

Coal Deposits Adjacent to the Karaganda Basin

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Abstract. The purpose of the article is to study the features of coal deposits adjacent to the Karaganda basin. In terms of the geological structure, the Verkhne-Sokursky coal-bearing region is in many ways similar to the developed Industrial site. The central part of the syncline is represented by Mesozoic deposits. In the Kumyskuduk area in the lower coal level, six indexed from bottom to top coal seams have been identified: brown 1, 2, 3, 4, 4¹, 5. The total thickness of all the coal seams of the lower level is 19.68 m. The Kuznetsk area also has favorable conditions for the development. The Kuznetsk area, which is essentially a continuation of the Kumyskuduk area to the northeast, also has favorable conditions for the development. At the Samara deposit, the coals of the Karaganda formation are of industrial interest.

Keywords: Verkhne-Sokursky coal-bearing region, Kuznetsky area, coal mass, Mesozoic sediments, coal layer.

Introduction

The Verkhne-Sokursky coal-bearing region is located east of the Maikuduk fault and covers the area of about 2000 km² in the eastern part of the Karaganda basin.

In structural and tectonic terms, the area is a syncline 50 km long and 40 km wide. Five areas with shallow brown coal seams (Kumyskuduksky, Kuznetsky, Central, South and West) have been identified within the region.

In terms of geological structure, the Verkhne-Sokursky coal-bearing region is in many respects similar to the developed Industrial site.

Within its limits, Paleozoic and Mesozoic deposits are developed, there is a thin cover of Neogene and Quaternary formations. Jurassic deposits are subdivided into four formations: Saranskaya (lower conglomerate), Dubovskaya (lower coal-bearing), Kumyskuduk (upper conglomerate-sandstone) and Mikhailovskaya (upper coal-bearing) [1].

The central part of the syncline is represented by Mesozoic deposits, which lie with angular unconformity on the eroded surface of intensively dislocated Paleozoic rocks, in the general case inheriting their structural plan.

The northern wing of the trough is gently sloping (3-5°), complicated by folds of the second order. On the southern wing, the angles of incidence of rocks increase to 10-15°, and near faults they reach 30° and more. In the central part of the region, the Northern upthrust is established, stretching for a distance of about 40 km. The amplitude of the upthrust is 100-130 m, the northward dip is at an angle of 45-50°. In the south of the area, the Southern upthrust was recorded.

In the Kumyskuduk area in the lower coal level, six indexed from bottom to top coal seams have been

identified: brown 1, 2, 3, 4, 4¹. The first three seams 1, 2, 3 are adjacent, each of which has a working capacity almost throughout its entire length. Seam 1 is composed of 4-10 coal packs with a thickness of 0.3-2.5 m. The rock layers have a thickness of 0.01-1.5 m. Their average content in terms of thickness reaches 26%. The average thickness of the seam is 8.03 m, of which coal is 6.95 m. Seam 2 is at a distance of 1-4 m from seam 1, has a thickness of up to 7.5 m, of which coal is up to 5 m. It consists of 2-5 coal packs. Seam 3 is located 0.03-3 m above seam 2. Its average thickness is 2.6 m including 2.36 m. Seam 4 in the Kumyskuduk area has a working thickness of up to 5.96 m in the southwestern part of the site and up to 2.75 m in the western part.

The total thickness of all coal seams of the lower level is 19.68 m. With an average thickness of the Dubov suite of 125 m, the coal-bearing coefficient is 15.7%. The depth of the lower coal level in the area ranges from 15-25 to 100 m and more. The dip angles of the seams do not exceed 10-15° [2].

The Kuznetsk area, which is essentially a continuation of the Kumyskuduk area to the northeast, also has favorable conditions for development. The lower coal level lies here at a depth of 100-120 m. The thickness of the coal mass is from 3.05 to 7.68 m, and the increase in thickness occurs in the direction of the seams falling.

The central site in the southeast borders on Kumyskuduk. As in the last one, four layers are distinguished in it, of which the lower one is the most sustained. There is a steep bedding of rocks and coal seams (45-50°), which is associated with the presence of the Northern latitudinal uplift.

Due to the abrupt subsidence of the formations, the Central section is not very promising for opencast mining.

The western section was penetrated by only three wells, which established the presence of a working brown coal seam with a thickness of 3.35-4.59 m at a shallow depth. There is no upper level in the Western section.

The quality of the coals of the lower coal level of the Dubovskaya suite has been most fully studied in the Kumyskuduk area [3].

The State Reserves Committee has approved the conditions for brown coals to be mined by open-pit mining. In accordance with them, the ash content of marketable coal of the lower coal level when selecting rock layers with a thickness of more than 1 m will be 32%, and the ash content of the coal mass 19.2%.

