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HYDROGEOLOGICAL CONDITIONS AND THE POSSIBILITY OF OIL AND GAS B--ETC(U)
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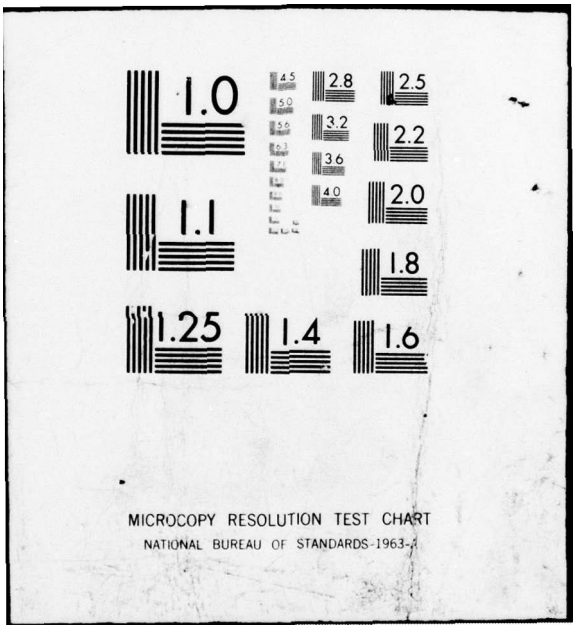
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FOREIGN TECHNOLOGY DIVISION

HYDROGEOLOGICAL CONDITIONS AND THE POSSIBILITY OF OIL AND GAS BEARING DEPOSITS IN THE KYZYL KUMS

by

O. I. Larikova, M. I. Subbota, V. F. Kleymemov

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Block	Italic	Transliteration	Block	Italic	Transliteration
А а	*А а*	A, a	Р р	*Р р*	R, r
Б б	*Б б*	B, b	С с	*С с*	S, s
В в	*В в*	V, v	Т т	*Т т*	T, t
Г г	*Г г*	G, g	У у	*У у*	U, u
Д д	*Д д*	D, d	Ф ф	*Ф ф*	F, f
Е е	*Е е*	Ye, ye; E, e*	Х х	*Х х*	Kh, kh
Ж ж	*Ж ж*	Zh, zh	Ц ц	*Ц ц*	Ts, ts
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М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ë in Russian, transliterate as yë or ë.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

HYDROGEOLOGICAL CONDITIONS AND THE POSSIBILITY OF OIL AND GAS BEARING DEPOSITS IN THE KYZYL KUMS

O. I. Larikova, M. I. Subbota, and V. F. Kleymenov

The special features of the geological structure of the Kyzyl Kum basin, which is located next to the Khivinskaya oil and gas-bearing province, make it possible for investigators to draw a conclusion concerning the possible oil and gas-bearing nature of the Mesozoic deposits [1-6 and others].

In 1966-1968 the authors of [this] article made a generalization of all the available hydrogeological material. The analysis of the hydrodynamic, hydrochemical, and paleohydrogeological data made it possible to establish the hydrogeological situation of each complex and to expose the conditions for the accumulation and retention of hydrocarbon formations.

Also the results of sampling of the deep layers were used for evaluating the hydrogeological conditions of the oil and gas-bearing capacity of the Kyzyl Kum basin.

The natural sedimentary mantle of the Kyzyl Kum basin is a configuration with Mesozoic and Cenozoic rocks from the Jurassic up to the present-day.

Conditionally the area of the basin in question is divided

into regional water-bearing complexes and the water-resistant rock masses which separate them. Regionally the Mesozoic deposits contain the water-bearing complexes: Jurassic, Neocomian-Aptian, Senoman, Turonian-Senonian complexes, and water-resistant complexes - Albian, Lower Turonian, and Danian-Paleocene.

The Jurassic deposits, which form the water-bearing complex, are distributed sporadically over the territory of the basin (Figure 1). In the Syrdar'inskaya depression they have opened three wells in the Aydarskaya, Ortokudukskaya, and Karaktausskaya areas. The limit of distribution of Jurassic deposits in the Aral Sea coastal region has not been established precisely. U. M. Akhmedsafin et al. [1] related the fine-grained sands in the Akkyr area and in some wells on the Tyuratam-Bukantau elevation to Jurassic deposits. Many investigators relate these deposits to Cretaceous (V. A. Zagoruyko, N. I. Fokina, etc.).

