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COMPLEX ANALYSIS OF GIS DIAGRAMS WITH THE PURPOSE OF STUDY THE WELL CUTSECTIONS OF OIL AND GAS FIELDS

Abstract. The main objectives of geophysical exploration of the wells of the field were: exploration of geological and geophysical cutsections of wells, lithologic differentiation, identification of reservoirs in cutsections, separation of reservoirs by the nature of saturation, estimation of saturation character and quantitative determination of reservoir properties of effective thicknesses. When the productive part of the borehole section is differented, layers of different lithologic composition are allocated, the sequence of their occurrence is determined, and collectors and impenetrable sections between them are identified. These problems are solved using a set of methods for studying the sections. The data of geophysical studies of wells are linked to the data of description and analysis of rock samples (sludge, core). The analysis of a complex of geophysical methods for studying the wells of the investigating field was made. Jurassic terrigenous deposits of the investigated field are characterized by geological heterogeneity and significant variability of geophysical parameters. Modern methods of well geophysical studies, with the fullness of the complex used and the knowledge of petrophysical relationships between the geophysical and calculating parameters of the studying geological object, with a correct representation of the type of reservoir and the application of geophysically sound methods of interpretation, make it possible to obtain representative data on the investigating geological section [1-3].

Key words: well logging; lithological differentiation, collector; coefficients of porosity, clay coefficients, oil and gas saturation; petrophysical studies; capacitive properties of the rock; specific electric resistance; intensity of natural gamma radiation, radiation, secondary gamma radiation; interval time; coefficients of sandiness, of compartmentalization.

Introduction. The studying field is located in the Atyrau region of the Republic of Kazakhstan [1]. The calculation of reserves and the assessment of oil, gas and condensate resources is based on a detailed study of the subsoil and synthesizes in itself all the information obtained in the process of prospecting, exploration and development of deposits: data on the study of mineralogical and petrographic features of rocks, reservoir physics and physical and chemical properties of fluids, the results of field and field geophysical studies, information on the conditions for the formation of oil, gas and condensate deposits, on the regularities of their placement in the subsoil, etc., petrophysical data on the oil and gas bearing strata, testing and testing of wells, industrial experiment works and development of deposits [7].

The field has an industrial oil content of Middle Jurassic deposits, in which as a result of the cross-correlation of the sections of all wells with the involvement of testing and interpretation of GIS materials, three productive horizons J-II, J-III and J-IV were identified, which, in turn, are divided into several layers [1-3].

II Middle Jurassic horizon, layer 1 according to the description of the core is represented by gray, light gray, dark gray, from fine to medium-grained, glauconite and quartz-feldspar, medium strength, on carbonate-clay cement, pore type, in places with charred plant remains sandstones; gray, light gray, dark gray, quartz, fine-grained, dense with plant remains, mica, clay cement, contact and basal type siltstone. Layers of coal are encountered.

II Middle Jurassic horizon, layer 2 according to the description of the core is represented by light gray, dark gray, glauconitic-quartz sandstones, mainly medium-cemented, fine-grained, medium-grained, silty, with clayey cement of pale-basal type, with sparse inclusions of carbonaceous residues. The rocks are clayey and calcareous in various degrees, they contain a considerable amount of carbonated vegetable detritus.

III Middle Jurassic horizon, layer 1 according to the description of the core is represented by fine-grained, gray, silty, weakly cemented, carbonate sands; gray, light gray, dark gray, glauconite-quartz, from weakly to strong-cemented, fine-grained, medium-grained, clayey cement of pore-basal type sandstones; gray, coarse and fine-grained, strongly clayey, slightly sandy, non-carbonate siltstones.

Table 1 – Collector properties for productive horizons

Parameters	J- II, layer 1	J- II, layer 2	J-III, layer 1	J-IV, layer 1
Porosity, %	17,4-26,2	25,5-27,7	11,7-31,9	12,4-25,9
Permeability, mD	51,5-152,8	51,9-128	6,36-476,8	1,3-50,1
Vsh, %	2,4-19,6	2,1-3,2	1,6-24,7	2-4,8

Completed field geophysical surveys in wells generally in line with the requirements of "Technical Instructions for Conducting Geophysical Investigations and Works on Cable Devices in Oil and Gas Wells" [5].

Standard logging was performed with log sonde N0.5M2A throughout the entire section and in the productive part, it was used for lithologic-stratigraphic dismemberment of the section.

Lateral logging is carried out in new wells. The lateral micro logging was carried out in new wells in the productive part of the section. The quality of the diagrams was evaluated by indications against hollowed-out clays and against homogeneous layers without a penetration zone.

Lateral logging was conducted in all wells with five standard lateral sondes: A0.4M0.1N, A1M0.1N, A2M0.5N, A4M0.5N, A8M1N and one inverted lateral sonde N0.5M2A.

According to the micro logging diagrams, intervals of degrade clays, dense interlayers are clearly identified in the well sections.

The GR (gamma ray log) curves show the lithological characterization of the section, isolating the clay layers at the maximum intensities of the GR. Dense rocks in the GR diagrams are marked by low values of natural radioactivity. The maximum values of GR have not hollowed-out or slightly hollowed-out clays. Sand-siltstone varieties, depending on the content of clay material and the degree of poly-micticity, are characterized by the intensities of natural gamma radiation from low to high, up to values commensurate with clays.

The minimum intensity values in the GRN (neutron gamma log) diagrams are characterized by deep cavities, maximum indications are noted against dense carbonatized rocks; Sand-siltstone varieties are characterized by intermediate values.

The reservoir rocks for reservoir are clays and mudstones with a specific electrical resistance from 0.9 to 1.3 Ohm, the minimum indications on the curve of GRN (1.3-1.49 c.u), the maximum indications of GR (10-12 mcR/hour), the interval time on the sonic logging curve is more than 290 μs/m.

