УДК 553.98(470.4/.5)

POST-SEDIMENTATION STRUCTURE OF ZHIGULI DISLOCATION AND NEO-TECTONICS OF CIS-URALS DOMANIKS. GEOLOGICAL RISKS OF DEVELOPMENT

V.I. Popkov, A.M. Shterenberg

Samara State Technical University

E-mail: popkov_vi@mail.ru

Abstract. The author presents the heterogenetic balanced volumetric geo-mechanical model for the structural massif of mountain rock post-sedimentation in view of geo-physical synergy and petro-migration. The paper provides a set of additional studies for seismic, tectono-physical, geological, geo-physical information in a process of search and exploration of hydrocarbon fields and large-scaled construction of surface and subsurface equipment, well drilling and their completion, as well as geo-dynamic studies, geo-hydrogeological simulation of their development stages. The author has studied the change in stress-deformed status of mountain massifs and the wells in a process of their subsurface operation. He also has studied the stress fields for the large-scaled reef formations in Zhiguli dislocation and the Cis-Ural region. The author has scientifically proved the inertia-capillary law of movement conservation (by Darcy-Stokes) and stress-deformed status of square compaction and structural packs of geo-physical rhythms during filtration, petro-migration diffusion and mass-transfer (Bessel's ray-path and Gaussian distribution). Basing upon the solution of equations related to number of movements (of Navier-Stokes type) for the deformed porous media and conjugated seismic emission of various mass transfer structures he, in a form of a system, has combined filtration as per Darcy and diffusion of structural-topological dislocation of impulses as per Euler with mobile neo-tectonics in porous-cavernous-fractured dissipative

accumulation of spectral-phase sedimentation and accumulation of hydrocarbons.

Key words: *Zhiguli dislocation, petro-migration, integration, tight formations, geo-physical synergy, reservoirs, hard-to-recover oil reserves, unconventional oil reservoirs, multi-stage hydro-fracturing, geological and hydro-dynamic models, oil field studies, innovative designing*

УДК 552.54

IDENTIFY ZONES OF NATURAL FRACTURES IN LOW-POROSITY CARBONATE SEDIMENTS ON THE BASIS OF ANOMALOUS RADIOACTIVITY

A.N. Mingazutdinov, O.V. Semenova

TatNIPIneft Institute

E-mail: MingazutdinovAN@tatnipi.ru

Abstract. Carbonate rocks contain more than half the world's oil reserves, while only a portion of the reserves is concentrated in reservoirs of porous type. A significant amount of the hydrocarbons is in low permeability carbonate rocks, which may be reservoirs of commercial value only in the presence of open cracks. In this regard, relevant is the challenge of finding fracture zones and the assessment of the degree of jointing in carbonate strata.

The presence of open cracks are determined using various methods that are sensitive to changes in the physical properties of rocks, caused by the fracture. However, existing methods for evaluation of fracture by physical methods have several disadvantages, not being direct methods.

The aim of this work is the analysis of data obtained in the spectral gamma-ray logging (SGK) in the core and their comparison with the data obtained when studying full-size core, to increase the completeness of investigation of properties of reservoirs and the allocation of intervals of fractured and loosened zones.

To determine the fractured and loosened zones on the basis of the phenomenon of "abnormal" radioactivity, we analyzed data obtained in the study of the core in several wells. Work with the content of SGK showed a General pattern of distribution of radioactive elements in the intervals of fractured rock.

Material analysis studies have shown that the spectral gamma method is objectively solves the problem of identification of the tectonic cracks. In

addition, this method operational at the time of implementation and does not require significant material costs.

Key words: *spectral gamma-ray logging, full-size core, natural radioactivity, fracturing, low-permeability carbonate reservoirs.*

УДК 553.984

HEAVY-OIL RESERVOIRS GEOLOGY AND SHORTCOMINGS OF THEIR ANALYSIS PROCEDURE

S.A. Panina, R.R. Abusalimova, A.A. Kostina

TatNIPIneft Institute

E-mail: ssofia@tatnipi.ru

Abstract. This paper covers a number of issues, namely presence of free water in heavy-oil reservoirs of the Sheshminsky horizon; problem of volumetric parameters determination by well-log data and their boundary values which are taken into account when identifying interlayers included in the net pay.

Various methods detect free water in this formation; so, this raises the question regarding the origin of this water. Permian deposits, as well as younger overlying deposits contain a number of aquifers. Oil probably migrated from the underlying formations and accumulated in the upper layers. Oil oxidized when contacting air due to shallow depth, resulting in low-mobility oil accumulations containing water.

All heavy oil reserves have been booked and estimated by a volumetric method. Porosity and oil saturation were determined by compensated neutron log, laterolog, gamma-ray log, and caliper log data. Neutron log data depend heavily on several technical factors, including borehole diameter measurement, mud cake properties, and flush fluid, which requires applicable adjustments.

