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执行主编

黄鹂

责任编辑

邓磊

帅群

龚丹

英文编辑

苏开科

排版

刘学英

ABSTRACTS

1 **The Differential Structural Characteristics and Oil and Gas Distribution in Fushan Depression of Beibuwan Basin**

Li Tinghui, Zhao Xin, Yang Anyuan, Feng Xiaodong, Wang shuo (First Author's Address : Dagang Branch, BGP Geophysical Research Institute, CNPC, Tianjin 300208, China)

Abstract: By analyzing the characteristics of structural geometry, dynamics and the evolution in Fushan Depression in Beibuwan Basin, the different tectonic development features in the longitudinal direction and in the plane were summarized; there are two sets of disconnected fault systems in the longitudinal direction, there existed different structures in the east and west on the plane. The structure was complicated in the west side and it mainly developed broom-like structure. However, the eastern structure was simple and it developed comb-like structure. It is affected by the tectonic difference, Fushan Depression has following distribution law: oil lies in upper position the gas lies in the low position, and oil is produced in the west and gas is produced in the east. Broom-like fault zone affects the hydrocarbon enrichment.

Key words: Fushan Depression; tectonic difference; fracture characteristics; tectonic evolution

5 **Sedimentary Characteristics and Evolution of Ed₂ in Dalujia Region of Linpan Oilfield in Huimin Depression**

Xing Yang, He Youbin, Zhang Xin, Wang Ning (First Author's Address : School of Geosciences, Yangtze university, Wuhan 430100, Hubei, China)

Abstract: The 2nd member of Dongying Formation (Ed₂) belonged to an interbed with sand shale frequently induced in the Dalujia Region of Linpan Oilfield in Huimin Depression. The oilfield has entered the middle-late stage of development, and severe interlayer contradiction was induced, the difficulty in development was increasingly appeared. The main problems such as better recognition of sedimentary microfacies, types and spatial distribution of sand bodies should be further deepened. On the basis of core observation, SEM thin section analysis and logging data analysis, combined with regional geological background, available research results and the comprehensive analysis of facies markers of the rock colors, structure and characteristics of its particle size, 3 kinds of sedimentary subfacies including delta front, prodelta and shallow lake and 8 kind of sedimentary microfacies were recognized. The sand body characteristics of sedimentary microfacies in each sublayer were described, the, distribution characteristics of sedimentary microfacies were illuminated and its evolution rule were discussed. With the comprehensive effects of the change of sediment supply and lake level fluctuation, the delta has gradually extended or shrunk from the NW to the SE. Three middle-term cycles are classified vertically, it was corresponded to once lake regressive and twice lake transgressive processes. Due to development of the delta-front sand-body and less lateral variation of sand body and better continuity of sand body, the large-scale stratigraphic-lithologic traps can be created.

Key words: Dalujia Region; 2nd member of Dongying Formation; delta facies; lacustrine facies; sedimentary characteristics

13 **The Source Rock Characteristics and Thermal Evolution Analysis in Shuangyang Formation of Moliqing Depression in Yitong Basin**

Jin Chenglin, Zhou Xiaofeng, Qiao Cheng, Ma Jiangxiao, Yang Cheng (First Author's Address: School of Geosciences, Yangtze University, Wuhan 430100, Hubei, China)

Abstract: The source rock characteristics and its distribution rules in Shuangyang Formation of Moliqing Depression in Yitong Basin were studied in combination with the organic type, abundance, maturity and source rocks thermal evolution. The results show that the main hydrocarbon source rocks of Moliqing Depression are located in Shuangyang Formation (E_2s). The mudstone thickness is ranged from 200 to 800 meters, from the northwest to the southeast margin, the mudstone thickness decreases gradually. Shuangyang Formation is good source rock with II_2 being the main organic type and less of it being II_1 . Source rock maturity depends on the location of sample. Source rocks in the depression are at a mature stage, and structurally high part is at a low maturity stage.