Dense rocks have high resistance on the lateral logging curve (1.7-1.9 Ohm), low natural radioactivity (6-8 microR/hour), low indications on the curve of interval time (180-195 μs/m).

In the Jurassic complex of rocks there is a considerable number of coal layers, the thickness of which varies from several centimeters to one and a half meters and more [1, 2]. On the readings of well logging instruments on the coals, very high neutron logging porosity readings are observed, a very low bulk density, an increase in the interval time and low gamma logging readings, and an increase in the electrical resistivity. Figure 1 shows an example of the separation of coal seams and reservoirs from a set of GIS methods along the field's well.

The selection of reservoirs for a set of geophysical methods for the study of wells was carried out according to the qualitative characteristic of terrigenous rocks with the use of almost all methods of geophysical studies performed, as well as core data and formation testing [4, 7, 8]. Qualitative characte-

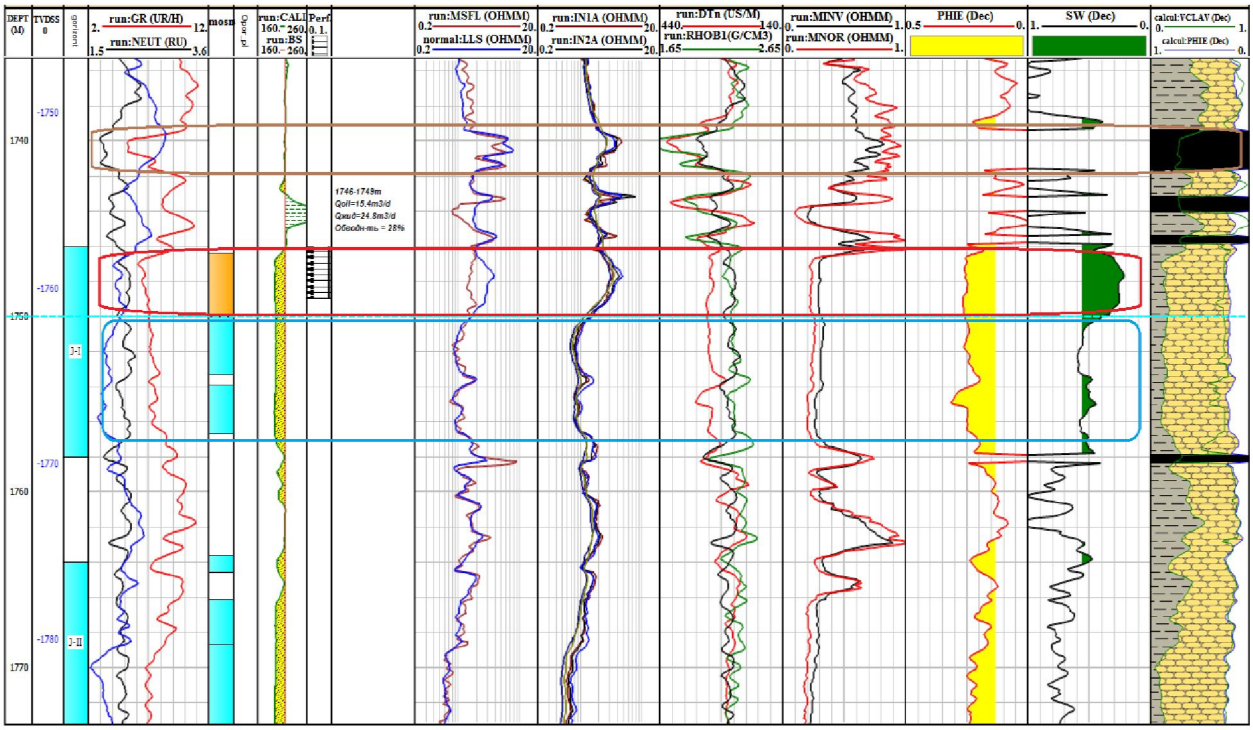


Figure 1 – The allocation of coal sites and reservoirs for the GIS complex

ristic of reservoir separation in the field cross-section are: the presence of a clayey crust or the preservation of the nominal diameter on the cavernogram; positive increment of the potential sonde over the gradient sonde on the microsonde diagrams; low intensity of natural gamma radiation; the presence of a radial resistance gradient, established by the data of different depth installations by the resistance method (LL, LLS, MLL, ILD).

When reservoirs are separated by informative methods in the Jurassic part of the section, there are multisonde ILD, the presence of a clay crust or the nominal diameter of the well, a negative SP (static polarization) anomaly, an increase in the RHOB (Gamma Gamma log density) value, an increase in the interval time on acoustic logs (DTP), an increase in W, and a minimum value for GR.

When determining the effective thicknesses from the total thickness, dense and argillaceous interlayers were excluded [6, 7]. Their presence was controlled by indications of acoustic and radioactive methods, as well as by the diagrams of micromethods.

The reservoirs have a reduced value of natural gamma radiation intensity (3-9 mcR/h), the density according to the RHOB method varies from 2.2 to 2.35 g/cm^3, the interval time of the elastic wave travel depending on lithology (from 310 to 340 μs/m).

In addition to qualitative characteristics, quantitative criteria were used for the separation of reservoirs – the boundary values of the porosity coefficients (11.5%), maximum bulk clay (Vsh = 41%), determined from the core data [2].

Density logging curves reflect the lithological characteristics of the section. In most cases, the density of reservoirs varies from 2.2 to 2.4 g/cm^3, in dense rocks from 2.7 g/cm^3 and higher.

The porosity of the collectors was determined from the acoustic logging curves in combination with the neutron logging curves.

The cavernometry is made in all wells. Thermometry was carried out in all wells to measure the temperature at the LLS, and also to measure the geothermal gradient.