The enrichment of the coals of the Kumyskuduk area was studied using a robe sampled in exploration mine No. 1. The yield of concentrate with a density of less than 1.4 g/cm³ in terms of out-of-breed coal is 83.5%, i.e. according to the VUKHIN classification, coals are classified as medium-enriched.

Research results

Samara field. The field is located 40 km west of the city of Shakhtinsk and 100 km from the city of Karaganda.

Structurally, it is confined to the western part of the Karaganda synclinorium and is a narrow (35 km), expanding to the south graben-syncline, limited from the west and east by large faults. The southern wing of the syncline is gently sloping and relatively calm, the rest of the wings are steep and severely disturbed.

As in the Karaganda basin, carboniferous deposits of the Carboniferous are subdivided into seven formations, which are characterized by slightly less thickness and much lower coal content (the total thickness of all coal seams is 38 m, taken into account 10 m).

The Ashlyarik suite contains seven thin (about 1 m) of seams off-balance by ash content coals that are currently of no practical value.

The working capacity of the Karaganda suite is (1-3 m) have layers K₄, K₇, K₁₄ and K₁₆₋₁₇. The coals have a high content of vitrinite. Ash content of coal mass 21-27%, marketable ash content of coal 25-33%. Medium to extremely high concentration of coal difficult [4].

Heat of combustion for a bomb 34-36 MJ/kg, the lowest working fuel 22 MJ/kg. The coals are in the greasy and partly gaseous stages, metamorphism, sinter and coke well. Coals of the GZh, KZh and K grades are located on the deep levels of the deposit, the coals of the Karaganda suite, apparently, they will not go beyond the fat stage and retain a high sintering capacity the KZh and Zh grades.

Only the coals of the upper (usually non-working) seams up to the depth of 1200 m will be gaseous (G).

In the Dolinskaya suite, there are only four of 10 layers (D₆, D₇, D₇¹, D₈) reach operating power (1-1.3 m), their structure is relatively simple. Coals rich in vitrinite (the sum of the fusible components 80%). Their ash content is 18-20%, marketable ash content

23-28%. Medium-rich coals (yield concentrate 62-76%, ash content 8-9%), are at the gas stage of metamorphism, in connection with which have a reduced sintering capacity (thickness plastic layer 13-15 mm). Heat of combustion (on the bomb) 32-35 MJ/kg. The coals of the Dolinskaya suite belong to the GZh grade and have a good coking.

In the Tentek Formation, the beds are usually non-working. On a small (5-15%) area, only seams T₁, T₂, T₅, T₆, T₇ reach a thickness of 0.5-0.7 m. They are composed of high-ash gas-fired power coals, which have no practical value.

In general, at the Samara deposit, the coals of the Karaganda suite, developed within the southern wings of the graben-syncline, and the coals of the Dolinskaya suite in its central part. K₄, K₇, D₆ formations, as well as on a significant part of the field, layers K₁₁, D₇, D₈. The formation development can be carried out only underground.

Less explored in detail are the field complex areas: in the south it is the area the development of layers of the Karaganda suite, in the central part, the layers of the Dolinskaya suite. Coal reserves were assessed according to the conditions of the Karaganda basin [5].

Hydrogeological conditions of the field complex due to the presence of surface runoffs of the Nura River, its tributaries and thick strata (20-25 m) of aquiferous Paleogene sands. because of which is possible for water and sand breakthrough into mountain development.

Possible inflows of water into leveltal mine workings are estimated at 455 m³/h. The coal seams of the deposit are gas-bearing. Upper the border of the methane zone is at depth 165-200 m. In the depth interval 200-500 m, the natural gas content of the Dolinskaya suite increases to 10-12 m³/t, and the Karaganda formation up to 20 m³/t. The coals of the deposit are prone to spontaneous combustion. Coal dust is explosive.

Thus, the Samara deposit is a reserve for the future development of coking coal mining in the Central Kazakhstan.

The Zavyalovskoe coal deposit is located 70 km west of the Tentek coal-bearing region, 15 km from the Samara deposit and structurally confined to the western part of the Karaganda synclinoria. The deposit is a narrow (50x10 km), sharply tapering to the south graben-syncline, cut off from the west and east by large faults. Its western wing is steep (50-70°), the eastern one is more gentle (45-50°).

As in the Karaganda basin, the coal-bearing deposits are subdivided into seven formations, characterized by a lesser thickness and significantly less coal content.

The Ashlyarik formation contains nine layers with the thickness of 0.1-0.4 m. Among them only the A₉ layer reaches the working thickness of 0.7-1 m.