Key words: Moliqing Depression; Shuangyang Formation; source rock; thermal evolution;

16 **Improving the Matching of Borehole Seismic Data and Its Application in Reservoir Prediction**

Ge Hongqi, Zhang Yunfeng, Wang Aiyong, Li Gang, Zhen Bo (First Author's Address: Key Laboratory of Exploration Technologies for Oil and Gas Resources (Yangtze University), Ministry of Education, Wuhan 430100, Hubei, China)

Abstract: With the deepening of oil exploration and development, reservoir prediction and description based on the well logging data and seismic data played a important role in tapping the potential of remaining oil. However, the problem of low matching of logging data with seismic data induced the higher difference between reservoir prediction result and real situation. By means of seismic longitudinal encryption sampling, homogenization of logging curve and time consistency of borehole seism, the matching of borehole data and seismic data was improved, and the prediction accuracy of reservoir was ensured. By taking a typical block in the north of Daqing placanticline as an example, through the inspecting the posterior inspection well, reservoir sand body identification precision reaches 83.6%, it illustrates that under the condition of good matching of wellbore and seism, it can effectively guarantee the accuracy of interwell sand body prediction.

Key words: well seismic combination; matching; reservoir prediction

19 **Application of “Three Step Inversion” Technology in the Prediction of Calcareous Glutenite Reservoirs**

—By Taking the Upper 4th Member of Xujiache Formation in the Western Yuanba Gas Field for Example

Liu Haitao, He Zhiyong, Xiao Wei, Lin Lin, Hao Jingyu (First Author's Address: Exploration Company, SINOPEC, Chengdu 610041, Sichuan, China)

Abstract: In the west of Yuanba Gas Field, braided delta plain-braided delta front subfacies were developed during sedimentary period of the upper 4th member of Xujiache Formation ($T_3x_4^u$). Lithology was thick layer of calcarenaceous glutenite, litharenite with thin layer of intercalated mudstone. The reservoir was mainly developed in calcarenaceous glutenite, it was a frac-pore reservoir with low-porosity and low-permeability. The key issue for reservoir prediction in tight sandstone was how to find sandstone from mudstone and find the calcarenaceous in sandstone. Based on the comprehensive analysis of geology-geophysics characteristics, a new reservoir prediction technology of “three step inversion” was studied. First natural gamma inversion was used to eliminate mudstone, and resistivity inversion was used to eliminate litharenite. Eventually constrained by porosity bulk, the effective thickness was extracted. Research shows that “three step inversion” can improve the accuracy com-

pared to regular “impedence inversion” . It’s recommended that the method can be used in a calcarenaceous glutenite-developed area.

Key words: “three step inversion”; Yuanba Gas Field; upper 4th member of Xujiache Formation; calcarenaceous glutenite; reservoir prediction

24 **Quantitative Evaluation of Coalbed Methane Based on Sensibility Logging Parameters**

— **By Taking the Northern Block of Sanjiao Area in the Gas Field of Eastern Block of Ordos Basin for Example**
Jin Lizuan, Feng Jungui, Wen Yuan, Li Songlin, He Bin, Ganghu Yage (First Author’s Address: CNOOC Enertech-Drilling & Production Co., Tianjin 300457, China)

Abstract: Coal-bed methane content was one of the pivotal parameter for evaluating coal-bed methane resources. Based on the current coal-bed methane content prediction method, combined with the coal core lab analysis data from the northern block of Sanjiao Area, logging parameters sensitive to the coal-bed gas content are chosen by using statistical regression, and for parameters with small correlation coefficient, composite parameter was built to improve the correlation coefficient between content and logging. Langmuir equation and multiple regression models are established respectively for gas content prediction. The comparison of the prediction result with that of measured one in the laboratory analysis shows that the adsorption model is more accuracy for gas content prediction.

