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Prospects for the development and identification of oil and gas fields in the Upper, Lower Cretaceous and Paleozoic sediments (using the example of the Western Aral field in the Ustyurt oil and gas region)

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Abstract. This article is devoted to scientific research into the prospects for the development and identification of oil and gas fields in the Upper, Lower Cretaceous and Paleozoic deposits (using the example of the Western Aral field in the Ustyurt oil and gas region).

The existence of reserves of sulfur-free gas or with a small amount of sulfide impurities in the depths of the country's earth creates new opportunities for diversification of production and operation with the appropriate infrastructure at planning sites and determines the prospects for further geological exploration work (GRR). The sediments being studied today as an object of study are at a level above those horizons that are exploited on an industrial scale. Taking this into account, the authors of this article have set goals and objectives for conducting scientific research in order to determine the prospects for the development of productive horizons of Cretaceous and Paleozoic deposits of the Bukhara-Khiva and Ustyurt oil and gas regions using the example of the Western Aral field. The main factors for such a statement are fundamental research carried out in previous years, as well as the accumulated experience for this period by leading scientists in this field of research.

Research on sulfur-free gas in the Ustyurt oil and gas region is currently not being studied and scientific and practical works have not been published in the scientific world. In this regard, during the period of rapid growth and application of information and communication technologies and digitalization, contrary to traditional views, it is necessary to switch to predictive planning and conduct scientific research on geological modeling of these processes, using modern software and effectively apply space monitoring methods. This will allow solving multivariate problems with minimal labor and financial costs. When setting goals and determining the prospects for research into sulfur-free gas, industrial enterprises do not show due attention and interest in the scientific developments of research institutes based on new innovative methods and technologies. This article is devoted to scientific research in the field of production of sulfur-free gas at horizons overlying productive ones, that is, Paleozoic and Jurassic deposits. The authors conducted research on the underlying sediments of the Ustyurt oil and gas region using a new innovative methodology.

Key words: stratigraphy, search, exploration, Cretaceous and Paleozoic deposits, area, structure, section, sulfide impurity, drilling, well, horizon, hydrocarbon, field, Western Aral, Ustyurt oil and gas region, Bukhara-Khiva oil and gas region, reservoir, sweet gas, migration, interval, block

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Stratigraphic and lithological-facies analysis of paleogene deposits of Central Asia and their relationship with mineral resources

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Abstract. The article discusses the stratigraphic levels, age intervals and lithologic-facial features of Paleogene deposits of Central Asia. The stratigraphic positions and correlations of horizons of Paleogene deposits are characterized vertically and laterally. The deposits of each identified facies unit are distinguished by a certain set of rocks. An overview and stratigraphic association of various types of minerals found in this territory and their distinctive lithological and stratigraphic features are provided both during the period of accumulation in sedimentation basins and in modern conditions. The complete cycle of sedimentation has been determined, consisting of Paleocene, Eocene and Oligocene stages, reflecting the direction of evolution of the Paleogene sedimentary basin of the study area, further facilitating the possibility of developing the territory in a new strategy for predicting the search for promising deposits, manifestations and mineral deposits.

Key words: *paleogene, lithology, stratigraphy, stage, formation, layers, sediments, rock, section, zone, area, depression, syncline, deposits*

For citation: T.Kh. Shoimurotov, I.N. Khakimzyanov, F.F. Zhuraev Stratigraficheskiy i litologo-fatsial'nyy analiz paleogenovykh otlozheniy tsentral'noy Azii i ikh svyaz' s poleznymi iskopayemymi [Stratigraphic and lithological-facies analysis of paleogene deposits of central Asia and their relationship with mineral resources]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 36-58. DOI <https://doi.org/10.25689/NP.2024.1.36-58>. EDN DAWDKS (in Russian)

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Development of the X-ray diffraction method in the mineralogy laboratory of Tyumen Petroleum Research Center LLC

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Abstract. This article discusses the evolution of the development of the X-ray diffraction method in the mineralogy laboratory of TPRC LLC, methods of sample preparation and software application, experience of participation in interlaboratory comparison tests in the perimeter of the Company, the optimal set of studies for studying the mineral composition of rocks in the research institutes of the Rosneft Oil Company was adopted.