In the Syrdar'inskaya depression the Jurassic deposits are represented mainly by clays with inclusions of carbonized plant remains, with intercalations of sandstones and siltstones. During the testing of the wells no affluents of water from these deposits were observed.

In the Aral Sea coastal region, according to the data of U. M. Akhmedsafin [1], the waters of the Jurassic deposits are confined to the fine- and medium-grained quartz sands with a depth of from 10 to 100 m. Well G-1 city of Aral'sk contained water of a chloride-sulfate-sodium composition (sulfate-sodium type according to V. A. Sulin) with a mineralization of 11.6 g/l. Well G-3 Dzhusalinskoye uplift contained water of a sulfate-chloride-sodium composition with mineralization of 6.4 g/l of the same type (according to V. A. Sulin), and in well G-1 Akkyr the water was less mineralized (1.4 g/l) and related to the hydrocarbonaceous-sodium type (according to V. A. Sulin).

The Neocomian-Aptian water-bearing complex is made up of sands and sandstones, interstratified with clays and siltstones. The general depth of the water-containing layers comprises 50-130 m. The mineralization of the waters increases from

0.86 g/l in the region of the Pritashkentskiye Chu-Ili to 10 g/l and higher to the north and northeast. The water types are predominantly sulfate- and hydrocarbonaceous-sodium. In the Arysskiy trough the mineralization of the water reaches 10.9 g/l, and the waters are the calcium chloride type, in the Southern Aral Sea coastal region the mineralization is 11.5 g/l. In the Neocomian-Aptian complex all told nine wells were sampled, however, it can be assumed that in the remaining territory of the basin the mineralization of the waters will be the same (see drawing II).

The Senoman water-bearing complex is distributed everywhere. In the Syrdar'inskaya depression its profile is represented by layers of sandstones, included in the clay-siltstone rock-mass. The Eastern Aral Sea coastal region complex is made up of intercalations of sands, less often sandstones, also included in the rock mass of clayey rocks. In the Tashkent depression the Senoman deposits are made up of breccia, conglomerates, gritstones, and sands.

The mineralization of waters in the complex changes from 0.6 to 9.3 g/l (Figure III). The minimal mineralization is observed in the Tashkent depression. Mineralization is increased in the northern and northwestern directions. In the Turkestano-Arysskiy trough it comprises 1.2-7.8 g/l, in the southeastern Aral Sea coastal region it is 3.8-4.9 g/l. Waters with maximum mineralization are recorded on the Nizhne-Syrdar'inskiy uplift - 9.3 g/l.

The Turonian-Senonian complex is the most widely distributed. Classified as water-holding are the intercalations of sandstones and sands among the clays in the Syrdar'inskaya and Aral Sea coastal region depressions, and the conglomerates and sands in the Tashkent depression. The depth of the water-bearing complex comprises 50-120 m in the Aral Sea coastal region, increasing to 200-400 m in the Arysskiy trough and the Tashkent depression. The mineralization of the waters varies from 0.4 to 10 g/l, and, as an exception, up to 30.8 g/l.*

*The high mineralization in individual points is explained by the retention of connate waters of salt lakes.

In the foothills of Karatau the mineralization does not exceed 0.4-0.8 g/l, in the central part of the basin it is increased to 1.0-1.6 g/l. In the Aral Sea coastal region mineralization of the waters comprises 2-3 g/l, reaching 7.7-8 g/l at the Sultan-Uizdag range. The waters are sulfate- and hydrocarbonaceous-sodium. On the Nizhne-Sydar'inskiy uplift waters with a mineralization greater than 10 g/l were recorded. And the type of water is changed - it becomes primarily magnesium chloride and calcium chloride (see Figure IV).

The water-bearing complexes which were considered are united into two hydrochemical zones. The lower zone includes the Jurassic and the Neocomian-Aptian water-bearing complexes, and the upper - the Senoman and Turonian-Senonian.

These zones are also characterized by the degree of hydrodynamic activity.

The lower hydrochemical zone on the submerged sectors contains brackish waters of the calcium chloride and sulfate-sodium types with a mineralization of 8-11 g/l. The deposits which make up the water-bearing complexes of the lower hydrochemical zone come to the surface in sectors which are small in area, and are made up primarily of water-tight clayey rocks, which hampers the possibility of the penetration of considerable volumes of infiltration waters into the strata. A certain amount of water may enter through Upper Cretaceous deposits which crop out in the region of the Karatau and Pritashkentskiye Chu-Ili ranges. No natural foci have been established for the discharging of waters of the Neocomian-Aptian water-bearing complex. Concealed discharging can be taking place through overflows into the Upper Cretaceous deposits.