The diagrams of the SP in separate wells are slightly differentiated and have the opposite sign, which indicates that the mineralization of the drilling mud filtrate exceeds the value of the mineralization of the stratal water (the inverse field of the SP).

Interpretation of geophysical well studies was carried out using the software "Interactive Petrophysics" [2].

This program solves the problem according to the petrophysical model, which consists of three components: 1 – GIS curves, 2 – components of the reservoir (volume content of rock types and fluids), 3 – parameters of each type of rocks and fluids.

As input parameters, the following log data and petrophysical constants were used: neutron porosity; acoustic logging; density gamma ray logging; resistance curves; gamma-logging; cavernometry; clay - density of 2.40 g/cm^3, interval time - on the average 292 µs/m; sandstone - density conditionally 2.65 g/cm^3, interval time - 170 µs/m; formation water - density 1.05 g/cm^3, ΔT_f - 600 µs/m.

Clayiness was estimated by the curves of GR and SP both in the complex and separately. In determining the clay content by GR, a double difference parameter is used in the Larionov relation [3]:

$$K_{sh} \text{ by GR} = 0.333 \cdot (2 \cdot (2 \cdot Z) - 1),$$

where Z – a double difference parameter according to GR, which is equal to:

$$Z = (GR - GR\ min) / GR\ max - GR\ min),$$

GR – current value of gamma radiation intensity; GR min – value of the intensity of gamma radiation in non-clay rocks; GR max – value of intensity of gamma radiation in clays.

When determining the clay content by the SP, the next equation was used:

$$K_{SH\_SP} = SP - SP_{min} / SP_{max} - SP_{min},$$

where SP – current value of spontaneous potential polarization, mV; SP_{min} – The value of the spontaneous polarization potential in non-clay rocks, mV; SP_{max} – value of the potential of spontaneous polarization in clays, mV.

When calculating the clayiness of the wells, a connection is made with the geophysical parameter that most accurately reflects the lithology of the section. An example of the determination of bulk clay by the methods of GR and SP is shown in figure 2.

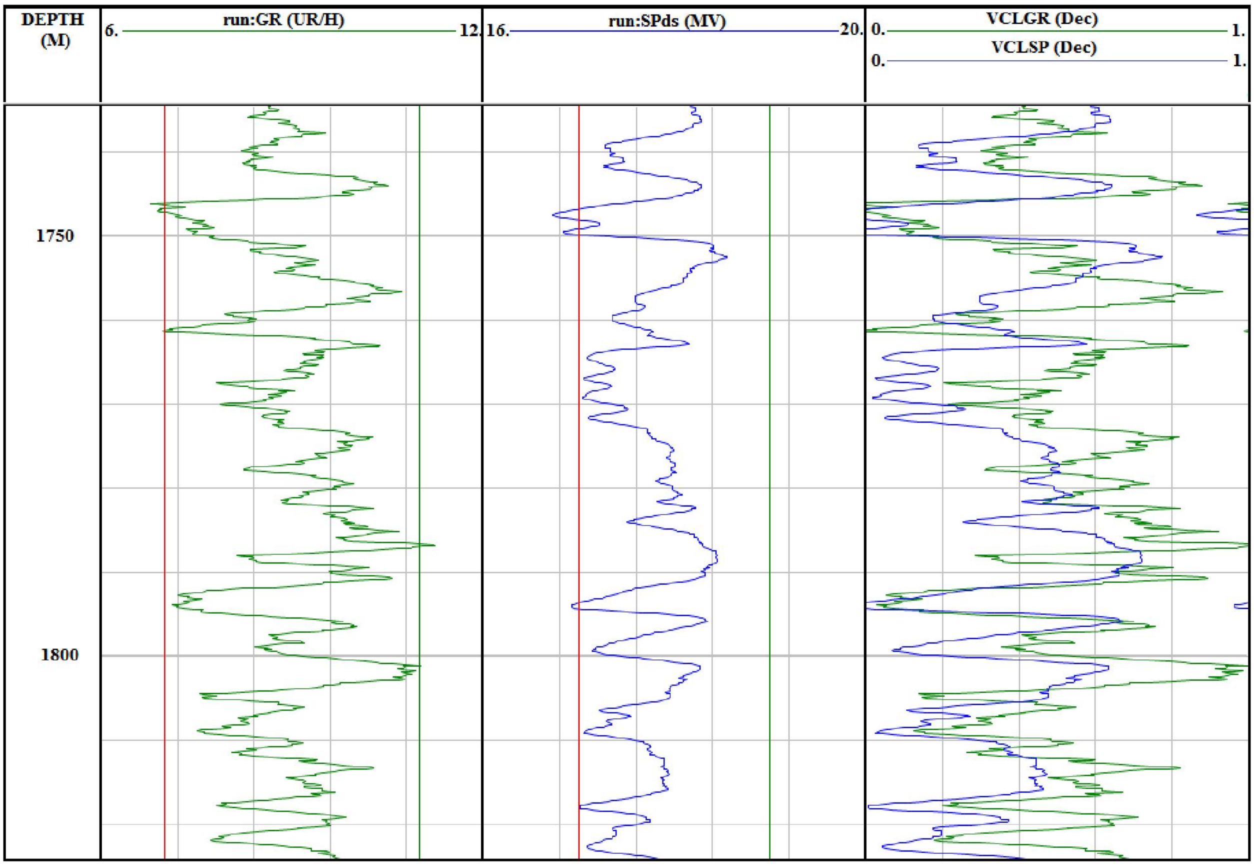


Figure 2 – An example of the determination of bulk clay by the methods of GR and SP

To calculate the porosity, we used the diagrams of RHOB, W, and DTP. The porosity in the well was calculated and adopted according to the porosity method, which most reliably displays the lithology of the section, and also from the complex (the presence of the method) carried out in the well under investigation and its quality.