Key words: *rock formation, core, X-ray phase analysis, X-ray structure analysis, Rietveld method, RIR method, interlaboratory relative competition*

For citation: M.A. Aleksandrov, A.V. Solovyeva, N.N. Arzhilovskaya, R.S. Shulga Razvitiye metoda rentgenovskoy difraktsii v laboratorii mineralogii OOO «Tyumenskiy neftyanoy nauchnyy tsentr» [Development of the X-ray diffraction method in the mineralogy laboratory of Tyumen Petroleum Research Center LLC]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 59-73. DOI <https://doi.org/10.25689/NP.2024.1.59-73>. EDN DWONIB (in Russian)

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EDN GEJHFY

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Pressure transient testing of hydraulically fractured horizontal wells

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Abstract. One of the most important factors affecting the oil and gas industry as the main means of increasing production from wells is hydraulic fracturing (FRACKING). It is important for successful hydraulic fracturing to conduct calibration tests of the formation and accurate calculation of filtration parameters of the development object. During the development of low-permeable reservoirs, hydraulic fracturing has become widespread. For some reasons, hydrodynamic studies of wells (GDIS) are not carried out during development and the information on the filtration properties of the formation becomes distorted after long-term operation of the well. The missing data on the filtration properties of the formation, the permeability coefficient, can be found out from the data of the formation test conducted during hydraulic fracturing. At the same time, a significant amount of data remains unclaimed during hydraulic fracturing tests

For the analysis of calibration tests, the pressure drop curve (efficiency) and the complementary analysis tool G-function are investigated. In this paper, it is proposed to use the interpretation of the G-function as additional information when interpreting the results of hydro-dynamic well studies (GDIS), the pressure recovery curve (KVD) and efficiency.

Key words: *fractured horizontal wells, hydrodynamic methods of well testing, drop curve, pressure build-up (efficiency, pressure build-up), G-function*

For citation: E.F. Gilfanov, T.K. Apasov Issledovaniye gorizontal'nykh skvazhin s treshchinami gidravlicheskogo razryva plasta metodami neustanovivsheysya fil'tratsii [Pressure transient testing of hydraulically fractured horizontal wells]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 74-88. DOI <https://doi.org/10.25689/NP.2024.1.74-88>. EDN GEJHFY (in Russian)

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EDN GOAEHU

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Research of the degree of PBU curve depending on reservoir parameters and well completions

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Abstract. In this paper the problem of reservoir pressure estimation is considered based on hydrodynamic studies of wells (HPT) in transient filtration modes. Pressure build-up curves were modeled for different reservoir porosity and permeability properties. An approach has been developed that lets one make decisions to complete the study based on the pressure rate change, and achieve a given pressure build-up amount.

Key words: *well test, reservoir pressure, pressure build-up, pressure transient analysis, pressure buildup curve*

For citation: G.A. Nigametyanova, D.Z. Ishkin Prognozirovaniye dlitel'nosti KVD na osnove parametrov plasta i zakanchivaniya skvazhin [Research of the degree of PBU curve depending on reservoir parameters and well completions]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 89-97. DOI <https://doi.org/10.25689/NP.2024.1.89-97>. EDN GOAEHU (in Russian)

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Study on determination of residual oil saturation in waterflooded zones

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Abstract. Determination of the change in the mobile oil reserves of the object during the development process, hence, the residual oil saturation parameter (SOWCR), is an important task for correct determination of technological indicators of development during field operation. Correctness of determination of this parameter depending on the development time influences the final value of oil recovery factor.

