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ABSTRACTS

1 The Primary Controlling Factors of Tight Gas Reservoir in Shahezi Formation in the Southern Xujiaweizi Fault Depression and Prediction of Favorable Exploration Area

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Abstract: Through the analysis of reservoirs physical property, w (TOC) and R_o test of mudstone, combined with seismic, well logging, well drilling and geochemical data, the accumulation conditions of tight gas in Shahezi Formation (Ks) in the south of Xujiaweizi Fault Depression were summarized, the geological factors controlling the reservoir formation of the tight gas reservoir were denoted in detail, and the tight gas reservoir formation mode of the region was summarized. The study indicated that the large area and high-quality source rock distribution controlling the distribution of gas reservoirs and the development of favorable reservoirs were the basis of forming the gas reservoirs. the regional high-quality cap rocks were the preservation of tight gas; the communication of source rock and reservoirs was the necessary condition of the formation of structure-lithologic gas reservoirs, however, the deep faults were unfavorable for gas reservoir formation. On the basis of considering the geological conditions comprehensively, it is pointed out that the favorable exploration area of the region is located in the section of SQ3, which is far from the subfacies of front sand body.

Key words: key elements of reservoir formation; favorable exploration area; tight gas; Shahezi Formation; Southern Xujiaweizi Fault Depression

9 Sedimentary Microfacies Description of Single Sand Body in Complex Meandering River: A Case Study of $Nm_l^{1(3)}$ Sandbody in the South of QHD 32-6 Oilfield

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Abstract: Fluvial reservoir was an important carrier for oil and gas storage, and sedimentary microfacies description of single sand body was essential for reservoir distribution and tapping the potential of remaining oil. Traditional sedimentary microfacies description method of "river side bar extrapolation boundaries" was easy to enlarge or reduce the river scale because of lateral erosion and several abandon of river sand. On the base of single sand body equal thickness map and using a depositional model as a guide and by taking the sand body in $Nm_l^{1(3)}$ in QHD 32-6 Oilfield for example, the river boundary was first identified, and then the last meandering fluvial river distribution was traced for forecasting abandoned channel, portraying the river side bar and modifying the micro-deposition phase diagram based on production data. The results obtained by using the above method are used to guide the landing of horizontal wells and improving the sandstone drilling and as well tapping the potential of remaining oil in the oilfield.

Key words: meandering river; sedimentary microfacies; compound sand body; tapping the potential of remaining oil

13 The Oil Enrichment Characteristics and Analysis of Control Factors in Ramp Area of Oil-enriched Sag

——By Taking Putaohua Reservoir in the East Slope of Sanzhao Depression of SongLiao Basin for Example

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roChina, Daqing 163000, Heilongjiang, China)

Abstract: In allusion to the problem of unclear understanding of the oil enrichment characteristics and its control factors of Putaohua Reservoir in the east slope of Sanzhao Depression, through the research of the found oil reservoir types, the oil reservoir distribution characteristics and the control factors of oil enrichment and so on, the study indicated that Putaohua Reservoir was mainly of fault-lithologic reservoir and lithologic reservoir, most of the found oil reservoirs were distributed in the ramp area of Shangjia nose structure and Shangnan nose structure to the end of the sag, oil was especially enriched in the ramp area near the sag and was continuously distributed, oil was not enriched in axis and two wings of the nose structure, it was scattered. The fault - lithologic reservoirs were found out both in the nose structure and its ramp area near the sag, and lithologic reservoirs were mainly distributed in its slope area to the southwest of the working area. The nose structure and its evolution characteristics, the distributive range of matured source rocks, the distribution of source-reservoir faults, the big faults perpendicular (or high angle diagonal) to the oil migration direction and the combination of sand body and fault were the main control factors to the oil enrichment in the studied area. The poorer condition of lateral oil migration controlled by the combination of sand body and faults is the main factor of inducing poorer enrichment of oil in the axis position and two wings of the nose structure.