Determination of the coefficient of porosity by neutron logging (GRN) was carried out in accordance with the methodological instructions, first the neutron porosity was calculated from the equation connecting the porosity and the readings of the GRN equipment in cu for wells with a diameter of 215 mm [2]:

$$W = (-8.802 + 51.529 / GRN + 6.916 / (GRN \cdot 2)) / 100.$$

The open porosity (K_{p_GRN}) was determined after the introduction of the correction for clayiness:

$$K_{p\_GRN} = W - K_{sh} \cdot W_{sh} ,$$

where W – neutron logging readings; W_{sh} – Hydrogen content of clays, taken conditionally ≈ 0,3; K_{sh} – volume content of clay minerals in the rock.

RHOB porosity was determined by the formula:

$$K_p\ RHOB = [(\sigma m - \sigma r) / (\sigma m - \sigma f)] - K_{sh} \cdot [\sigma m - \sigma cl) / (\sigma m - \sigma f)] ,$$

where σm – matrix of the rock, g/cm^3; σ_f – density of fluid, g/cm^3; σcl – current value of the density of clays, g/cm^3; K_{sh} – volume content of clay minerals in the rock; σr – density of the rock, g/cm^3.

The porosity coefficient for acoustic logging was determined by the formula:

$$K_p = \frac{(\Delta T - \Delta Tm) - Ksh \times (\Delta Tsh - \Delta Tm)}{(\Delta Tf - \Delta Tm)}$$

where Ksh – volumetric shale index; ΔT – current time interval value, µs/m; ΔTm – value of the interval time in the rock, µs/m; ΔT_f – the value of the interval time in the filtrate, µs/m; ΔTsh – value of interval time in clays, µs/m.

The reliability of determining the porosity in the GIS was checked by comparison with the porosity determinations on the core for the Jurassic horizon (figure 3).

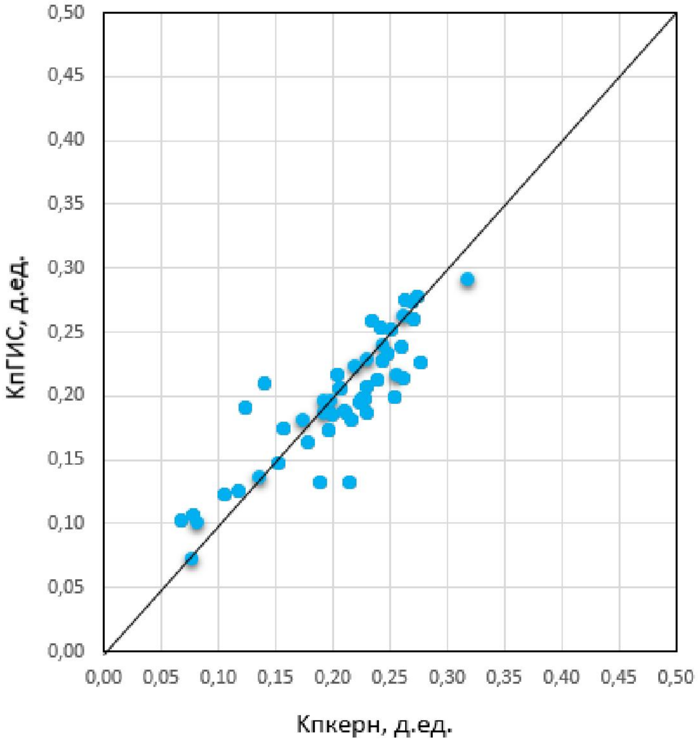
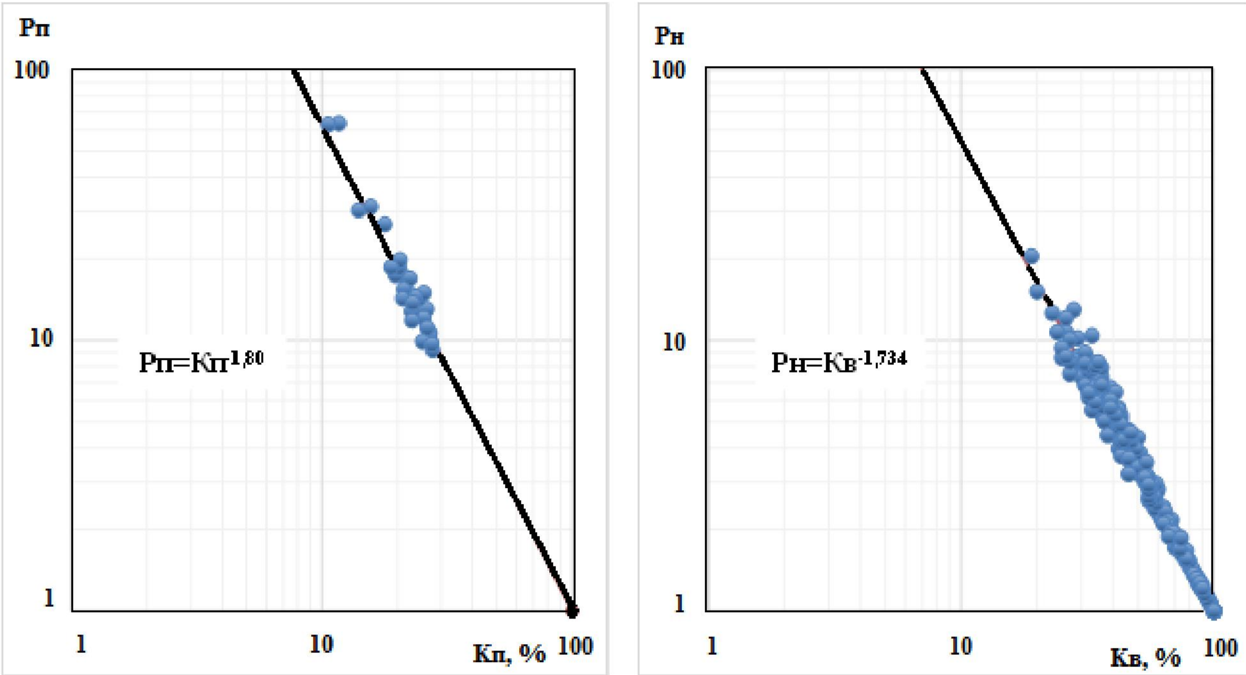