In the Karaganda suite of 12 coal seams, only the K₉ seam has a working thickness (0.9-3 m). The rest of the seams are characterized by a variable

thickness, ranging from 0.1 to 1.3 m. The ash content of the coal mass of the K₉ seam is 28%, the marketable ash content is 33%. Coal preparation is extremely difficult. The calorific value of the bomb is 35.6 MJ/kg. The coals are at the fat stage of metamorphism, are well sintered (the thickness of the plastic layer is 20 mm) and are coked. Coal grade KZh.

In the Dolinskaya suite, of 24 coal seams and interlayers, only seams D₁₁ and D₁₀ have a working capacity, but not over the entire area of their distribution. The thickness of most of the strata of the Dolinskaya suite is very variable and ranges from 0.1 to 0.5 m. The strata are often pinched out, and therefore have a limited areal distribution. The thickness of the D₁₀ stratum fluctuates within 0.3-0.7 m. To the north, the stratum loses its working capacity. Layer D₁₁ consists of two packs. The upper member 0.2-0.8 m thick pinches out in the northern direction. The lower member, 0.7-1.2 m thick, is the most sustained. The ash content of raw coal is 18-25%, the seam ash content is 22-33%. Coals contain a lot of vitrinite (70-80%) and are well sintered, their grade is Zh.

Tentetskaya suite contains eight coal seams. Most of them have a thickness of 0.3-0.6 m. Only the T₁ layer has the thickness of 1-1.5 m, which decreases to the north to 0.7 m. The decrease in the total coal content of the formation also occurs in the northern direction. Ash content of coals of the Tentek suite is 28-30%, marketable coal is 31-34%. The coal belongs to the Zh and KZh grades [6].

The coals of the Tentetskaya and Dolinskaya formations of the Zavyalovskiy deposit are homogeneous in terms of petrographic composition and are at the fat stage of metamorphism. They sinter and coke well. The coals of the Karaganda suite (layer K₉), due to their high ash content and extremely difficult washability, are classified as energy coals. The strata of the Dolinskaya and Tentetskaya formations are gas-bearing (up to 20 m³/t).

Kuu-Chekinskoye coal deposit. The deposit is located 55 km north-east of the city of Karaganda. Reconnaissance was carried out in 1945-1958. Since the end of the last century, it has been exploited by small quarries. In 1963, one large open pit was laid.

The deposit is confined to the brachisyncline, which has a triangle shape in plan. The brachisynclinal is composed of carbonate sediments of the Famennian and Tournaisian stages, which overlap the volcanic formations of the Lower-Middle Devonian with unconformity. The central part of the brachisyncline is composed of Visean coal-bearing deposits, divided into three formations: the Akuduk (400 m thick), Ashlyarik (450 m), and Karaganda (180 m thick, preserved from erosion).

The structure of the brachisynclinal is rather complex. The angles of incidence of rocks on its western wing are 40-60°, on the east – 70-90°, on the south up to 40°. The field is characterized by a wide development of secondary folding and a large number of faults with an amplitude from several

meters to hundreds of meters.

The upper part of the Ashlyarik suite contains seven coal seams (from A₁ to A₇), well matched with similar seams in the Industrial area of the Karaganda basin. The main, the most mature and powerful formations are A₇, A₅, A₃, A₂, A₁. All layers have a complex structure. The thickness of the working seams ranges from 0.7 to 14.9 m, on average 2.1-4.4 m. The total thickness of all seams is 16.3 m, including the useful 13.2 m.

The Karaganda suite includes 13 seams (from K₁₄ to K₁), of which five K₁₄, K₁₃, K₁₂ (top layer), K₁₂ (bottom layer) and K₁₀ are workers. They all have a complex structure. The total working thickness of the seams ranges from 1.3 to 26 m, on average it is 3.9-13 m coal content 15.3%.

In qualitative terms, the coals of the Ashlyarik and Karaganda formations are humus and stone coals. They are distinguished by high ash content of the coal mass (32-36%) and extremely difficult washability. Marketable ash content is 37-41%. The phosphorus content usually does not exceed 0.02%. The heat of combustion of the combustible mass on the bomb is 32.7-35 MJ/kg. The caking capacity of coal is low, the thickness of the plastic layer ranges from 6 to 15 mm. The seams consist of energy coal.

Major coal seams on a large part the area of the deposit is suitable for opencast mining. Currently, there is one open-pit mine at the Borlinskoye field. The field is located 110 km north of the city of Karaganda. The Karaganda-Tselinograd railway ran 60 km from the deposit, and the Karaganda-Ekibastuz asphalted highway 3 km away. In the immediate vicinity (about 6 km) the Irtysh-Karaganda canal runs along the bed of the Shiderty river.

The Borlinskaya depression, containing coal-bearing deposits, is surrounded by ridges of low hills, composed of limestone. The difference in the relief of the surface of the deposit reaches 35-40 m. In the southeastern part, the valley is crossed by the Shiderty river, and the Muzdybulak river (ravine) also passes nearby, which dries up in summer.