Key words: sensitivity logging parameter; coal-bed methane content; Langmuir equation; multiple regression; gas field in the Eastern Block of Ordos

30 **A New Calculation Model of Initiation Angle for Hydraulic Fractures in Shale Gas Reservoirs under the Interference of Multi-fracture Stress**

Yu Huan, Wang Shilu, Wu Fangzhi, Yu Qiwei, Huang Yujie (First Author’s Address : School of Petroleum Engineering, Yangtze University, Wuhan 430100, Hubei, China)

Abstract: Shale reservoirs had physical characteristics of low porosity and low permeability. Forming a complex fracture network by stimulated reconstruction of shale reservoirs was an effective method for efficient production of shale gas. But in the process of reconstruction, the interference stress from multi-fracture extension at the same time would affect the fractural strike. In consideration of remote stress, under the condition of stress interference of multi-fracture extension and combined with different fractural initiation theories, this paper establishes a new calculation model of initiation angle when hydraulic fractures initiate fractures again at the terminal of natural fractures after they were captured by natural fractures. The analysis shows that in consideration of stress interference, the length of hydraulic fractures and natural fractures has little influence on the initiation angle in this case. With the increasing of fracture space, the stress interference between fractures decreases, as a result, the initiation angle begins to increase and then decrease subsequently. As well, because of the influence of the multi-fractures interference stress, the initiation angle basically has no variation with the increasing of net pressure under the high intersection angle condition. Under the low intersection angle condition, the initiation angle changes with the net pressure, the bigger the net pressure is, the smaller the initiation angle is.

Key words: shale gas; discontinuity displacement; stress interference; stress intensity factor; initiation angle

36 **Problems in Well Test Interpretation of Multi-branched Horizontal Wells and Application Analysis**

Zhao Hongxu (Author’s Address : China France Bohai Geoservices Co. Ltd., Tianjin 300452, China)

Abstract: The borehole structure of multi-branched horizontal wells was complicated, pressure solving method involved complex mathematical problems, certain progress was made in its theoretical study, for the interpretation model in real application, corresponding assumption is established and there existed certain differences in actual complex situations of the multi-branched horizontal wells, its well test interpretation was not ideal in practice. The Saphir module of Ecrin software has been widely used in well test interpretation, the problems existed in Saphir was that it could not be used for accurately describing the pressure trend of the multi-branched horizontal wells, especially for the operated wells with serious heterogeneity and complex multi-branches, the interpretation model of the software was different from actual geology situation, it could only be approximated. Due to complexity and multiple solutions in test interpretation of multi-branched horizontal wells, establishing actual interpretation model for well test interpretation needs to be improved and understood constantly, it is necessary for researching the reservoir characters of different multi-branched horizontal wells and influential factors and as well as corresponding interpretation methods, writing interpreting programs, establishing interpretation model for the multi-branched horizontal wells according with actual situation.

Key words: multi-branched horizontal well; well test interpretation; Saphir; interpretation model

40 **An Experimental Study of Liquid Hold-up in Oil and Gas Two Phases Flow**

Wang Le (Author's address: School of Petroleum Engineering, Yangtze University, Wuhan 430100, Hubei, China)

Abstract: Mixed Oil and gas flow was a general phenomenon in petroleum industry. The research of liquid hold-up could offer a base for multiphase study. By experimental study of oil and gas mixed flow in laboratory, the correlated experiment for different fluid amounts, different oil and gas ratio and different pipe diameters was carried out in the synthetic glass tube with different inclination angle, the result showed that the liquid hold-up is changed with the variation of outside environment condition. The result show that the hold-up is influenced by the inclination angle of flow tubing, the liquid hold-up of the horizontal line is different from that of non-horizontal section. When the angle increases from 0° , the liquid hold-up changes obviously, with the slow change of the increment angle, the liquid hold-up is fallen down when the inclined tubing is turned to a vertical one. The regulation is that the liquid hold-up is presented as a natural logarithm as the gas flow rate increases. The change of gas flow induces less influence on the liquid hold-up. Only in the horizontal pipe flow, obvious influence of liquid flow would be induced on the liquid hold-up. The pipe diameter has certain effect on the flow pattern, the increase of liquid could turn the circular flow or transition flow into a slug flow. It provides a guidance for the selection of oil production methods, setting up rational working principle and high efficient oil production in the oilfields.