Figure 3 – Comparison of porosity coefficients

The relationship between the porosity parameter and the porosity coefficient is the basic interpretation model for determining the porosity coefficient from the well electrometry data. The high degree of reliability of the approximation (R2 = 0.94), and the high correlation coefficient of the porosity parameter and the porosity coefficient, indicating a close relationship between them, makes it possible to recommend the expression obtained for use in interpreting well log data [3, 8]. To construct the Pp = f (Kp) dependence, the porosity parameter and the porosity coefficient were used, corresponding to atmospheric conditions. The dependence of the porosity parameter on the porosity coefficient for the Jurassic deposits studied is described by the equation (figure 4a) [1]:

$$P_p = K_p^{-1,8}$$



a b

Figure 4 – Dependence of porosity parameter on the porosity coefficient (a), dependence of the saturation parameter on water saturation coefficient (b)

The main method for determining the character of reservoir saturation is well electrometry. For this purpose, the relationship between the saturation parameter ($P_s = \rho_o / \rho_w$) and the water saturation coefficient of rocks (K_w), which is described by the equation (figure 4b) [1] was studied:

$$P_s = K_w^{-1,734}$$

The water saturation coefficient is determined by the Archie equation, for pure non-clay reservoirs of the Middle Jurassic deposits:

$$K_w = (a \cdot R_w / K_p m R_f)^{1/n},$$

where K_w – water saturation; R_w – resistance of formation water, Ohm; K_p – logging porosity; R_f – true resistance of the formation in the non-washed zone, Ohm; m – exhibitor of carburizing; n – saturation exponent.

For Jurassic sediments based on the analysis of the core: a=1; n=1,8; m=1.73.

The oil saturation coefficient is calculated from expression: $K_o = 1–K_w$.

The saturation of reservoirs of the productive horizons was assessed on the basis of the specific electrical resistance (SER) and the design factor of oil and gas saturation (K_{og}). For productive reservoirs, the critical values of resistance of oil-saturated reservoirs are as follows: the formation is confidently productive at resistance values from 1.1-5.7 Ohm; to the water-bearing layer at resistances from 0.3 to 1 Ohm. The minimum value of resistance for oil reservoirs is determined on the basis of well sampling data of the field – 1,1 Ohm. When processing the results of electric logging, data on the formation water resistance (ρ f.w = 0.024 Ohm) were used. According to the sampling data, the minimum value of the saturation coefficient at which an industrial oil inflow is obtained is a value equal to 44%.

When the productive part of the borehole section is dismembered, layers of different lithologic composition are allocated, the sequence of their occurrence is determined, and collectors and impenetrable sections between them are determined. These problems are solved using a set of methods for studying the sections. In this complex, geophysical methods currently occupy the main place, with which all types of wells are necessarily studied. The geophysical survey data is linked to the description and analysis of rock samples (sludge, core sample).

The results of the complex interpretation for the purpose of determining the character of the saturation of the reservoir formations are shown in figure 1, intervals of oil-bearing (highlighted in red) and aquifer (blue) reservoirs. An example of determining the nature of saturation of reservoir layers and the position of water-oil contact along a well's well is shown in figure 5.

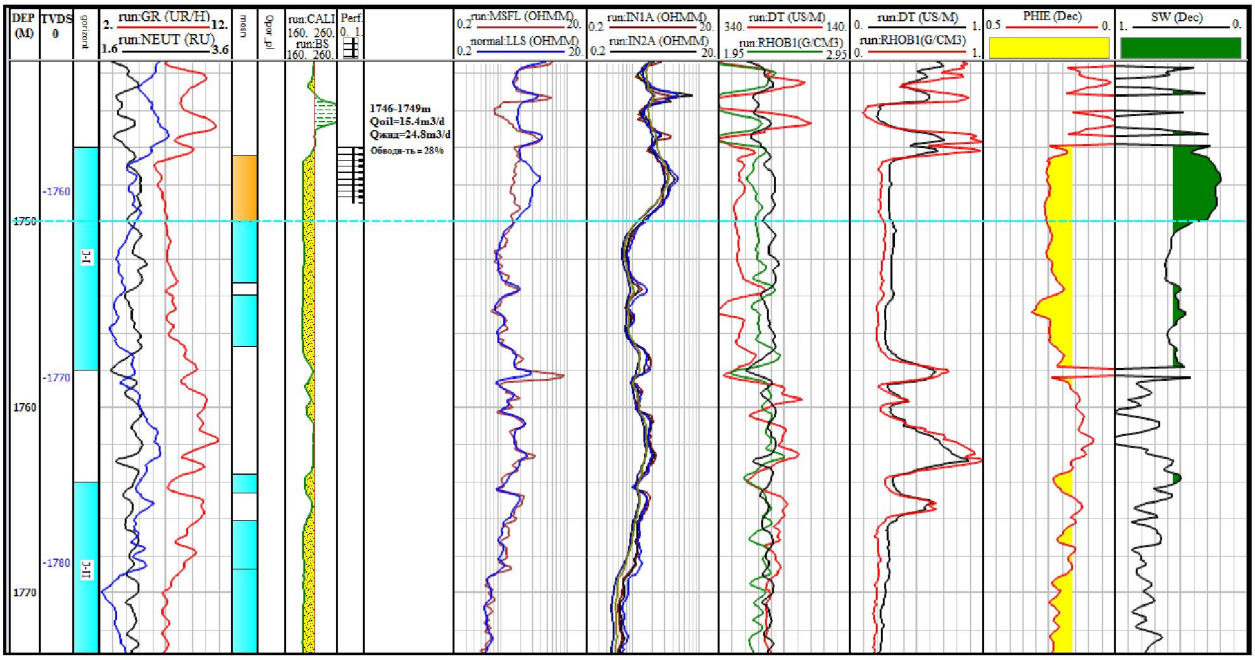


Figure 5 – An example of determining the pattern of saturation of reservoir-layers and the position of water-oil contact along a well

The extraction of the effective thicknesses was carried out with allowance for the boundary value Kp = 11.5%. The minimum saturation value at which an industrial oil inflow is obtained is a value equal to 44% [2].