Key words: accumulation pattern; Sanzhao Depression; Putaohua Reservoir; nose structure; oil and gas migration

17 Oil and Water Layer Characteristics of Adjusted Reservoirs and Logging Identification

—By Taking Moxizhuang Region in the Hinterland of Junggar Basin for Example

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Abstract: The majority of oil and gas reservoirs in the hinterland of Junggar Basin have experienced the adjustment and reconstruction at different degrees. Moxizhuang Region was a typical reconstructed reservoir with many remaining oil in nonoil and gas layers. The occurrence of oil and gas was different with conventional reservoirs, the oil and gas level of core and cuttings was equivalent, and resistivity was approximate, but fluid producing property was much different. It was difficult to identify fluid of logging data, initial interpretation coincidence rate was less than 60%. Reservoir oil and gas distribution in different fluid properties was studied by using fluorescence slice, it was indicated that large pores were for oil and gas, there was much water contained in large pores and oil was contained in small pores. The statistics oil and water geochemical index indicated that the correlation of geochemical index of reconstructed reservoirs was poorer with and fluid property, it was different from the conventional reservoirs. It was found out in the study of logging characteristics of the target layer that for different fluid properties, the reservoir resistivity, deep resistivity, shallow resistivity and SP anomaly were different. Based on the above data and combined with interval transit time, a fluid identification chart is established for more accurate identification of fluid properties.

Key words: logging interpretation; oil and gas identification; adjustment and reconstruction; geochemical indicators; the hinterland of Junggar Basin; Moxizhuang Region

21 Application of Electric Imaging Logging in the Identification of LWM Carbonate Grain Beach in Sichuan Basin

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Abstract: The grain beach of the Lower Cambrian LWM Formation was a high quality reservoir development zone in Sichuan Basin. Logging identification of the grain beach was significant for guiding the prediction of reservoirs in LWM Formation. The reservoir properties in different parts of the grain beach were different, so its logging characteristics were different. Based on the high resolution of the electric imaging logging and the characteristics of conventional logging information diversity,

an integrated chart was established for conventional logs and electric imaging logging identification, it was used for identifying different parts of the grain beach. That is according to the electric imaging logging and the contrast of cores, a typical composite logging identification chart for grain beach was established. Application shows that the chart method can be a good guide for the recognition of reservoir lithology, sedimentary microfacies and caverns in LWM Formation, the problem of multiplicity is solved, it provides an important guidance in oil exploration and production.

Key words: electric imaging logging; LWM Formation; grain beach; sedimentary microfacies; pore type

27 **The Application of Continuous Tracer Relative Flow Rate Logging Technology and Its Software Realization**

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Abstract: The continuous tracer and relative flow rate logging has been a new logging method in recent years. This method had advantages of wide range of measurement and high precision compared to the frequently used injection profile measurement way. This article introduces the related logging tool and the principles of its measurement and interpretation. Based on the study, a software for continuous tracer and relative flow rate logging is designed. A secondary interpretation and evaluation is carried out in Well Z587 of YH Oilfield and compared to the original interpretation result then, it shows that the software is high precision and good application effect is obtained.

Key words: relative flow; water injection profile; isotope tracer; module development

31 **Geological Steering Technology for Horizontal Well Drilling of Deep Gas Reservoirs in the Northern Songliao Basin**

Wang Xiaochen (Author's Address: Gas Production Branch Company of Daqing Oilfield Co. Ltd., PetroChina, Daqing 163458, Heilongjiang, China)

Abstract: In the development of deep gas reservoirs in the northern Songliao Basin, there existed serious problems such as low productivity and poor reserves production in straight wells. Because of the deep burial of reservoirs, rapid changes of lithologic property, strong heterogeneity and poor physical property, there existed higher risk in horizontal well drilling. To ensure the success of horizontal well drilling, improve the drilling rate of reservoirs and single well productivity, a geosteering technology of horizontal wells was studied. Based on the study of gas reservoir tectonics, the reservoir characteristics and reservoir distribution are analyzed by well-seismic analysis, and a geological modeling technology was used for the prediction of reservoirs in the areas to be drilled. The data of research results, drilling, geologic logs, and data of measurement while drilling are used for a real-time correction of geological model, tracking and adjusting the wellbore trajectory. In the geosteering operation, the method of "three contrasts" and the "three adjustments" in the deflection of horizontal section is summarized, the target precision and the reservoir drilling rate are improved, and the good effect is obtained.