The upper hydrochemical zone is characterized by the presence of fresh and weakly brackish waters, primarily of the sulfate and hydrocarbonaceous types. The main areas of recharging of the deposits of the upper hydrochemical zone are located in the regions of an outcropping onto the surface of permeable layers of the Upper Cretaceous (Karatau and Pritashkentskiye Chu-Ili ranges). The Bukantau range and the Sultan-Uizdag range are additional

areas of recharging. The discharging of ground waters takes place in sources which are connected with disruptive disturbances on the islands and on the shore of the Aral Sea. Partial discharging also takes place in the alluvial deposits of the Amu Darya river (north of the city of Nukus), where along the Amu Darya tectonic swell the Turonian deposits lie under alluvial. The movement of the ground waters of the upper hydrochemical zone in the Kyzyl Kum basin proceeds from a northeastern to southwestern direction from the ranges of the western Tyan'-Shan' to the Aral Sea (L. A. Ostrovskiy, 1964). In the Tashkent depression the upper hydrochemical zone also includes a water-bearing complex of the Lower Cretaceous, which contains thermal (up to 70°C) high-discharging fresh waters.

In conclusion it should be noted that it is hardly possible to make an analogy with the neighboring Bukharo-Khivinskaya oil and gas bearing province.

Jurassic and Lower Cretaceous water-bearing beds of the Bukharo-Khivinskaya area are characterized by a high degree of saturation with hydrocarbon gases (for Jurassic the saturation is close to full).

In the Kyzyl Kum during the Mesozoic and Cenozoic periods there were unfavorable conditions of sedimentation for the formation and accumulation of hydrocarbons. During the Jurassic and the Lower Cretaceous periods sedimentation occurred primarily under continental conditions with the predominance of oxidizing conditions. The brief Albian and Lower Turonian transgressions led only to a partial replacement of the fresh waters by saline sea.

Increased concentrations of hydrocarbon gases dissolved in the water were not encountered anywhere. The available analyses are characterized by a predominance of nitrogen. Within the confines of the Arysskaya depression the waters of the Neocomian-Aptian complex contain all told up to 6% methane (well 5-G Timurskaya). In the eastern Kyzyl Kum zone the waters of these same deposits contain up to 1% methane (well 8 Aydarskaya), and in the waters of the middle Eocene of Akkumskaya structure methane with traces of heavy hydrocarbons was detected in spontaneous

gases (G. P. Filip'yev, B. S. Tsirel'son, A. B. Li, etc.).

In the depressions which are adjacent to the Bukharskaya and Chardzhouskaya fault benches they (O. V. Bartashevich, N. S. Kukuyeva, 1965, and others) have established foci of oil and gas formation which are connected with the terrigenous Lower and Middle Jurassic deposits, and apparently being the source of formation of all the exposed accumulations of hydrocarbons in the Mesozoic profile of the Bukharo-Khivinskaya gas and oil-bearing province.

Up to the present time no oil and gas producing deposits have been exposed within the confines of the Kyzyl Kum basin in the Mesozoic profile due to the inadequate study of the region by drilling. They can be expected among the Jurassic lacustrine-continental formations. Furthermore, it cannot be excluded that hydrocarbons may be derived from Paleozoic deposits, which have been virtually unstudied and at the present time are conditionally related to foundation rocks.

Regardless of this, the geochemically aggressive (in respect to hydrocarbons) habit of the waters does not permit a high evaluation for the prospects of Jurassic and Lower Cretaceous deposits.

Relatively favorable geochemical conditions have been recorded only on the sectors noted in the drawing. Evidently only here has a situation built up which is favorable for the preservation of possible accumulations of hydrocarbon gas and oil.

The build-up of Senoman and Turonian-Senonian deposits took place primarily under continental conditions. After the uplift in the Oligocene epoch the deposits of the Upper Cretaceous in the side zones of the depression were brought up to the surface, and thus began the infiltration of atmospheric precipitation into them and the displacement of the sedimentation waters. Taking into consideration the high (around 30 cm/year) present-day rate of movement of the waters of the upper hydrochemical zone, it can be proposed that since the Oligocene epoch there has been a complete substitution of sedimentation waters by infiltration waters.

