N E W S
OF THE NATIONAL ACADEMY OF SCIENCES OF THE REPUBLIC OF KAZAKHSTAN
SERIES OF GEOLOGY AND TECHNICAL SCIENCES
ISSN 2224-5278
Volume 2, Number 428 (2018), 156 – 166

UDC 550.832 (550.853)

A. K. Issagaliyeva, G. T. Borisenko, A. B. Adambayeva

Satbayev University, Almaty, Kazakhstan.
E-mail: a_isagalieva@mail.ru, bgt69@mail.ru, amangul_1996@mail,ru

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 polymicticity, 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-