Key words: Songliao Basin; deep gas reservoir; horizontal well; geosteering

35 **Drilling and Completion Difficulties of Carboniferous Strata in the Zhongguai Area of Junggar Basin and the Technical Strategy**

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Abstract: With the continuous breakthrough of oil and gas exploration in the Zhongguai Uplift in recent years, it presented a good exploration prospect. Carboniferous was one of the main oil-bearing formations in the Zhongguai Uplift, but the target Carboniferous fractures were well-developed, pressure-bearing capacity was poor in the formation and density window was narrow for safe drilling, complex accidents such as lost circulation and kick were easily induced. The development of fractures also caused the fluid invasion in lower strata, which would affect the cementing quality. Furthermore, rock type was complex in Carboniferous strata with poor drillability, by which the drilling velocity was constrained and drilling interval was prolonged. According to these characteristics of fre-

quent complex incidents and low drilling speed in the Carboniferous strata, the leakage prevention and plugging technology for volcanic formation was emphatically studied before drilling, and drilling fluid system suitable for various formations was prepared to reduce the time of complex accidents. Appropriate mud system was chosen for optimizing design parameters of operation and improving cementing quality. The combination of high offensive bit and high speed turbine + diamond impregnated bit is chosen to improve the drilling speed based on the characteristics of Carboniferous stratigraphy.

Key words: Zhonguai Area of Junggar Basin; the Carboniferous stratum; leakage prevention and plugging; improving drilling speed; cementing quality; high speed turbine

39 **Effect of Microscopic Pore Structure on Waterflooding Development in Complex Faulted Block Reservoirs**

—By Taking the South Gaoshen Area of Jidong Oilfield for Example

Zhang Xuelei, Hu Yongle, Fan Ru, Shen Nan, Zhang Shouliang (First Author's Address: Research Institute of Petroleum Exploration and Development, Beijing 100083, China)

Abstract: In the south of Gaoshen Area in Jidong Oilfield, the displacement efficiency of JD Es₃²⁺³ reservoir was not better than that of other faulted block reservoirs in Bohai Gulf Basin. In order to study the effect microscopic pore structure on displacement efficiency in faulted block reservoirs, by taking the South Gaoshen Area for example, the results of mercury injection experiment, relative permeability experiment, displacement efficiency experiment of core samples are analyzed, the results show that the reservoir is medium porosity with fine-medium pore throat, heterogeneous pore structure. It is demonstrated that in the area, the reservoir is poorer pore structure, stronger heterogeneity, higher irreducible water saturation and residual oil saturation, and displacement efficiency is 5%~10% lower than that of other reservoirs. The large pore throat gets larger and small pore throat is plugged after waterflooding, it objectively weakens the development effect for the strong water-wet reservoirs.

Key words: complex faulted block reservoir; microscopic pore structure; wettability; waterflooding development; Jidong Oilfield

44 **The Impact of Grid Upscaling on the Results of Numerical Simulation**

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Abstract: The grid upscaling technology reduced the number of geologic model's grids, at the same time it kept the property of matching with the actual geosphere to ensure the stable simulating result. For further to see the impact characteristics of grid upscaling on the results of numerical simulation. In this paper, for the purpose of deeply studying the influential characters of grid upscaling on the result of numerical simulation, through four respects, such as the method of grid upscaling, the degree of grid upscaling, the distribution regularity of plane formation parameters and longitudinal formation characteristics, the mechanism of numerical simulation was studied by comparing with different methods of grid upscaling, changing the grid upscaling steps, and changing the plane permeability differential of formations and the differential between the layers in the geological model. Finally, the influential characters of grid upscaling on the result of numerical simulation are obtained.