Thus over the entire territory of the Kyzyl Kum the profile of the Upper Cretaceous deposits is subjected to the active intrusion of infiltration waters, continuing for a prolonged time, which virtually eliminates the probability of detecting commercial accumulations of hydrocarbons in them.

All-Union Petroleum Scientific Research Institute of Geological Exploration [Moscow]

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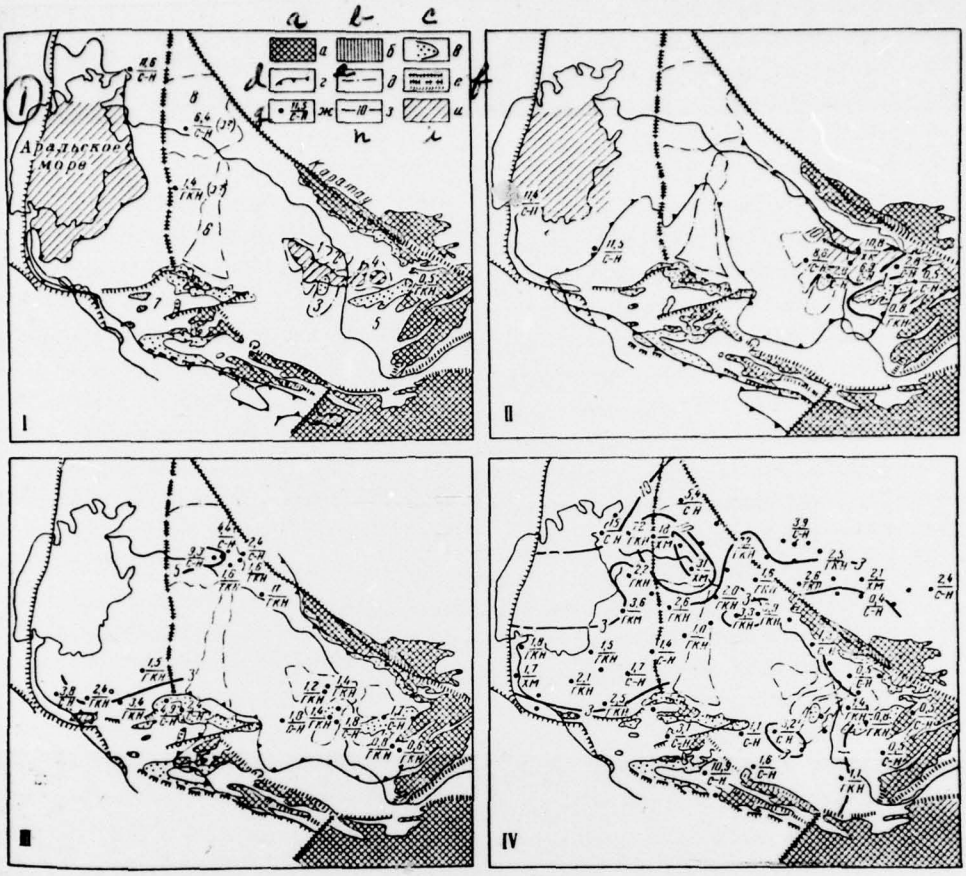

Schematic charts of mineralization, water types, and hydrogeological conditions for oil and gas bearing capacity of the Mesozoic water-bearing complexes in the Kyzyl Kum greater artesian basin.

Water-bearing complex: I - Jurassic, II - Neocomian-Aptian, III - Albian-Senoman, IV - Turonian-Senonian. Outcrops of rocks on the surface: a - foundation, b - heights, c - chalk, d - limit of distribution of rocks in the complex; e - limits of structural elements; f - lines of the main tectonic dislocations; g - wells (numerator - mineralization of water, g/l, denominator - type of water according to V. A. Sulin). XK - calcium chloride, XM - magnesium chloride, ГКН - hydrocarbonaceous-sodium, CH - sulfate-sodium; h - line of equal mineralization, g/l; i - sectors with relatively favorable hydrogeological conditions for the retention of hydrocarbons. 1 - Zhaugashskiy trough; 2 - Berdinskiy trough; 3 - Karaktausskiy ledge; 4 - Arysskiy trough; 5 - Tashkent trough; 6 - Kumkalinskiy swell; 7 - Central Kyzyl Kum massive; 8 - Dzhusalinskiy anticline.

Key: (1) Aral Sea


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