To determine the influence of the development process on the changes in the mobile oil reserves of the object on the residual oil saturation parameters, 584 core studies for 21 wells were analyzed. As a rule, determination of the residual oil saturation parameter by means of core studies requires specification of the time of development of the object of study: core material may be taken in different periods of the object development. Based on the analysis of core material from waterflooded areas of one of the fields of the Republic of Tatarstan, it can be noted that the residual oil saturation value is higher in the zones less covered by waterflooding. In zones covered by waterflooding (with large injection volumes at injection wells) the residual oil saturation values are lower. From the analysis of changes in residual oil saturation values in waterflooded zones, it is necessary to take into account the increase in recoverable oil reserves during development in waterflooded areas of the field.

Key words: *mobile oil reserves, residual oil saturation, core studies, logging data, recoverable oil reserves*

For citation: R.Kh. Nizaev, R.R. Khasanov Issledovaniy po opredeleniyu ostatochnoy nefenasyshtenosti v zavodnennykh zonakh [Study on determination of residual oil saturation in waterflooded zones]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 98-106. DOI <https://doi.org/10.25689/NP.2024.1.98-106>. EDN IGJZDK (in Russian)

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Automation of data pre-processing and history-matching using software technology

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Abstract. For more than half a century of field exploitation, Tatneft has accumulated a large amount of geological, geophysical and field information. Over the past few years, significant work has been done to transfer this information from paper sources to electronic form. Analysis and verification of such a volume of information for subsequent use in the construction of geological and hydrodynamic models are associated with significant labor costs, which, depending on the duration of the development history, the number of production facilities and the number of wells drilled in the field, can be comparable to the modeling stages. The quality of initial data preparation has a direct impact on the ability of models to perform the tasks assigned to them. The paper presents ways to solve the problem of optimizing and automating preparation and identifying inconsistencies in the original data, as well as a method for automatically identifying inaccuracies in the geological model.

Key words: *geological modelling, hydrodynamic modelling, program code, relative permeability*

For citation: R.M. Amerkhanov, R.R. Khasanov, A.Kh. Gilyazov, B.T. Makhmutov Avtomatizatsiya preprotssessinga dannykh i nastroyki gidrodinamicheskoy modeli mestorozhdeniya s primeneniym programmirovaniya [Automation of data pre-processing and history-matching using software technology]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 107-122. DOI <https://doi.org/10.25689/NP.2024.1.107-122>. EDN KHKMTW (in Russian)

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Refinement of the geological and hydrodynamic model of pashian deposits of the Romashkinskoye field site, taking into account the underlying deposits and facies modeling

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Abstract. Industrial development of the Romashkinskoye oil field began in 1945, and at the moment it is at a late stage of development. The subsoil user is faced with the task of optimizing the development of productive reservoir in order to increase oil production. Improving the system for developing oil fields at the present stage is impossible without the use of modeling tools - building a geological and hydrodynamic model. To improve the quality of simulation model, it is necessary to improve the applied modeling approaches and integrate various geological, geophysical, field and laboratory data. Increasing the detail of the geological structure and clarifying the dependencies of filtration-capacitive properties makes it possible to localize residual reserves.

This paper discusses ways to clarify and improve the geological-hydrodynamic model based on the correlation of sediments in accordance with the sedimentation model, the entrainment of reservoirs with poor reservoir permeability, taking into account the confluence zones of the pashian with the underlying mullinsky deposits, adjustment the dependencies of the relative permeability and justification displacement efficiency separately for the upper pashian, lower pashian objects and selected facies.