The principle of separating the section into reservoirs and host rocks was based on the traditional qualitative features of the isolation of terrigenous pore collectors (figure 5) [4, 6, 8]:

– reduction of natural radioactivity relative to the surrounding rocks;

– preservation or reduction of the nominal diameter by a cavernogram;

– the presence of the zone of penetration of the filtrate of the drilling mud into the formation, which is noted on the deep-seated sondes (LLS, LL-MLL, ILD).

According to GIS data, layer 1, II Middle Jurassic horizon is represented by reservoirs with porosity of 18-28%, range of oil-saturation coefficient change is 45-82%. The horizon is composed of 1-6 oil-bearing and aquiferous strata, characterized by a total thickness of 26.2 m. The average value of oil-saturated thicknesses of the reservoir is 11.1 m and varies within 1.98-18.5 m. The total effective thickness on average is 12.2 m, with a change in the range 3.5-18.5 m. The coefficient of sand content is 0,13-0,69, on the average by the layer - 0,46. The dismemberment of the horizon is on average 2.8.

According to GIS II, the mid-Jurassic horizon, layer 2 is represented by collectors with a porosity of 24.5-26.0%, the oil saturation coefficient varies from 55 to 70%. The total thickness of this horizon divided by dense rocks into 1-3 interlayers varies from 3.3 to 8.8 m. The average oil-saturated thickness is 2.4 m. The effective thickness of the collectors varies from 1.1 to 4.8 m. The coefficient of sandiness varies from 0.15 to 0.70, averaging 0.45. The average dissection is 1.9.

III Middle Jurassic horizon, layer 1 according to the results of complex interpretation of GIS diagrams is represented by collectors with a porosity of 19-26%. Oil saturation varies from 45 to 62%, the average oil saturation of reservoirs is 50%. This horizon is represented by 1-4 permeable sand layers. The average thickness of the horizon is on average 12.5 m, oil-saturated thickness 4.0 m, effective thickness 8.3 m. The coefficient of sand content averaged 0.65, the coefficient of subdivision 1.9.

III Middle Jurassic horizon, layer 2. According to GIS, the average porosity is 22%, the oil saturation is 56%. The total thickness of the horizon, represented by 1-2 interlayers of permeable sandstones, averages 3.3 m. The thickness of the oil-saturated interlayer is 1.07 m. The average effective thickness of the formation is 2.3 m. The coefficient of sandiness varies from 0.13 to 0.97, averaging 0.68, with an average dissection of 1.1.

III Middle Jurassic horizon, layer 3. According to GIS data, this horizon is represented by reservoirs with a porosity of 18-21.0%, oil-and-gas saturation coefficient -51-59%. The horizon is composed of 1-5 oil-bearing and aquifers, characterized by a total thickness of 13.6 m. The value of the oil-saturated reservoir is 3.5 m. The total effective thickness is on average 6.6 m, with a change in the range of 1.1-12.6 m. The coefficient of sand content is 0.08-0.98, on the average by the formation - 0.50. The dismemberment of the horizon is 3.0.

Table 2 – The results of a comprehensive interpretation of the wells in the field

№ well	Reservoir interval, m		GR, mcR/h	GRN, c.u	CV, mm	pr, Ohm	DTP, µs/m	W, p.u	RHOB, g/cm^3	K_p_RHOB, p.u	K_p_GRN, p.u	K_p_DTP, p.u	Ksh, p.u	K_p, p.u	Kog, p.u
	roof	sole													
15	1704,7	1706,3	9,54	1,57	192,4	0,74	361,1	0,21	2,25	0,20	0,12	0,28	0,35	0,20	water
	1711,2	1713,4	10,19	1,55	193,5	0,67	331,7	0,22	2,28	0,18	0,13	0,22	0,35	0,18	water
	1714,6	1715,7	9,57	1,49	195,5	0,73	356,5	0,25	2,24	0,21	0,18	0,27	0,33	0,21	water
	1716,2	1720,8	9,68	1,51	196,3	0,81	348,6	0,24	2,26	0,19	0,16	0,25	0,35	0,19	water
	1734,9	1737,1	8,74	1,49	202,3	1,42	355,2	0,25	2,25	0,21	0,24	0,29	0,25	0,27	water
	1734,9	1737,1	8,88	1,48	204,4	1,45	355,9	0,25	2,24	0,21	0,22	0,29	0,28	0,26	0,63
	1738,0	1739,2	8,59	1,51	197,7	1,47	362,1	0,24	2,25	0,21	0,24	0,31	0,25	0,28	0,67
	1741,9	1743,0	11,50	1,56	219,9	1,72	355,4	0,21	2,25	0,19	0,17	0,25	0,39	0,21	0,54
	1743,2	1743,9	10,90	1,46	218,1	1,66	347,5	0,27	2,25	0,19	0,18	0,26	0,38	0,22	0,58
16	1711,1	1714,2	8,15	1,74	216,1	0,49	303,3	0,28	2,29	0,21	0,28	0,28	0,09	0,28	water
	1720,4	1721,5	10,34	1,68	217,5	0,62	297,6	0,31	2,35	0,15	0,26	0,20	0,27	0,20	water
	1752,0	1753,8	10,33	1,71	211,4	1,90	305,5	0,29	2,22	0,22	0,22	0,21	0,35	0,22	0,66
	1754,4	1755,8	12,29	1,45	217,6	1,55	303,5	0,46	2,28	0,19	0,30	0,20	0,31	0,25	0,67
	1757,2	1758,5	8,32	1,73	214,4	1,65	301,39	0,28	2,25	0,22	0,26	0,22	0,14	0,24	0,66
	1758,5	1767,0	8,43	1,80	213,0	0,90	279,99	0,25	2,35	0,16	0,23	0,21	0,15	0,22	water
	1767,4	1772,3	8,37	1,74	213,0	0,70	289,09	0,28	2,33	0,18	0,26	0,22	0,15	0,24	water
17	1746,4	1750,0	6,77	2,16	196,1	2,80	308,17	0,21	2,23	0,23	0,19	0,25	0,18	0,25	0,78
18	1773,2	1774,47	69,41	2,16	197,00	1,217	292,86	0,332	2,29	0,18	0,25	0,19	0,28	0,22	0,5

