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ANALYSIS OF THE INHOMOGENEITY OF THE TERRIGENOUS DEVON STRUCTURES BASED ON THE STRUCTURAL - TECTONIC MODEL

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Abstract. At the current stage of development of geological science and computer technologies, it is possible to integrate all available geological, geophysical and field information and its integrated analysis using digital three-dimensional modeling of the geological structure of the field. Currently, there are many software packages that are convenient for modeling, but the issues of methodology and technology for building models remain a very difficult engineering task. Geological modeling covers all aspects of the field study: from a conceptual view of the field structure to a detailed correlation of the petrophysical properties of the productive strata. It reproduces with a high degree of detail all the features of the geological structure of the development object and its interaction with the systems of production and injection wells. The structure of the main three-dimensional grid shows the conceptual and structural features of the formation occurrence.

The geological model should not narrowly focus on any particular problem, whether it is the calculation of reserves or the basis for hydrodynamic modeling of the field development process. Correctly and with reliable detail, the constructed model can solve any of the proposed tasks to a certain extent. On the basis of the model, you can conduct a full mapping of the object under study, that is, build up maps of the roof, sole of effective and saturated thicknesses. Based on the obtained 2D maps or on the original 3D parameters, it is possible to conduct an estimated inventory calculation using the volumetric method. The latter in combination with the model can become the basis of the development project.

Key words: *source rocks, reservoir, the heterogeneity of the formations, terrigenous rocks, structural - tectonic model*

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ANALYSIS OF RESEARCH RESULTS OF CORE SAMPLES AND CORE OIL USING STATISTICAL METHODS

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Abstract. The aim of the work is to assess the potential of oil and bitumen productivity of the analyzed deposits. Research was conducted on 13 core samples from various intervals of 4 wells. This paper presents the results of an analysis of the composition and properties of hydrocarbons extracted from the core of carbonate and adjoining deposits from an interval of 1631.2-1774.8 m. The analysis is based on the results of thermogravimetric, chromatographic and optical studies. The results were processed using the calculation of linear and rank correlation. A significant relationship is noted between the values of the parameters obtained as a result of chromatographic studies and laboratory studies to determine the composition of oil and the processes that occur in them when heated according to a given program, as well as between the results of chromatographic and optical studies. The analysis showed a significant contribution of light fractions of isoalkanes and light fractions of normal alkanes during thermal transformations, i.e. during storage, delivery to the laboratory and sample preparation, there was no significant loss of light components of the core material hydrocarbons. No correlation was found between optical and thermal methods, since these methods are aimed at identifying various stocks of organic material, which also require the application of various methods of exposure in their development. A detailed analysis of the samples revealing a noticeable mass loss during thermal exposure and low values of the light absorption coefficient makes it possible to identify rock samples with organic matter that is not converted to bitumoids. The results obtained make it possible to assess the applicability of both research methods and development systems with various technologies for influencing the bottom-hole zone and inter-well volume of the formation.

Key words: *thermogravimetry, spectrophotometry, chromatography, core, core oil, shale, dolomite, mudstone, limestone, rank correlation, linear correlation, Cheddock scale*

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**LOCALIZATION OF THE RESIDUAL OIL RESERVE AREAS OF THE RIGHTBANK
GROUP OF FIELDS OF PAO SLAVNEFT-MEGIONNEFTEGAZ**

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Abstract. The article considers the method of ranking the zones of localization of residual recoverable reservoir reserves by the degree of risk for further design of sidetracking and ensuring their involvement in the development. Modern reservoir simulation software permits history matching of almost any object. However, due to the geological heterogeneity of the formation, it is difficult to take into account the actual direction of the filtration flows. To improve the effectiveness of implemented measures, an integrated approach and a comprehensive analysis of the structure of residual reserves is required. An integrated approach enables to establish not only the physical causes of the entrapment or retention of oil in the porous medium, but also to evaluate the distribution of current oil saturation area and cut deposits to establish containment zones of residual reserves, to predict technological efficiency of drilling operations, to identify prospective areas for drilling. According to the results of geophysical and field-geophysical studies of wells, when analyzing the heterogeneity of the reservoir's geophysical properties by area and section, an uneven distribution of residual reserves across productive formations was established. An assumption is made about the advanced development of reserves in the upper part of the formation and a conclusion is made about the presence of zones of high concentration of residual oil reserves in the lower part of the formation. The authors have developed an express method that can be used to identify zones that are not involved in the development due to vertical anisotropy for planning the sidetracking without building of reservoir simulation model. The application of the method is considered on the example of formation X of the Western Siberia deposit, represented by cretaceous deposits. The proposed method is supposed to be scaled to objects with similar geological and physical characteristics for planning geological and technical activities.