Key words: *geological modelling, hydrodynamic modelling, correlation, facies, confluence zones, relative permeability, oil displacement*

For citation: M.V. Fedotov, A.V. Nasibullin, T.I. Ganiev, A.A. Kildiushov, K.D. Shumatbaev Utochneniye geologo-gidrodinamicheskoy modeli pashiyskikh otlozheniy uchastka Romashkinskogo mesto-rozhdeniya s uchetom nizhelezhachikh otlozheniy i fatsial'nogo modelirovaniya [Refinement of the geological and hydrodynamic model of pashian deposits of the Romashkinskoye field site, taking into account the underlying deposits and facies modeling]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 123-138. DOI <https://doi.org/10.25689/NP.2024.1.123-138>. EDN NGRRUU (in Russian)

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Testing the CRM model adaptation based on hydrodynamic modeling data

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Abstract. The article describes the experience of testing adaptation quality of an analytical CRM model (Capacity Resistance Model) to the simple oil-development object hydrodynamic simulator data. The simulation object is a three-layer homogeneous oil reservoir with various vertical permeability and homogeneous horizontal permeability. Well stock contains one injector and eight producers arranged in a nine-point waterflooding pattern. The duration of a simulation is 187 steps, the calculation step equals 1 month. Several different simulations of the hydrodynamic model with different well constraints have been carried out, namely: constant and variable injection rate, constant flow rate and constant bottom-hole pressure maintenance constraint. For each simulation case CRM models have been calculated then graphs have been analyzed and conclusions have been made. The purpose of the study is to use synthetic data testing to determine the performance of the CRM model and its potential suitability for real data handling.

Key words: *Capacity Resistance Model, hydrodynamic models, analytical models, mathematical modeling, proxy modeling, oil reservoir, synthetic data, modeling, well constraints, well operation*

For citation: T.A. Nafikov, M.N. Khanipov Testirovaniye adaptatsii CRM modeli na dannykh gidrodinamicheskogo modelirovaniya [Testing the CRM model adaptation based on hydrodynamic modeling data]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 139-152. DOI <https://doi.org/10.25689/NP.2024.1.139-152>. EDN PJIUKP (in Russian)

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Effects of forced fluid production intensity on oil rates and cumulative oil production in different producing intervals of the Romashkinskoye oil field

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Abstract. The paper analyses the effects of various intensities of forced fluid recovery on oil rates and cumulative oil production at the late stage of field development. The theoretical background behind the method is provided, statistical analysis of incremental oil rates and cumulative oil production following the implementation of forced production with various intensities has been performed for Devonian reservoirs of the Romashkinskoye oil field.

Keywords: *forced fluid recovery, oil fields development, well, oil production*

For citation: V.A. Khabardin, D.R. Gatin, D.F.Gizatullina O vliyaniy intensivnosti forsirovaniya dobychi zhidkosti na debit i nakoplenyy otbor nefi na razlichnykh gorizontakh Romashkinskogo mestorozhdeniya [Effects of forced fluid production intensity on oil rates and cumulative oil production in different producing intervals of the Romashkinskoye oil field]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 153-169. DOI <https://doi.org/10.25689/NP.2024.1.153-169>. EDN RSTXYJ (in Russian)

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Development of technology for limiting premature gas breakthrough into the producing wells of the Goit-Kort field using asphaltene-resinous substances

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Abstract. The PPD system of Miocene deposits of the XXIII formation of the Chokrak tier of the Goit-Kort field began to form in 1978 by pumping gas into wells No. 29; 59; 107. The implementation of the technology of impact on the deposit by injection of high-pressure gas in order to increase oil recovery of the XXIII formation of the Goit - Kort field faced in field conditions with the advance of the injected gas into the producing wells, the growth of gas factors and a decrease in the coverage of the reservoir by displacement. In order to increase the efficiency of work to prevent and eliminate gas breakthroughs during the development of oil fields by pumping high-pressure gas through relatively highly permeable layers, it is advisable to block these layers in producing wells and carry out work to limit the flow of gas into them in injection wells. These requirements are most met by the method of selective isolation of gas with compositions based on asphaltene-resinous substances (DIA). The results of the conducted research and field tests indicate the fundamental possibility of using solutions of asphaltene-resinous substances to limit the flow of gas in the wells of the Goit-Kort field, leveling the inflow profiles and increasing oil recovery of the reservoir.

