 m^3 / t) and saturation pressure (0.22 MPa), as well as by its higher density and viscosity in reservoir conditions (956.0 kg/m^3 and 373 MPa*s). The volume coefficient was only 1.011 d. units[2].

2.3 Properties and composition of decomposed oil

In this paper, laboratory studies of the physical and chemical characteristics of oil under surface conditions were studied on 102 samples from 66 wells, including 90 samples from the southern field of the West wing, 9 samples from the Northern field of the West wing, and 3 samples from the Eastern wing. One sample from well 15 (aptskaya Deposit of the South field of the West wing) was rejected due to sharply different values of density and viscosity from the other samples.

After compiling the work 23 new samples from 21 wells were studied.

South field of the West wing. The oils of the Paleogene, Cenomanian, upper Albian, lower Albian and Aptian horizons of the Cretaceous deposits are similar in their properties, slightly lighter than the rest of the oil of the upper Albian horizon. Below is a description of the characteristics of oil in the average horizon.

Bituminous oils (according to ST RK 1347-2005), with a density of 950.8-963.2 kg/m^3, have a very high viscosity – 328.19-587.25 MPa*s at 20^{o}C. The paraffin content is low and is only 0.51-1.06 %. The content of resins is higher: silica gels – 6.92-23.19 %, sulfuric acid-39.39-41.17 %, the content of asphaltenes was 1.45-3.71 %. The content of sulfuric acid resins is usually higher than that of silica, since not only resinous substances react with sulfuric acid, but also partially asphaltenes and some high-molecular oil hydrocarbons. Their high content in General indicates a weighted composition of oil. Low paraffin content and high resin content are caused by low oil pour points-on average from -20 ^{o}C to -28 ^{o}C. The mass content of oil components is high-sulfur (2.21-2.56 %). The fractional composition of oil indicates a low content of light fractions, since the boiling point is at a high level-185-249 ^{o}C. The volume content of light fractions boiling up to 300 ^{o}C was 16-23 %, and up to 350 ^{o}C 45-46 %.

The oils of the Cretaceous horizons of the South field of the West wing are classified as bituminous, high-viscosity, low-paraffin, from resinous to high-resinous, high-sulfur.

Oil from the Cenomanian and Aptian horizons was studied along **the Northern field of the Western wing.** Both oil horizons are also similar in their characteristics: bituminous (according to ST RK 1347-2005) and high-viscosity, the density at 20 ^{o}C was 961.9 kg / m^3 and 965.2 kg/m^3, respectively, the dynamic viscosity at 20 ^{o}C was 582.64 MPa*s and 529.15 MPa*s. According to the mass content of oil components, they are high-sulfur (2.22-2.95%), resinous in the Cenomanian (11.17% silica resins, 1.54% asphaltenes) and high – resinous in the Aptian horizon (19.24% silica resins, 3.78% asphaltenes), low-paraffin (1.32% and 0.88 %). The pour point is -23oC and-20 ^{o}C. Oil also has a high boiling point-247-252 ^{o}C, 17-19% boils up to 300 ^{o}C and 41% - up to 350 ^{o}C.

The degassed oil of the upper Albian horizon of **the Eastern wing** is similar to the oil of the Western wing and is also bituminous (according to ST RK 1347-2005) at a density of 966.3 kg / m^3 and highly viscous at a dynamic viscosity of 570.14 MPa*s. The content of paraffins is slightly lower and amounted to 0.39 %, the content of silica gels and asphaltenes is not determined, and the content of sulfuric acid resins is 24.80 %. The average mass concentration of sulfur is 2.51 %, and the pour point is 27 ^{o}C. The boiling point corresponds to 240 ^{o}C. The yield of fractions boiling up to 300 OS was 20 % by volume. Low-paraffin oil, high-sulfur[2].

2.4 Composition and properties of gas dissolved in oil

The properties of gas dissolved in oil were studied using 6 samples, one of which was taken from the Cenomanian, one from the lower Albian, two from the Aptian, and two more from the upper Albian horizons of the southern field of **the West wing.** The gas was not studied in the North field of the West wing, the East wing, and the Graben. After work, two samples from the R-8 well were examined.

The gas in all the studied deposits is characterized by a light composition and mainly consists of methane, as well as a noticeable nitrogen content was found in all the samples. Concentrations of ethane and heavier components vary from insignificant to completely absent.