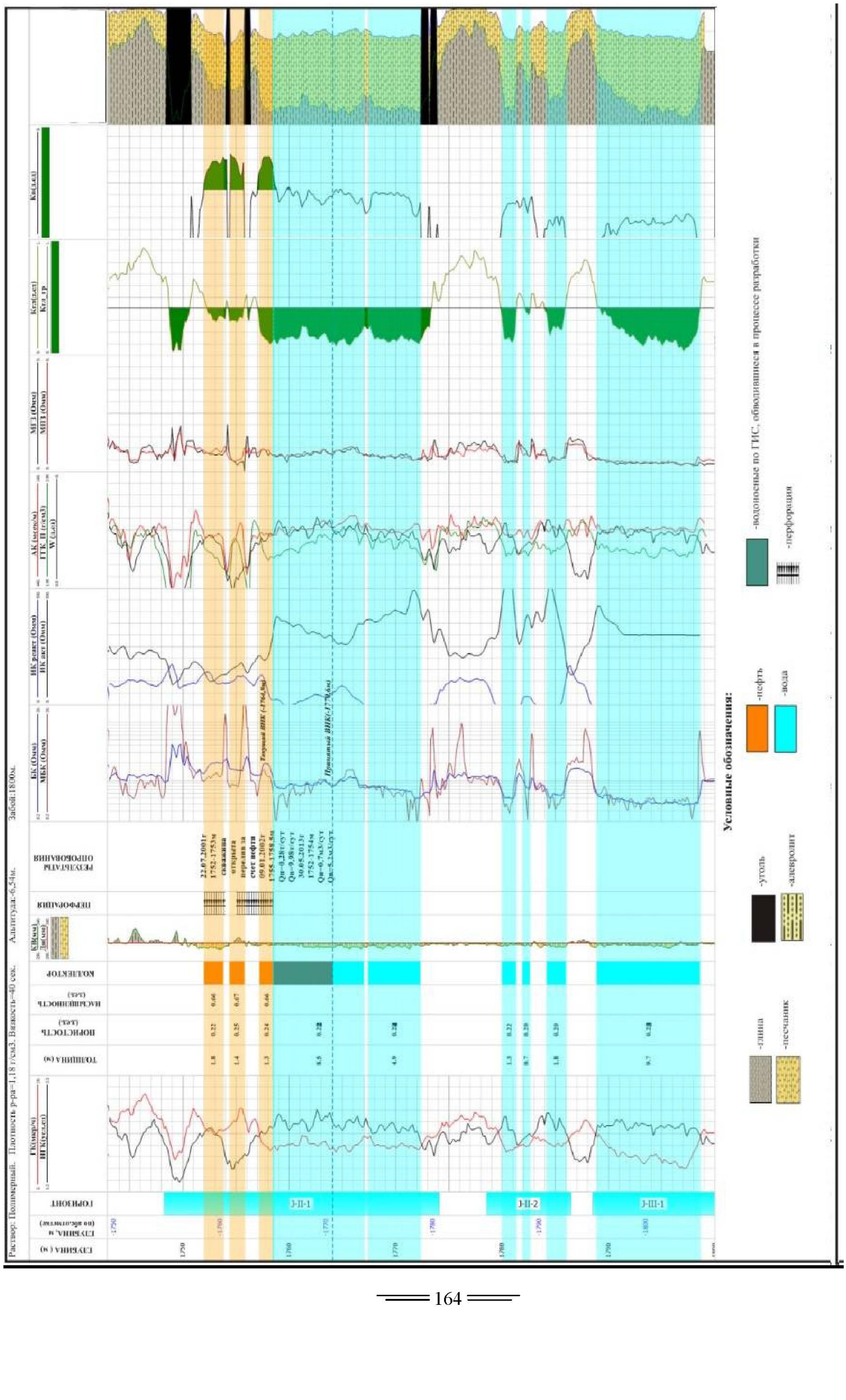


Figure 6 – Volumetric and fluid models for the Middle Jurassic productive horizons

IV Middle Jurassic horizon, layer 1 according to the data of geophysical studies of wells, reservoir rocks are characterized by a porosity of 15-20%. The oil saturation of reservoirs ranges from 45 to 60%. The productive horizon is composed of 1-7 sandy interlayers, characterized by a total thickness of 30.1 m on average and varying within 25.7-34.3 m. The average oil-saturated thickness of the reservoir is 14.2 m. The effective thickness of the reservoirs varies from 6, 2 to 16.4 m. The coefficient of sand content of this horizon varies from 0.19 to 0.62 and averages 0.45. The average dissection is 4.5.