Key words: grid upscaling; numerical simulation; formatopm parameter; influential character

47 **Comprehensive Reservoir Sorting of Sapu Reservoirs in Daqing Changyuan Periphery Oilfields**

Wang Hongwei (Author's Address: Research Institute of Exploration and Development, Daqing Oilfield Co. Ltd., PetroChina, Daqing 163712, Heilongjiang, China)

Abstract: In the past, reservoir classifying was mainly based on one or two major indexes reflecting reservoir material base, which was in short of universality and systematicness. In this paper, the principal component analysis was used to reduce the dimension of the 6 indexes reflecting the characteristics of Sapu Reservoirs in Daqing peripheral oilfields and 3 were extracted, such as physical fac-

tor, abundance factor and fracture factor, they carried 81% information of the original 6 indexes, the extracted principal components were clear meanings and in line with the characteristics of the reservoir development. After eliminating singular value, the rest 27 blocks were divided into three types and gravity centers of these three type blocks were used to be an initial condensation point of dynamic clustering. Then dynamic clustering method was applied to reclassify 125 blocks and classification results were recalculated by discriminant analysis, the recalculated correctness was 76.8%. So the discriminant function with high prediction accuracy can be used to judge the category of subsequent production blocks. The classified producing status and depletion pattern show that the classification result is in accordance with reservoir development situation, it provides a scientific basis for adjustment and management of sandstone reservoirs and making the plan of development, also provides reference for other multi-factor classification and evaluation.

Key words: principal component analysis; dynamic cluster; discriminant analysis ; comprehensive sorting of reservoir; physical factor; abundance factor ; fracture factor

51 Troubleshooting Method in the Condition of Unknown Production in Gas-lift Wells

Liu Zilong, Xie Xiangwei, Luo Wei (First Author's Address: School of Petroleum Engineering, Yangtze University, Wuhan 430100, Hubei, China)

Abstract: Gas lift troubleshooting could be more quickly and efficiently carried out with mathematical simulation method. Liquid production was the most basic given parameter in the mathematical simulation method. However, the liquid production capacity could not be obtained in real-time when troubleshooting in gas lift wells was carried out in the field. As a result, the application of available mathematical simulation method was limited. In this paper, based on the inflow performance of oil wells and a mathematical simulation model, an improved method for gas lift troubleshooting in the condition of unknown production is proposed. The compiled program with a practical example is validated, it shows that the method is feasible.

Key words: gas lift; troubleshooting; unknown production; mathematical model

55 Translayer Fracturing Technology for Horizontal Wells in Ultra-low Abundance Reservoirs and Its Application

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Abstract: Gulongnan Area was 40 m in thickness, which was located in the west to the north placanticline of Songliao Basin with average reserves abundance of $14 \times 10^4 \text{ t/km}^2$, relatively stable reservoir development and simple oil-water relation. The reservoir thickness was 2.8m and 3 layers were developed in average. Single well production was low for vertical well development, while conventional horizontal well development had low well control reserves and poor economic benefits. Then, by applying the horizontal well translayer fracturing technology and optimizing fracturing parameters according to the development situation of vertical positions, "one fracture penetrating multi-layers" can be realized to enhance the well control reserves and reserve utilization. After the technology is used in Block M15 the utilization of development reserves in the horizontal well is improved from 55.3% to 84.4% and the daily production of the horizontal well is 3.9 times more than that of vertical well. Fracturing monitoring and tracer monitoring in water injection well indicate that translayer fracturing is implemented.

Key words: ultra-low permeability; horizontal well; translayer fracturing; well pattern optimization

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