The first efforts to define boundary values of reservoir parameters date back to 1976. The boundary values were determined using a statistical approach, with oil saturation versus porosity taken as the basis. We plotted oil saturation distribution over porous intervals, and according to this data, intervals with porosity less than 5% contain obviously poor reservoirs. Intervals with 5-11% porosity have 1-3% of oil saturation; however, this is typical of the lower part of

formation which has been swept to a varying extent, so the boundary value for porosity has been assumed to be 11%.

Key words*: Sheshminsky horizon, reservoir, heavy oil, well logging, core, free water.*

УДК 622.276.038:532.5

THE IDENTIFICATION OF ABSOLUTE PERMEABILITY FOR TWO-PHASE FLOW IN LAYERED HETEROGENEOUS RESERVOIR

A.V. Elesin, A.Sh. Kadyirova, A.I. Nikiforov, A.V. Tsepaev

Institute of Mechanics and Engineering, Kazan Science Center,

Russian Academy of Sciences

E-mail: elesin@imm.knc.ru

Abstract. The identification problem of absolute permeability coefficients for two-phase flow is considered. It is believed that on the well known values of flow rate in some moments of time. The identification task is reduced to minimization of the residual function. The minimization procedure is carried out the Levenberg-Marquardt method.

Key words: *two-phase filtration; identification of absolute permeability; minimization of residual function; control volumes method; method of Levenberg-Marquardt.*

УДК 622.243.24

TECHNOLOGICAL ASPECTS OF DRILLING COMPLEX TRAJECTORY WELLS

D.A.Mironov

TatNIPIneft Institute

E-mail: mironovda@tatnipi.ru

Abstract. This paper presents BHA (bottom hole assembly) design aspects and choice of well complex trajectory delicacy.

In the first part is defined the optimum location of heavy-weight drill pipe, which allows to reduce the likelihood of buckling effect. Calculations are performed in the software package TADPRO according to the actual survey. The results of the calculations showed that in wells with complex trajectories optimal is the installation of the drill collars below the interval of inflection of the trunk. This arrangement virtually eliminates the possibility of buckling effect, because when the location of the drill collars above the point of inflection of the trajectory of the barrel and even without the drill collars, drill string is pressed against the borehole wall, there is an effect of unresponsiveness, decreased mechanical drilling speed. If drill collars to position closer to the bottom, the hang-up is eliminated, because the above drill collars drill string will be stretched. In the future, the calculation results were confirmed in practice – mechanical speed after rotation of heavy-weight drill pipe significantly increased.

In the second part of the paper considers the dependence of the torque of the drill string from the maximum intensity change of the zenith angle and the complexity of the well trajectory. In the design the well trajectory with the horizontal termination of a trunk was developed three variants of the trajectory with the maximum intensity change of the Zenith angle of 3°/10 m, 2°/10 m, 1.5°/10 m. order to select the optimal trajectory the calculations in the software

package TADPRO and built a graphical representation of the wellbore and the calculated torques for the selected trajectories. The calculation results showed that the design trajectory with the rate of change of curvature of 3°/10 m creates conditions for effective drilling by: straightness of trajectory; a smaller moment of rotation of the drill string; the short barrel length compared to the trajectory with the rate of change of curvature of 2°/10 m and 1.5°/10 m.

Key words: *trajectory, BHA, drill collars, inclination angle, TADPRO software, buckling-effect.*

УДК 622.276.1/.4:622.243.24

EFFECT OF MATURE OIL FIELD CONDITIONS ON REQUIREMENTS FOR MWD AND LWD SYSTEMS USED IN COMPLEX-TRAJECTORY WELLS DRILLING

[1]R.A. Shaikhutdinov, [2]Yu.A. Gutorov

[1]OOO VNIIGIS-ZTK, Oktyabrsky

[2]NTC Neftyanaya Dolina, Oktyabrsky

E-mail: shairamil@mail.ru

Abstract. This paper analyzes the effect of geological and technical conditions in mature oil fields on reliability and information content requirements for telemetry systems designed to control the process of complex-trajectory wells drilling. The desired accuracy and efficiency of drilling such wells can only be provided by a real-time geo-steering technique. To attain the desired information content and reliability, one should use a remote sensing system which is a combination of a basic MWD system and a peripheral LWD system, set as close as possible to the drilling bit. To obtain optimum compromise between information content and reliability of the remote sensing system, a parametric variety of peripheral LWD systems should be generated adaptable both to specific geological and technical conditions, and to the drilling tools in use.

***Key words**: geological and technical conditions, information content, reliability, MWD and LWD systems, drill-bit assembly, parametric variety, geophysical, technical and geo-steering parameters.*

УДК 665.7.038

DEVELOPMENT OF NANOPARTICLES VISCOSITY MODIFIERS AND THE STUDY OF THEIR STRUCTURAL GROUP COMPOSITION

E.V. Kharitonov, G.I. Dusmetova, A.V. Sharifullin

Kazan national research technological university

E-mail: kharitonov.eve@list.ru

Abstract. This research aims to study the structural group composition of viscosity modifiers based on low molecular weight polyethylene and Ethylene-vinyl acetate (EVA). The major component of the raw material base for petroleum industry, not only Russia, but also in other oil-producing countries of the world, are heavy crude oil and bitumen reserves. Heavy oil reserves in Russia are estimated about 6-7 billion tones, wherein the Volga and Ural regions contains 60.4% of all Russian heavy oil reserves and 70.8% of viscous oil. Heavy oil deposits are found in Tatarstan, Udmurtia, Bashkiria, Samara and Perm regions.