Key words: *residual recoverable oil reserves, sidetracking, minimization of drilling risks*

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**INTEGRATED APPROACH TO ANALYSIS AND IMPROVEMENT OF THE
DEVELOPMENT SYSTEM ON THE EXAMPLE OF OIL DEPOSIT WITH A WIDE
WATER-OIL ZONE**

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Abstract. Currently, most of the oil fields of the Republic of Tatarstan pay much attention to residual recoverable reserves, since the amount of “traditional” oil decreases every year. This trend imposes certain difficulties on the process of their extraction. However, with a full study of hard-to-recover reserves, it is possible to maintain stable oil production by involving such deposits or their parts in the development.

This article discusses a comprehensive study of the geological structure of an oil reservoir, together with an analysis of changes in reservoir pressure and current moving oil reserves. Based on the results obtained, the most favorable areas are selected for well drilling and geological and technical measures. It is assumed that these measures will make it possible to reasonably improve the development system of an oil deposit with an extensive oil and water zone to cover the development of residual reserves.

Key words: *timan horizon, geological structure, reserves, well, development object, production, reservoir pressure, injection, integrated, development system*

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**UPDATING NUMBER OF FRAC STAGES FOR HORIZONTAL WELLS PRODUCING
FROM LOW-PERMEABILITY RESERVOIR IN VIKULOV FORMATION ON
KAMENNY LICENSE BLOCK**

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Abstract. This paper discusses the problem of defining optimum fracture density for multi-stage frac jobs using “cup-2-cup” packer technology based on the analysis of actual horizontal well start-up parameters.

Key words: *horizontal wells, low-permeability reservoir, multi-stage hydraulic fracturing, Vikulov formation, Kamenny license block*

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DEVELOPMENT OF OIL PRODUCTION PROBABILISTIC FORECASTING TECHNIQUE

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Abstract. Deterministic methods are typically used for reservoir and production engineering or well intervention planning. Deterministic reservoir simulation models or design equations that are usually used provide only a single estimate of reserves and production. However, distribution of reservoir properties is random due to their significant areal and vertical heterogeneity, as well as uncertainty of their measurement. Therefore, accurate forecast of oil production rate is impossible. It is only possible to define a degree of possibility for a certain well flow rate.

For this reason, stochastic methods of reserve estimation based, for example, on Monte-Carlo technique or 3D geologic models have been successfully used for quite a long time. These methods provide a probabilistic estimate of oil reserves. However, when proceeding to field development analysis and planning, the entire group of geologic models turns into the same group of reservoir simulation models differing by geological structure representation. Labor-consuming nature of their generation and history matching makes it impossible to obtain a real-time probabilistic estimate of well flow rates.

This paper discusses the development of technique for well flow rate probabilistic forecasting based on stochastic approach to geologic reservoir description. This technique is quite simple and does not require significant time spending and computation effort. The main concept of the technique is estimating parameters in a certain point of a reservoir, obtaining parameter density function and evaluating production rate of a new well in a certain point by Monte-Carlo method.

Key words: *oil production forecast, geostatistics, geostochastics, Monte-Carlo method, variogram, interpolation, declustering*

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SPECTROPHOTOMETRY AS A METHOD OF SELECTION OF ACIDIC COMPOSITIONS FOR WELL STIMULATION

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Abstract. Aim of this work is increase accuracy of selection of formulations of acid compositions during acid treatments of bottom-hole zones of terrigenous reservoirs of producing wells by applying spectrophotometry method to assessing the quality of acid emulsions obtained.

Methodology for selecting necessary acid composition for processing bottom-hole zone of a producing well consists in an integrated approach and need for spectrophotometry. Before carrying out acid treatment, oil samples are taken from the candidate well. Further, in laboratory conditions, acid compositions of various concentrations are prepared, which form acid emulsions based on selected oil. A solution in toluene is prepared with initial oil and resulting acid compositions for further optical studies on a spectrophotometer with determination of optical density at various wavelengths. Mathematically, light absorption coefficient is calculated, graphical dependences on radiation wavelength are constructed, and a conclusion is drawn on possibility of using studied acid compositions.