The lightest was the dissolved gas of the upper Albian horizon, consisting of 93.69% methane and 5.32 % nitrogen, with a relative density of 0.590 d. u. For the Cenomanian horizon, the content of methane, nitrogen and relative density were 91.31 %, 8.09 % and 0.592 d. units, respectively, for the lower Albian horizon-82.60 %, 12.20 % and 0.596 d. units, for the Aptian horizon-88.86 %, 8.74 % and 0.647 d. units.

Of the inorganic components, the nitrogen content is the highest, while the content of the other components, including hydrogen sulfide, ranged from insignificant to non-existent. A small admixture of hydrogen was detected from samples from the lower Albian horizon, and carbon monoxide was detected from the Aptian horizon. These components are usually not contained in natural gases, as they are products of incomplete oxidation of hydrocarbons[2].

2.4 Properties and composition of reservoir water

The properties and composition of reservoir water in the productive horizons of the field were studied using 21 samples from 20 wells in the South field of the West wing and 2 samples from 2 wells in the North field. The data previously available were supplemented with 10 samples from 9 wells. According to new data determined the composition of water in the Aptian horizon North field, verhnelenskoe horizon South fields of the West wing and expanded the data on Cretaceous horizons of the South field.

On **the Cenomanian horizon** of the southern and Northern fields, water is similar in composition. In the southern field, the water salinity was 107.5 g / l, and the density was 1090 kg / m^3. Type of water chlorelly, the ionic composition of sodium chloride. The content of bicarbonates was 2.36 mol / m^3 (143.7 mg/l), and sulphates – 3.76 mol/m^3 (360.9 mg/l). In the Northern field, the water salinity is 102.5 g / l, the density is 1077 kg / m^3. The content of hydrocarbonates is also lower- 0.60 mol / m^3 (36.6 mg / l), there are no sulfates.

The upper Albian horizon is characterized for the first time by the southern field of the West wing. Water of the chlorocalcium type with a mineralization of

126.4 g / l and a density of 1095 kg / m^3. The content of sulfates and bicarbonates is insignificant, the content of calcium prevails over magnesium.

Along the **lower Albian horizon** of the southern field of the Western wing, water is also highly mineralized (137.5 g / l), of the chlorocalcium type, with a density of 1106 kg/m^3. The water differs from other horizons in its high content of sulfate ions-on average 8.88 mol / m^3 (852.3 mg/l).

The water of **the Aptian horizon** is similar in salt composition in the southern and Northern fields of the Western wing: the total salinity averaged 143.4 g/l and 166.2 g/l, and the density was 1111-1133 kg / m^3, respectively. According to V. A. Sulin, water belongs to the chlorocalcium type and differs in low content of hydrocarbonates-1.21-2.41 mol/m^3 (73.9-147.1 mg/l) and higher content of sulfates – 5.12-10.83 mol/m^3 (383.83-491.5 mg/l)[2].

3 Characteristics of the enterprise as a source of atmospheric pollution

The development process of the Kara-Arna field will be accompanied by emissions of pollutants into the atmosphere during:

- Well construction;
- arrangement of well sites;
- production, transportation and preparation of hydrocarbon raw materials.
- Air pollution is assumed to result from the release of:
- dust in the course of construction and installation works (digging trenches, collapsing the fuel platform, transporting soil, etc.);
- exhaust gas when the internal combustion engine is running;
- light fractions of hydrocarbons from process equipment (drainage tanks, separators, oil reservoirs, pumps and shut-off and control equipment);
- products of gas combustion (heaters) of oil.

Both organized and unorganized sources of emissions will operate during the field operation.

3.2 The calculation of the emissions of pollutants

The calculation of emissions –of pollutants was carried out in accordance with the following regulatory and methodological documents approved in the Republic of Kazakhstan:

- "Collection of methods for calculating emissions of pollutants from various industries", Almaty 1996;
- "Method for calculating emissions of pollutants into the atmosphere from stationary diesel installations", RND 211.2.02.04-2004 Astana, 2004;
- "Instructions for inventory of emissions of harmful substances into the atmosphere (RND 211.1.02.03-97);
- "Instructions for regulating emissions of pollutants into the atmosphere", etc.