Keywords: *asphaltene-resinous substances (DIA), transition zone, selective insulation, gas breakthrough, light absorption coefficient*

For citation: M.M. Bakraev, I.L-A. Dugaev, A.I. Barkinkhoev, F.Z. Bulyukova Razrabotka tekhnologii ogranicheniya prezhdevremennogo proryva gaza v dobyvayushchiye skvazhiny mesto-rozhdeniya Goyt-Kort s ispol'zovaniyem asfal'teno-smolistykh veshchestv [Development of technology for limiting premature gas breakthrough into the producing wells of the Goit-Kort field using asphaltene-resinous substances]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 170-183. DOI <https://doi.org/10.25689/NP.2024.1.170-183>. EDN SANKLK (in Russian)

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EDN WBAWDR

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On non-newtonian properties of polymer solutions during filtration through a porous medium

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Abstract. The construction of reliable hydrodynamic models is an important step in the development of oil fields. These models are based on mathematical models of liquid and gas filtration, which strive to describe the properties of real oil production systems as accurately as possible.

The development processes of oil and gas fields are inextricably linked with the movement of multiphase multicomponent media. Such systems are characterized by nonequilibrium and nonlinear rheological properties, which complicates their modeling.

An assessment of the experience in studying the nonlinear effects of filtration of polymer solutions in porous media showed that an insufficient number of studies have been performed in the presence of residual oil. This may indicate the need for further research in these areas and expansion of the knowledge base.

Key words: *relative phase permeabilities, laboratory studies, nonlinear filtration effects, filtration rate, pressure gradient*

For citation: A.V. Nasybullin, D.R. Khayarova O nen'yutonovskikh svoystvakh polimernykh rastvorov pri fil'tratsii cherez poristuyu sredu [On non-newtonian properties of polymer solutions during filtration through a porous medium]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 184-192. DOI <https://doi.org/10.25689/NP.2024.1.184-192>. EDN WBAWDR (in Russian)

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Actual solutions for implementing thermal effects on the bottomhole zone of the well for high viscosity oil fields

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Abstract. The article discusses current thermal methods for developing a high-viscosity oil field using the example of the Zhylankabak field. A selection of a number of thermal EORs, including electrothermal and thermal steam treatments, is described. In conditions of complicated exploitation of the field, namely the absence of a constant source of water and power lines, the most optimal method was proposed for heating the bottomhole zone of the well with a solid fuel heater. The operating principle of a solid fuel heater is based on the use of reagents inside the reactor, which enter into an exothermic reaction when interacting with each other. Solid fuel heater technology allows you to control the start time of this reaction. During the reaction, a large amount of hot gases are released, which contribute to an increase in pressure, heating of the bottomhole zone of the well and cleaning of asphaltene-resin-paraffin deposits from the wellbore. A diagram of the design of a solid fuel heater and the results of pilot field tests at the Zhylankabak field are presented. Based on the test results, this device showed itself successfully and was recommended for use in conditions similar to the described field.

Keywords: *enhanced oil recovery methods, high-viscosity oil fields, thermal methods, electrothermal methods, asphaltene-resin-paraffin deposits, bottomhole formation zone, complicated development conditions, solid fuel heater, wide fractions of light hydrocarbons, thermochemical effects*

For citation: A.F. Shageev, S.A. Dolgih, V.A. Milyutina, D.R. Minekaeva Aktual'nyye resheniya dlya teplovoy obrabotki prizaboynoy zony skvazhiny dlya mestorozhdeniy vysoko-vyazkikh neftey [Actual solutions for implementing thermal effects on the bottomhole zone of the well for high viscosity oil fields]. Neftyanaya Provintsiya, No. 1(37), 2024. pp.193-214. DOI <https://doi.org/10.25689/NP.2024.1.193-214>. EDN XWIPST (in Russian)