Key words: *optical methods, spectrophotometry, acidic composition, acid emulsions, well stimulation, asphaltenes*

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RESULTS OF LABORATORY STUDIES OF THE PROPERTIES OF ASPHALTENE- RESIN-PARAFFIN DEPOSITS

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Abstract. The effectiveness of a number of methods for removing asphaltene-resin-paraffin deposits from the surface of the downhole equipment depends on the properties of the asphaltene-resin-paraffin deposits and the properties of the composition and structure of the deposits, the intermolecular adhesion forces and the adhesion to the surface that determine these properties. In this regard, the study of the physicochemical properties of paraffin deposits is of practical interest.

The paper presents the results of an analysis of the properties of field samples of paraffin in order to clarify the optimal composition of the sediment solvent composition. The nature of the influence of moisture saturation on the mechanical strength index of field samples of asphaltene-resin-paraffin deposits is established, in which a trend towards a decrease with increasing moisture saturation can be distinguished. The high heterogeneity of the mechanical properties of paraffin deposits is shown, which justifies the need for individual selection of compositions for a well or group of wells, as well as the processing time when using solvent compositions.

Key words: *asphaltene-resin-paraffin deposits, mechanical strength, moisture saturation, sucker rods, efficiency*

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EXPERIMENTAL TESTINGS OF THE HYDROGEN'S SULFIDE AND MERCAPTANES'S ABSORBER AT THE BELKAMNEFT CHECK-IN POINT

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Annotation. The problem of increasing the quality of oil raw materials by neutralizing or removing hydrogen sulfide and mercaptans from oil in the process of oil production, recovery and refining is considered. In recent years, there has been an increase in these chemical compounds in most oil fields that are in the final stages of development. These chemical compounds have a sharp unpleasant odor, cause corrosion of the equipment and significantly increase the cost of oil due to the difficulty of processing it, and also require additional measures due to their corrosiveness. Therefore, the removal of sulfur and its derivatives is one of the most relevant tasks in the extraction, collection and preparation of oil. To improve the indicators of the oil quality, the Belkamneft acceptance and acceptance point (PSP), the best method of disposal of hydrogen sulfide and light commercial liquids, is the use of chemical reagents. In connection with this, pilot field tests (OPI) and theoretical calculations of each of the following reagents were carried out: PSV 3402 grade A, Desulfon-SNPCH-1100, Gastrit K131M grade A. It was revealed that these reagents comply with the technical regulations of the Eurasian Economic Union (TR EAEU 045/2017) and TU 20.59.59-002-74033386-2007. Their initial dosage has been established to reduce the content of sulfur-containing compounds.

Key words: *hydrogen sulfide, mercaptans, oil, deposits, hydrogen sulfide absorber (neutralizer)*

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**THE DEVELOPMENT OF AN ACTION PLAN FOR THE PREVENTION AND
ELIMINATION OF THE OIL AND OIL PRODUCTS SPILLS OF THE JOINT-STOCK
COMPANY «PORT OF KAMBARKA»**

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Abstract. Currently, oil pollution covers more and more territories and water areas. The article is devoted to the development of an action plan for the prevention and elimination of oil and oil products spills in the Port of Kambarka of the joint-stock company (JSC). It is the largest port in the Kama river basin, located 400 kilometers downstream from the city of Perm. Through it, Kambarka sends cargo along the internal waterways of Russia, as well as supplies products to countries such as Turkey, Romania, and Bulgaria. Also, JSC "Port Kambarka" bunkering vessels on the territory of the repair and settling point directly from the tanker. During transportation and lifting operations, accidents may occur that lead to spills of hydrocarbons. The work at the Port of Kambarka of the JSC identified possible sources of oil pollution. These include: fuel tanks of vessels in the event of an accident with a vessel (hull damage in a collision, impact, stranding, explosion); storage tanks for petroleum products on the territory.

Key words: *oil and petroleum products, emergency situation (ES), oil spill response (OSR), emergency response (ESR), oil and petroleum product spills*

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THE LOGISTIC OF HABITABLE UNDERWATER DRILLING VEHICLE

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Abstract. In the article was considered the question about logistic solid and liquid materials and crewchange for habitable underwater drilling vehicle (HUDV). HUDV are used for development of oil and gas fields on the Arctic shelf that covered of ice a long time. We suggest a new technical solution for the underwater logistic, because prepared solution is missing. Also, we offer the name and specification for different complicating issues of the HUDV development.

Key words: *underwater well construction, habitable underwater drilling vehicle, underwater logistic, issue of underwater development*