Table 3 - Estimated atmospheric emissions from oil storage tanks by year

Code	The name of the emissions of pollutants	Emissions					
		2016 y.		2017 y.		2018 y.	
		g/s	t/year	g/s	t/year	g/s	t/year
0415	Hydrocarbons C1-C5	1,2212	1,3200	1,2212	1,2257	1,2212	0,4984
0416	Hydrocarbons C6-C10	0,4537	0,4893	0,4527	0,4544	0,4537	0,1847
0602	Benzene	0,0059	0,0064	0,0059	0,0059	0,0059	0,0024
0621	Toluene	0,0037	0,0040	0,0037	0,0037	0,0037	0,0015
0616	Xylene	0,0019	0,0020	0,0019	0,0019	0,0019	0,0008
	Total	1,6854	1,8217	1,6854	1,6916	1,6854	0,6878

3.3 Measures to reduce air emissions

Reduction of emissions and reduction of their ground-level concentrations is provided by a complex of planned, technological and special measures.

Technological measures include the use of the latest technological equipment, advanced production technologies, including:

1. Tanks are equipped with breathing valves that prevent significant losses of hydrocarbons.

2. the strength and tightness of technological devices and pipelines is Ensured.

3.a system of automation and remote control has been Implemented and is in operation.

4. scheduled preventive repairs and prevention of technological equipment are Carried out.

5. Harmful and explosive processes are located in separate rooms and in open areas.

The company regularly conducts activities aimed at improving the technological safety of work at wells and industrial sites:

- monitoring of reservoir pressure and production volume;
- periodic monitoring of pipeline tightness;
- periodic inspection of the technical condition of the tank farm;
- storage of chemicals in specially equipped places and strict compliance with safety regulations when working with them;
- equipment of all pipelines with check valves;
- availability of an emergency set of tools and technical means for dealing with emergencies at each industrial site;
- development of an action plan for the prevention and elimination of accidents at the facility;
- equipment of reservoirs with local warning and alarm systems;
- training of service personnel to act in an emergency, etc [3].

CONCLUSION

This diploma project identified the tectonic structures and oil and gas potential of the Kara-Arna field and analyzed the physical and chemical properties of oil and gas. As the annotation says, I think that I have completely covered the all 3 parts. Using lithology and stratigraphic characteristics for this field, a stratigraphic column was constructed and a graph of the physical and chemical properties of oil and gas was constructed using all the data found about the Kara-Arna field.

In economic terms, the area is favorable, with a developed oil industry infrastructure. The district includes:

- Central Asia – Center gas pipeline;
- Tengiz - Kulsary – Atyrau - Novorossiysk oil pipeline;
- Uzen - Kulsary - Atyrau - Samara oil pipeline;
- Astrakhan-Mangyshlak water pipeline

Kara Arna’s plan for further drilling: to increase the technical and economic efficiency of the development by combination of operational facilities and implementation at the same time, by means of special equipment for monitoring and regulating the process in wells it is provided simultaneously-separate operation.

Provided at the main facilities for optimization and strengthening the current system of Reservoir pressure maintenance with near-circuit flooding by transferring 4 mining companies wells for water injection after working them off for oil. It also considers geological and technical measures aimed at rehabilitation of the existing well stock. These are conclusions from inaction, transfers to other objects, the use of simultaneously-separate operation technology, conclusions from liquidation, conservation, transfers of wells to other categories, isolation of watered intervals, capital and underground repairs of wells etc are Planned various geological and technical measures in the amount of 40 works by major well repairs annually.

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2 Дополнение №2 к уточненному проекту разработки месторождения кара-арна (по состоянию на 01.06.2015 г.) Книга I

3 Дополнение №2 к уточненному проекту разработки месторождения кара-арна (по состоянию на 01.06.2015 г). Книга II

Протокол анализа Отчета подобия

заведующего кафедрой / начальника структурного подразделения

Заведующий кафедрой / начальник структурного подразделения заявляет, что ознакомился(-ась) с Полным отчетом подобия, который был сгенерирован Системой выявления и предотвращения плагиата в отношении работы:

Автор: Орынбасарова Айнұр Ағанасқызы
Название: Тектоническое строение, нефтегазоносность и анализ физико-химических свойств и состава нефти и газа место-рождения Кара Арна

Координатор: Диляра Урманова
Коэффициент подобия 1:0,1
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Замена букв:3
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☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное количество вызывает сомнения в отношении ценности работы по существу и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь отредактирована с целью ограничения заимствований;
☐ обнаруженные в работе заимствования являются недобросовестными и обладают признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, работа не допускается к защите.