Key words: oil and gas flow; inclination angle; liquid hold-up; gas-liquid ratio; pipe diameter

44 **Research and Application of Water Shutoff Agent System for Fractured Water-out Wells in Wuliwan Oilfield**

Lyu Wei, Yang Huan, Cao Ying (First Author's Address: Research Institute of Oil and Gas Technology, Changqing Oilfield Company, PetroChina, Xi'an 710018, Shaanxi, China)

Abstract: In Triassic reservoir of Wuliwan Oilfield, micro-fracture was developed, it had obvious direction, and water flooding was easily induced According to the characteristics of fractured water flooded wells, a water swellable particle plugging agent, oil soluble resin plugging agent, high strength underground cross linking agent were developed as the main body of the chemical system. The performance of water absorption rate, swelling rate, suspension and blocking strength were evaluated. The results showed that the particle size of water bulk grain plugging agent was small, the water absorption and swelling rate were high. With the increase of temperature, the strength of swellable particulate plugging agent decreased, but the strength could still retain more than 50% at

60°C. The oil soluble resin blocking agent could be dissolved in oil, but its soluble rate was slow. The stability of underground cross-linking agent had good stability and high strength. Through the simulation of water plugging performance test, the permeability of the sand filled pipe was lower, the plugging rate was more than 99.8%, and the sealing effect was good. By taking Well Liu X as an example, according to the characteristics of different systems of plugging agent, a plug type sealing method is used. The daily oil production is 4.01t after stimulation. By the end of May, 2015, the daily oil production is 2.29t and cumulative oil increment is 695.72t.

Key words: low permeability reservoir; fractured reservoir; water flooded well; polymer particle plugging agent; oil soluble resin plugging agent; underground cross linking agent

49 Discussion of the Pseudo-pressure Used in Well Testing Model for Coal-bed Methane Reservoirs

Song Liuqing (Author's Address: Hulunbei'er Branch, Daqing Oilfield Co. Ltd., PetroChina, Hulunbei'er 021000, Inner Mongolia, China,)

Abstract: The approach of pseudo pressure was commonly used in pressure transient analysis model in conventional gas reservoirs, however in coal-bed methane (CBM) reservoirs, the pressure in Langmuir Equation was replaced by pseudo pressure directly, which was not consistent with the definition of Langmuir Equation, and it also would induce a considerable error. By comparing the calculated value using the Langmuir Equation of pseudo pressure with the isothermal adsorption data, it indicates that the error induced by pseudo pressure increases with pressure depletion during the mid-late stage of CBM development. Through the method of data fitting, the relationship between adsorption capacity and pseudo pressure is established. It is concluded that when Langmuir Equation is used for matching it, the error increases with pressure depletion, which can reach 90%. When the Weibull Function is used, the result is good and the error is within 10%. Weibull Function is used to match the adsorption data in Hancheng Xiangshan No.5 Coal, the correlation coefficient is up to 0.997, it indicates that the Weibull Function can be used for practical application.

Key words: Coalbed methane; well testing model; pseudo pressure; Langmuir Equation; Weibull Function

54 Coal-bed Methane (CBM) Well Production Characteristics and Influencing Factors of Medium-low Production Wells in L Block

Hu Yunting, Feng Yi, Wang Wensheng, Duan Baojiang, Ge Yang, Wu Huan (First Author's Address: China France Bohai Geoservices Co., Ltd., Shenzhen 518067, Guangdong, China)

Abstract: Aiming at solving the problems of complex factors influencing the CBM well production in L Block, the productivity of CBM wells in the studied area was classified, the production characteristics of 72 wells in the area were analyzed to explore the factors affecting gas production capacity. The results show that there are mainly medium-low wells in the area, the monthly gas well production peak varied from 15000m³ to 35000m³, the production peak span was large, and there was no obvious regularity. The early drainage period was short, the stable production time was different between wells in each production level, and the production decreases quickly during later period. In addition, the influence of coal seam buried depth, coal seam gas content, its permeability and the operation technology on CBM gas production was discussed. Based on the analysis of coalbed methane production characteristics and influencing factors in L Block, it is of great significance to guide the CBM well production and the improvement of well drainage measures in L Block.

Key words: L Block; CBM well; production characteristics; low production well; coal-bed buried depth; CBM content; permeability