Structurally, the deposit is confined to gentle synclinal structures located within the Shidertinsky synclinorium, composed of volcanogenic-sedimentary formations of the Proterozoic, Lower and Middle Paleozoic.

The coal-bearing strata is underlain by rocks – analogs of the Akuduk and Ashlyarik formations of the Karaganda basin. Coal-bearing deposits are represented by the Karaganda suite. At the base of the suite, there are three complex coal levels. The most carbonated of them are the two lower ones, which are the main reserves of the deposit. The thickness of the suite is up to 180 m.

The hydrogeological conditions of the deposit are favorable for the development of open works.

Productive deposits of the Karaganda suite with a thickness of 180-300 m are represented by three coal levels: lower, middle and upper ones with different coal saturation (respectively 65.65 and 25%).

The total thickness of the lower coal level ranges from 21.85 to 33.75 m (average 26.59 m), the middle level: from 19.2 to 25.7 m (20.67 m on average). The middle coal level is located 35 m above the lower one.

Coal of the deposit is stone with a significant mineral admixture in the form of finely dispersed clay material and separate interstratal rock layers. The expected coefficient of the hardness of the seams (coal and in-situ rock) will be 1.5-3, which requires the use of drilling and blasting operations or bucket wheel excavators with high cutting forces during excavation.

The average ash content of raw coal along the lower and middle levels, respectively, is 41.7 and 42.1%.

The calorific value of raw coal in terms of per combustible mass is 32.4-35.4 MJ/kg. The sintering capacity of raw coal is low. By the yield of volatiles and the thickness of the plastic layer, the coals of all

seams are classified as the K2 technological grade.

Conclusion

The coals of the deposit, due to their extremely difficult washability, can only be used in an ordinary form as an energy fuel for thermal power plants. The volume of external stripping for the field as a whole is 1170 million m³, internal stripping is 63.3 million tons.

The average industrial stripping ratio is 2 m³/t, including for the internal overburden – 0.19 m³/t, for the external – 1.97 m³/t.

In terms of the volume of reserves, it is recommended to develop the deposit with one open-pit with an annual capacity of up to 10 million tons. The Central section is planned for the top-priority development with the length of the work front on the soil of the lower level 3 km. Subsequently, it is planned to develop the Eastern and Western sections.

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Қарағанды бассейніне іргелес көмір кенорындары

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Аңдатпа. Мақаланың мақсаты – Қарағанды бассейніне іргелес жатқан көмір кенорындарының ерекшеліктерін зерттеу. Геологиялық құрылымы бойынша Жоғарғы Соқыр көмір ауданы көп жағдайда дамыған өнеркәсіптік аймаққа ұқсас. Синклиналдың орталық бөлігі мезозой шөгінділерімен ұсынылған. Төменгі көмір көкжиегіндегі Күмісқұдық учаскесінде төменнен жоғары индекстелген алты көмір қабаты бөлінген: қоңыр 1, 2, 3, 4, 4¹, 5. Төменгі горизонттың барлық көмір қабаттарының жалпы қуаты 19,68 м құрайды, Кузнецк аймағында да игеруге қолайлы жағдайлар бар. Кузнецк учаскесі, шын мәнінде, Күмісқұдық солтүстік-шығысқа жалғасы болып табылады, сонымен қатар, игеруге қолайлы жағдайлар бар. Самара өнеркәсіптік кенорында Қарағанды көмірі қойнауқат қабаттары қызығушылық тудырады.

Кілт сөздер: Жоғарғы-Соқыр көмір ауданы, Кузнецк учаскесі, көмір массасы, мезозой шөгінділері, көмір қабаты.

Угольные месторождения, прилегающие к Карагандинскому бассейну

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Аннотация. Цель статьи – исследование особенностей угольных месторождений, прилегающих к Карагандинскому бассейну. По геологическому строению Верхне-Сокурский угленосный район во многом сходен с освоенным Промышленным участком. Центральная часть синклинали представлена мезозойскими отложениями. На Кумыскудукском участке в нижнем угольном горизонте выделено шесть индексированных снизу вверх угольных пластов: бурый 1, 2, 3, 4, 4¹, 5. Суммарная мощность всех угольных пластов нижнего горизонта составляет 19,68 м. Кузнецкий участок также имеет благоприятные условия для освоения. Кузнецкий участок, являющийся по существу продолжением Кумыскудукского на северо-восток, также имеет благоприятные условия для освоения. На Самарском месторождении промышленный интерес представляют угли Карагандинской свиты.

Ключевые слова: Верхне-Сокурский угленосный район, Кузнецкий участок, угольная масса, мезозойские отложения, слой угля.

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