In IV Middle Jurassic, layer 2 according to GIS data, porosity is 19% at 48% oil saturation. The horizon is composed of 1-2 oil-bearing and aquifers, characterized by a total thickness of 3.8 m. The thickness of the oil-saturated reservoir is 1.50 m. The total effective thickness is 2.9 m on average. The coefficient of sandiness is 0.55-0.84, on the bed - 0,7. The dismemberment of the horizon is 1.5 [2].

Coefficient of sandiness is the ratio of effective power to the total thickness of the formation, traced in the section of the given well. It shows how much the collectors occupy in the total volume of the productive horizon. The partition coefficient is determined for the deposit as a whole and characterizes the average number of sandy interlayers composing the horizon-the ratio of the number of sandy interlayers summed over all wells to the total number of wells that opened the reservoir [9].

The results of a comprehensive interpretation of the wells, volume and fluid models for the Middle Jurassic productive horizons are shown in table 2 and in figure 6.

Conclusions:

– Technologies for determining the geophysical properties of reservoirs reduce the risk of drilling and increase productivity. They effectively combine the achievements of advanced science with the latest technologies of interpretation, visualization and modeling, which turns them into an indispensable means of reducing risk and ensuring success in drilling wells.

– When the productive part of the borehole section is dismembered, layers of different lithologic composition are allocated, the sequence of their occurrence is determined, and collectors and impenetrable sections between them are determined.

– For calculations, it is recommended to determine the porosity coefficients from geophysical data, since they allow more reliable estimation of the porosity of the reservoirs: the number of determinations and the number of wells covered by the GIS study is much larger than the core.

– At this field, explicit aquifers are not tested, so the boundary oil-gas saturation coefficient should be clarified.

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МҰНАЙ-ГАЗ КЕНОРЫНДАРЫНДАҒЫ ҰҢҒЫМА ҚИМАЛАРЫН ЗЕРТТЕУ МАҚСАТЫНДА ҰГЗ ДИАГРАММАЛАРЫНЫҢ КЕШЕНДІ САРАПТАМАСЫ

Аннотация. Кенорындағы ұңғыманы геофизикалық зерттеудің мақсаты: ұңғыма қимасын геологиялық-геофизикалық зерттеу, литологиялық жіктеу, коллектор қабаттарды анықтау, қанықтылық сипатына байланысты коллекторларды ажырату, қанықтылық сипатын бағалау және тиімді қабаттағы коллекторлық қасиеттерді сандық бағалау. Қимадағы тиімді қабаттарды жіктеу кезінде әртүрлі литологиялық құрамдағы қабаттар бөлінеді және олардың шөгу кезектілігі айқындалады, сонымен қатар, коллекторлар және олардың арасындағы өткізбейтін қабаттар анықталады. Бұл мәселені қиманы зерттеу кезінде кешенді әдіс көмегімен шешеді. Ұңғыманы геофизикалық зерттеу мәліметтері таужыныс үлгілерінің (қалдық, керн) сараптамаларымен байланыстырылады. Жұмыста зерттеліп отырған кенорынның Юра терригенді шөгінділері геологиялық әртектілікпен және геофизикалық параметрлерінің өзгеруімен сипатталады. Ұңғыманы геофизикалық зерттеулердің қазіргі әдістері қолданылатын кешеннің толық болуында және зерттелген геологиялық нысанның геофизикалық және есептеу параметрлері арасындағы петрофизикалық байланысты білу. Коллектор түрін дұрыс анықтағанда және географиялық интерпретация әдісін қолданғанда зерттеліп отырған қиманың дұрыс мәліметтерін алуға мүмкіндік береді [1-3].

Түйін сөздер: ұңғыманы геофизикалық зерттеулер; литологиялық бөлу, коллектор; кеуектілік коэффициенті, саздылық, мұнай газға қанықтылық; петрофизикалық зерттеулер; тау жыныстың сыйымдылық қасиеті; меншікті электрлік кедергі; табиғи гамма-шағылу, радиациялық, екінші гамма-шағылу; аралық уакыт; құмдылық, жіктеу коэффициенті.

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КОМПЛЕКСНЫЙ АНАЛИЗ ДИАГРАММ ГИС С ЦЕЛЬЮ ИЗУЧЕНИЯ РАЗРЕЗОВ СКВАЖИН НЕФТЕГАЗОВОГО МЕСТОРОЖДЕНИЯ

Аннотация. Основными задачами геофизических исследований скважин месторождения являлись: изучение геолого-геофизического разреза скважин, литологическое расчленение, выделение в разрезе пластов-коллекторов, разделение коллекторов по характеру насыщенности, оценка характера насыщенности и количественное определение коллекторских свойств эффективных толщин. При расчленении продуктивной части разреза скважины выделяются слои различного литологического состава, устанавливается последовательность их залегания, а также определяются коллекторы и непроницаемые разделы между ними. Решаются эти задачи с помощью комплекса методов изучения разрезов. Данные геофизических исследований скважин увязываются с данными описания и анализа образцов пород (шлама, керна). В работе проведен анализ комплекса геофизических методов исследования скважин изучаемого месторождения. Юрские терригенные отложения изучаемого месторождения характеризуются геологической неоднородностью и существенной изменчивостью геофизических параметров. Современные методы геофизических исследований скважин, при полноте используемого комплекса и знании петрофизических связей между геофизическими и подсчетными параметрами изучаемого геологического объекта, при правильном представлении о типе коллектора и применении геофизически обоснованных способов интерпретации, дают возможность получить представительные данные об изучаемом геологическом разрезе [1-3].

Ключевые слова: геофизические исследования скважин; литологическое расчленение, коллектор; коэффициенты пористости, глинистости, нефтегазонасыщенности; петрофизические исследования; емкостные свойства породы; удельное электрическое сопротивление; интенсивности естественного гамма-излучения, радиационного, вторичного гамма-излучения; интервальное время; коэффициенты песчанистости, расчлененности.