The development of heavy oil, it's expensive and the advanced production methods are required. During the transportation of such oil a list difficulties associated with hydrocarbons property are encountered: high viscosity values, pour point, shear rate, mass fraction and asphaltene. which leads to substantial costs while transporting them through pipelines (high load on the pumps, thermal preparation before entering the pipeline system). Therefore, the most efficient and cost-effective method to reduce the pumping costs is considered to be reagent method, by introducing viscosity modifiers in the flow with addition of nanoparticles.

This work's objective, is to study the structure of the developed additives using Fourier Transform Infrared Spectroscopy(FTIR), Matrix Assisted Laser Desorbtion/Ionization(MALDI) methods and taking photomicrographs with JSM-6490LV Scanning electron microscope. The conducted studies of structural

group composition by FTIR spectroscopy method, showed that the possible structure of agglomerate additives consists of nucleus-nanoscale alumina particles bonded with polymers (Sevilen). Thus, occurring a partial restructuring of vinyl acetate.

Key words: *viscosity, ethylene-vinyl acetate copolymer, nanocomponents, additive, oil.*

УДК 622.276.74

SOLIDS CONTROL METHODS USED IN TATARSTAN FIELDS

R.Z. Nurgaliev

Almetyevsk State Petroleum Institute

E-mail: nurgalievrz@agni-rt.ru

Abstract. It is well known that solids production complicates operation of downhole pumping equipment. By example of Tatarstan oil fields, the author discusses different methods of solids control: casing of bottomhole zone of wells, protection of downhole pump suction against solids, field wellstream treatment. Case studies and analyses of results are presented.

Key words: *solids, pumping equipment, bottomhole zone, oil and water gathering and treatment*

УДК 622.276.53.054.23

IN-LINE GEAR DRIVE WITH COUPLED WHEELS ENHANCES FUNCTIONALITY OF ELECTRICAL SUBMERSIBLE PROGRESSING CAVITY PUMPING UNIT

D.I. Chistov, O.E. Zubkova

Ufa State Oil Technical University

E-mail: chistov.mf@mail.ru

Abstract. Performance of artificial lift equipment can be impaired because of the negative impact of a number of factors (solids, high content of free gas, high oil viscosity, drop pf production rates, etc.). As a result, electric submersible pumping units cannot be used to the best advantage, so operators have to use more expensive technologies and equipment to ensure sustained oil production

Today, different types of progressing cavity pumps (PCP) are widely used for oil production. These are PCP systems with different types of motors, with sucker rod drives, back-geared PCP units.

The authors offer a new design of a transmission section of an electrical submersible progressing cavity pump (ESPCP). The improved performance is attained through a pseudo-circulating oil system and a floating pinion and sun wheel.

The gear mechanism is used in a diametrically-restricted space, so the authors have changed the conventional procedure of gear calculation: first, reference diameters that meet the requirements of assembling, concentricity, and neighborhood were defined, and after that, calculation of gear wheels' strength was performed.

Application of the offered transmission section will allow operation of ESPCP with the output power 28 kW, min rotary speed 200 RPM. Also, it allows maximum pump efficiency, particularly when lifting high-viscosity oil.

Key words. *ESPCP (electrical submersible progressing cavity pump), planetary gear reducer, transmission section, floating pinion and sun wheel, pseudo-circulating oil system.*

УДК 622.276.1/.4"712.8"

ASPECTS OF TECHNOLOGY AND ENERGY EFFICIENCY IN MATURE OILFIELD DEVELOPMENT

[1]Yu.A. Gutorov, [2]R.M. Idiyatullin

[1]NTC Neftyanaya Dolina, Oktyabrsky

[2]OOO Center Delovoye Razvitie, Oktyabrsky

E-mail: gutorov70@mail.ru

Abstract. This paper gives evidence of low technical and economic efficiency of current enhanced oil recovery techniques because of increased share of unconventional reserves in the majority of Russian oilfields due to significant detrimental effect of various man-caused factors. As a consequence of declining oil prices, many Russian oil producers have chosen not to use expensive EOR methods with long payback periods and changed over to less costly techniques, resulting in reduced oil recovery factors. We suggest increasing profitability and technical-and-economic efficiency, as well as energy efficiency in mature fields through large-scale implementation of innovative and resource-saving technologies at all development stages, from well drilling, cementing and perforating to production automation and on-line monitoring via "smart wells".

Key words: *unconventional reserves, enhanced oil recovery techniques, oil recovery factor, technical efficiency, energy efficiency, innovative technologies.*