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Interference of fracking fluids and process liquids

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Abstract. The study investigated the impact of ion composition in technological fluids on the re-agglomeration of hydraulic fracturing (HF) fluids after their destruction. The findings underscored the importance of considering "re-agglomeration" during the planning and execution of HF operations, as well as the necessity of conducting compatibility studies on the fluids. Experimental observations revealed that kill fluids based on mineralized water exhibited a reduction in dynamic viscosity when HF fluids were added. However, the addition of specific components posed a risk of re-agglomeration, particularly in wells with high corrosion rates. Further investigations involving higher concentrations of trivalent iron ions are warranted to assess these risks under such conditions.

Key words: *hydraulic fracturing, pH indicator, killing fluids, washing liquids, compatibility, stitching, dynamic viscosity, washing agent*

For citation: I.A. Alenkin, R.R. Zakirov Vzaimovliyaniye zhidkostey grp i tekhnologicheskikh zhidkostey [Interference of fracking fluids and process liquids]. Neftyanaya Provintsiya, No. 1(37), 2024. pp. 215-228. DOI <https://doi.org/10.25689/NP.2024.1.215-228>. EDN ULMNPV (in Russian)

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Estimation of the colmatation negative impact and the penetration depth of the washing liquid leachate on the well productivity

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Abstract. During drilling and major repairs of wells in oil and gas fields, the productivity of the well decreases. It is known that the productivity of a well in the bottom-hole formation zone (BHFZ) decreases due to the negative influence of the filtrate and the solid phase of the drilling mud, incomplete perforation of the entire productive part of the formation.

The article discusses various factors that significantly affect the permeability of the BHFZ during its secondary opening, which is relevant at the final stage of field development. Recommendations are given to improve the efficiency of drilling and drilling operations technology in various geological and technical conditions of field operation.

Based on the conducted research, the areas of effective application of secondary opening of a productive reservoir at the final stage of field development have been identified.

In the presence of plantar water, it is necessary to open only part of the formation, while ensuring almost maximum, anhydrous productivity of wells and minimal risk of a breakthrough of the cone of plantar water to them. One of the ways to preserve reservoir properties during long-term downtime of the well is the use of liquids without a solid phase and perforation during depression to the BHFZ of the productive formation.

Key words: *well productivity, opening of a productive reservoir, penetration of filtered flushing liquid into the reservoir, perforation, hydrodynamic perfection of wells*

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Consideration of the reasons for decommissioning of roller cone bits

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Abstract. The article provides a classification of the reasons for the decommissioning of roller cone bits, indicating the most significant categories that require priority modernization. A group of roller cone bits with uneven wear of steel teeth is considered in detail, with an emphasis on the scope of application of this group of drill bits. Consideration of the above classification allows us to identify the most relevant areas for the modernization of roller cone bits. The assessment of wear is relevant both for companies developing rock-crushing tools and providing service support drill bits.

Keywords: *oil, gas, drilling, roller cone bit, rock-crushing tool, steel teeth, milled teeth, wear, erosion, cone*

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Application of a profile cap to isolate unstable rocks of the saraily formation when drilling sidetracks at the Ilinskoye field

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Abstract. This article discusses the problem of incompatibility of drilling conditions associated with the loss of stability of the rocks composing the walls of the wellbore. In the Udmurt Republic, the construction of wells for Devonian development sites is complicated by unstable Saraili sediments, which are the cover of productive horizons. The instability of the Saraili deposits, both during the construction of wells and when drilling sidetracks, can lead to more serious consequences, such as screes and rock falls, sticking of the drilling tool, involuntary cuts, losses of the drilled shaft, and others. These problems can be solved by the technology of capping unstable rocks by using a profile cap while maintaining the nominal diameter of the wellbore.

Key words: *well, productive horizon, construction, sidetrack drilling, rock instability, profile cap, Saraili clay, drilling tool, shaft, field*

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