Обоснование:
Работа выполнена самостоятельно и не несет элементов плагиата. В связи с этим, работа признается самостоятельной и допускается к защите.

24.05.2020
Дата

Подписано цифровой подписью: Енсепбаев Т.А.
Дата: 2020.05.27 14:22:31 +06'00'

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Подпись заведующего кафедрой / начальника структурного подразделения

Окончательное решение в отношении допуска к защите, включая обоснование: *Дипломная работа допускается к защите.*

24.05.2020
Дата

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Протокол анализа Отчета подобия Научным руководителем

Заявляю, что я ознакомился(-ась) с Полным отчетом подобия, который был сгенерирован
Системой выявления и предотвращения плагиата в отношении работы:

Автор: Орынбасарова Айнұр Ағанасқызы
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Замена букв:3
Интервалы:0
Микропробелы:0
Белые знаки: 0
После анализа Отчета подобия констатирую следующее:
☑ обнаруженные в работе заимствования являются добросовестными и не обладают
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защите;
☐ обнаруженные в работе заимствования не обладают признаками плагиата, но их чрезмерное
количество вызывает сомнения в отношении ценности работы по существу и отсутствием самостоятельности ее автора. В связи с чем, работа должна быть вновь
отредактирована с целью ограничения заимствований;
☐ обнаруженные в работе заимствования являются недобросовестными и обладают
признаками плагиата, или в ней содержатся преднамеренные искажения текста, указывающие на попытки сокрытия недобросовестных заимствований. В связи с чем, не
допускаю работу к защите.

Обоснование: *Работа выполнена самостоятельно и не несет элементов плагиата. Обнаруженные в работе заимствования являются добросовестными. В связи с этим, признаю работу самостоятельной и допускаю ее к защите перед государственной комиссией.*

24.05.2020

Дата *Подпись Научного руководителя*

MINISTRY OF EDUCATION AND SCIENCE OF THE REPUBLIC OF KAZAKHSTAN

Kazakh National Research Technical University named after K. I. Satpayev

REVIEW

of the diploma work

Student Orynbassarova Ainur Aganasovna
Specialty 5B070600 – Geology and exploration of mineral deposits
Institute of Geology, Oil and Mining named after K. Turysov
Department of Petroleum Geology
Title of the diploma work Tectonic structure, oil and gas potential and analysis of physicochemical properties of oil and gas of the Kara arna field.

Scientific adviser: master of technical sciences, lecturer Urmanova D. E.

The diploma work of Orynbassarova Ainur Aganasovna written on a relevant topic "Tectonic structure, oil and gas potential and analysis of physicochemical properties of oil and gas of the Kara arna field."

The main goal of student Orynbassarova A. A. was: to identify tectonic structure, oil and gas potential and to analyze the physicochemical properties of oil and gas of the Kara Arna field.

The diploma work is developed based on the analysis of a large number of specialized literature and in accordance with current methodological recommendations and normative legal acts established by the legislation of the Republic of Kazakhstan.

The diploma work describes the general, geological and lithologycal characteristics of the area, tectonic structures, oil and gas content, lithology and stratigraphic column. Analyzed the physical and chemical properties and composition of the oil. Also the ways to calculate the emissions of pollutants into the environment and atmosphere and measures to reduce them were considered.

The work was carried out rhythmically and in accordance with the calendar schedule. Graphic material is designed carefully and in accordance with the requirements of the organization's Standard "General requirements for the construction, presentation, design and content of standards", ST RK 1.2-2013GSTR RK. ST KazNRTU – 09 – 2017.

The diploma work of Orynbassarova A. A. corresponds to the technical task and is characterized by a deep study of the topic and is made with the use of modern progressive technologies.

I believe that Orynbassarova A. A. has applied the methodology, types and volumes of geological and lithological work to build a stratigraphic column of that field, prepared for independent work in the specialty 5B070600– Geology and exploration of mineral deposits.

Scientific adviser:  master of technical sciences, lecturer Urmanova D.E.